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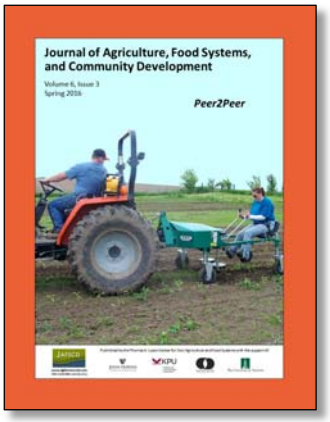

On our cover: Specialized equipment, like this EcoWeeder, can help small-scale fruit and vegetable growers expand to meet the growing demand for local foods. Yet the investment required to purchase specialized machinery and attachments is often beyond the financial reach of small-scale, beginning producers. Sharing equipment with other growers is one possible solution to this challenge. See the paper in this issue, *The Benefits and Challenges of Machinery Sharing Among Small-scale Fruit and Vegetable Growers. (Photo courtesy of the Northeast Iowa Food & Fitness Initiative; used with permission.)*

(continued)

Reviews

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IN THIS ISSUE

DUNCAN HILCHEY

Peer2Peer

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This open call issue of JAFSCD is slightly smaller than our usual 15 to 20 items. We've been busy working to transition our publishing platform to one hosted by Public Knowledge Project (PKP; http://pkp.sfu.ca), as well as preparing to launch our pilot Community Supported Journal campaign. Over the next year we will be experimenting with a new financial model as we explore the feasibility of becoming an open access (OA) journal. We hope that the JAFSCD community of authors, subscribers, institutional libraries, reviewers, and programs related to food systems research, academic, and outreach programs will collaborate to assist us in this endeavor.

We start this issue with John Ikerd's Economic Pamphleteer column, entitled *Toward an Ethic of Sustainability,* the wisdom of which bears repeating here: *A thing is right when it tends to enhance the quality and integrity of both human and nonhuman life on earth by honoring the unique responsibilities and rewards of humans as members and caretakers of the earth's integral community. A thing is wrong when it tends otherwise.* In addition, Ikerd reminds us to be thankful for the intrepid few who take up the call to farm sustainably and who toil to make the world a little better for all of us, even when it is not necessarily financially rewarding to do so.

Our papers in this issue begin with several that are focused on peer-to-peer learning. In *West Virginia Farmers Market Training Network: A Case Study in Connecting Markets and Resources*, **Daniel Eades**, **Kelly Nix,** and **Kelly Crane** offer an insightful reflective essay about the transition of a conventional technical assistance model to a peer-to-peer learning program that emphasizes knowledge co-creation through collaborative research, and problem solving. Similarly, **Georgeanne Artz** and **Linda Naeve** find peer-to-peer equipment sharing yields an even wider range of advantages to collaborators in *The Benefits and Challenges of Machinery Sharing Among Small-scale Fruit and Vegetable Growers.* In contrast, studying the challenges of on-farm produce safety practices of a farm community that limits it use of machinery is the focus of *Understanding Perceptions of*

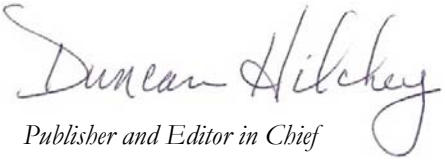
On the cover: Specialized equipment, like this EcoWeeder, can help small-scale fruit and vegetable growers expand to meet the growing demand for local foods. Yet the investment required to purchase specialized machinery and attachments is often beyond the financial reach of small-scale, beginning producers. Sharing equipment with other growers is one possible solution to this challenge. See the paper in this issue, *The Benefits and Challenges of Machinery Sharing Among Small-scale Fruit and Vegetable Growers. (Photo courtesy of the Northeast Iowa Food & Fitness Initiative [http://www.iowafoodandfitness.org]; used with permission.)*

Fresh Produce Safety and Barriers to Good Agricultural Practice (GAP) Use Among Amish Growers in the Holmes County Settlement of Ohio by **Jason S. Parker**, **Pamela Schlegel**, **Douglas Doohan**, and **Jeffrey T. LeJeune.** In *Principles Guiding Practice: A Case Study Analysis of the Principles of Sustainable Agriculture for Diverse Farms*, **Kelly N. Moore**, **Marilyn E. Swisher**, **Juan Carlos Rodriguez**, **Mark Blevins**, **Michael Hogan**, **Lauren Hunter**, **Christine Kelly-Begazo**, **Stephen Komar**, **Suzanne Mills-Wasniak**, and **David Redhage** use a guided discovery process to find that, despite considerable diversity in operations, their sample of farms showed remarkably consistent similarities in the sustainability principles that guide their management decisions.

Next up, **Joseph P. Brewer II** and **Paul V. Stock** discuss the shortcomings in extension programming for Native Peoples in their policy analysis, *Beyond Extension: Strengthening the Federally Recognized Tribal Extension Program (FRTEP).* They make the case for increased resources to have the kind of impact intended by the federal program. **Carrie A. Scrufari** provides a detailed legal analysis of Walmart's new animal welfare policy in *The Tipping Point: Can Walmart's New Animal Welfare Policy End Factory Farming?,* and concludes that it may be the U.S.'s best hope for transitioning to more humane animal agriculture. In *Locational Advantage and the Impact of Scale: Comparing Local and Conventional Fruit and Vegetable Transportation Efficiencies,* **Chuck Grigsby** and **Chad Hellwinckel** offer us a modern twist on the old chestnut that the further the distance a producer is from their market, the larger the volume they need to maximize efficiency. Their economic modeling suggests that localized food systems near urban cores are more likely to be resilient to fuel price shocks. In our final paper, *Examining Barriers to Implementation of Electronic Benefit Transfer (EBT) in Farmers Markets: Perspectives from Market Managers,* authors **Anne Roubal, Alfonso Morales**, **Karen Timberlake**, and **Ana Martinez-Donate** learn from a sample of farmers market managers that compatibility of EBT with market mission, vendor acceptance, and perceived benefit of EBT (among other factors) are important for success of EBT programs.

The issue concludes with four book reviews. In *Food System Sustainability Standards: Room for Everyone?,* **Keith Williams** reviews *FAO/UNEP Workshop on Voluntary Standards for Sustainable Food Systems: Challenges and Opportunities*, edited by Alexandre Maybeck and Suzanne Redfern. In *Putting the World on a Better Diet,* **Grace Gershuny** reviews *Global Eating Disorder*, by Gunnar Rundgren. In *A Public Health Approach to Our Food System,* **Gregory Zimmerman** reviews *Introduction to the U.S. Food System: Public Health, Environment, and Equity*, edited by Roni Neff. And finally, in *Anticipating a Transformative Future,* **Fred Kirschenmann** reviews *How To Thrive in the Next Economy: Designing Tomorrow's World Today*, by John Thackara.

The coming year promises to be an interesting one, full of challenges for JAFSCD as we try to maximize the impact of our authors' work with an eye toward more ever more sustainable local and regional food systems. We look forward to your collaboration with JAFSCD to make this happen.



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THE ECONOMIC PAMPHLETEER
JOHN IKERD

Toward an *Ethic of Sustainability*

Published online May 14, 2016

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Sustainable farming is ultimately an ethical commitment. As I have written in a previous column, "There are lots of other occupations where people can make more money with far fewer physical and intellectual challenges.…Unless they truly believe that farming is their 'calling,' I advise would-be farmers to choose other occupations" (Ikerd, 2015a, p. 10). A purpose or calling determines what a person should and should not do with their lives and thus is a matter of ethics.

In a previous column, I proposed a *Food Ethic* as a guide for purposeful eating (Ikerd, 2015b). I think we also need an *Ethic of Sustainability* as a guide for purposeful living, in farming or any other way of life. I propose: *A thing is right when it tends to enhance the quality and integrity of both human and nonhuman life on earth by honoring the unique responsibilities and rewards of humans as members and caretakers of the earth's integral community. A thing is wrong when it tends otherwise.*

First, the ethic goes beyond defining sustainable practices or even principles by defining some things we might do as "right" and others as

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

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

"wrong." Questions of right and wrong cannot be answered using currently accepted scientific methods. These are matters of belief or faith. Thus scientists tend to ignore them, and consequently so do most advocates of sustainability. This has allowed the concept of sustainability to be trivialized and coopted by corporations and marginalized by government agencies.

As Pope Francis observes in his encyclical letter, Laudato Si', *for Care of our Common Home,* "we can note the rise of a false or superficial ecology which bolsters complacency and a cheerful recklessness. Such evasiveness serves as a license to carrying on with our present lifestyles and models of production and consumption" (Francis I, 2015, para. 59). In my opinion, "superficial sustainability" today is "bolstering complacency and cheerful recklessness" in American agriculture and is being used as a "license" for continuing unsustainable farming.

Second, the *Ethic of Sustainability* reflects an "integral worldview." All life on earth, including human life, is integrally interconnected and interdependent, and all living things are integrally connected with all nonliving things on earth (for a deeper discussion of worldview and sustainability, see Ikerd, Gamble, and Cox, 2015). A person's worldview, integral or otherwise, depends on his or her perception of "how the world works" and of our individual and collective roles as humans within it. Since our worldviews determine what we accept as fact or truth, an "integral worldview" is a spiritual, metaphysical, or philosophical perception of reality.

An integral worldview is not new to sustainable farming. Rudolf Steiner, the father of biodynamic farming, said, "Central to bio-dynamics is the concept that a farm is healthy only as much as it becomes an organism in itself—an individualized, diverse ecosystem guided by the farmer, standing in living interaction with the larger ecological, social, economic, and spiritual realities of which it is part" (Steiner, 1924/1993).

Third, the *Ethic of Sustainability* focuses on the quality and integrity of "life," meaning the whole of life on earth. Living things are the only means we have of acquiring the energy necessary to sustaining human life on earth. Our food, our clothes, our houses, and our cars all require energy to make and energy to use. Everything of any use to us, including everything of economic value, ultimately comes from the physical elements of the earth: air, water, soil, minerals. However, it's the earth's *energy* that makes the other elements of nature useful to humans. Sustainability ultimately depends on sustaining the *usefulness of energy.*

The sustainability of human life on earth is inherently dependent on the quality, integrity, and thus the *usefulness* of the living world to offset the inevitable tendency of the nonliving world toward entropy or uselessness.

The first law of thermodynamics states that energy can neither be created nor destroyed. However, the second law, the law of entropy, states that whenever energy is used, or reused, to do anything useful, some of its usefulness is lost. Only living things, primarily plants on land and plankton in oceans, are capable of capturing, organizing, concentrating, and storing new solar energy to offset the inevitable tendency of energy toward uselessness. We humans can sequester useful energy, using windmills, falling water, and photovoltaic cells. However, we are inherently reliant on the biological energy collectors for our life's energy. So, the sustainability of human life on earth is inherently dependent on the quality, integrity, and thus the *usefulness* of the living world to offset the inevitable tendency of the nonliving world toward entropy or uselessness.

The emphasis of the ethic on life is also important because we *can't see* the loss of usefulness of energy due to entropy. Farmers can't see the loss of useful energy on their farms, but they can see the diminished quality of biological life in their soils, their crops and livestock, and the lives of the people who farm and live in their rural communities. Any approach to farming that fails to

enhance the quality and integrity not only of human life but of all life on earth is not only unsustainable, it is morally and ethically wrong.

Finally, the *Ethic of Sustainability* acknowledges that our lives have *purpose*. Without purpose, there can be no responsibility. Concerns for sustainability arise from our uniquely human responsibilities as members and caretakers of the earth's communities. Nowhere is this responsibility clearer than in farming. As Pope Francis states, "The biblical texts are to be read in their context… recognizing that they tell us to 'till and keep' the garden of the world (cf. *Gen* 2:15). 'Tilling' refers to cultivating, ploughing or working, while 'keeping' means caring, protecting, overseeing and preserving...Each community can take from the bounty of the earth whatever it needs for subsistence, but it also has the duty to protect the earth and to ensure its fruitfulness for coming generations" (Francis I, 2015, para. 67).

This responsibility was clearly understood by the pioneers of sustainable agriculture. J. I. Rodale wrote, "The *organiculturist* farmer must realize that in him is placed a sacred trust, the task of producing food that will impart health to the people who consume it. As a patriotic duty he assumes an obligation to preserve the fertility of the soil, a precious heritage that he must pass on, undefiled and even enriched, to subsequent generations" (Rodale, 1948, Chapter 8, para. 15). Sir Albert Howard began his classic book, *An Agricultural Testament,* with the assertion, "The maintenance of the fertility of the soil is the first condition of any permanent system of agriculture" (Howard, 1940, Introduction, para. 1)—which is also the foundation for any permanent society.

So sustainable farming is not just an occupation; it is a calling to a life of purpose. Those who are called have an awesome responsibility, but also an opportunity for service to humanity with equally awesome rewards. Purpose gives meaning and quality to life and is the key to true human well-being and happiness. Most of us are called to be something other than farmers, but we should all be grateful and supportive of those who respond to an ethical calling to be farmers.

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West Virginia Farmers Market Training Network: A case study in connecting markets and resources

Daniel Eades [a]* and Kelly Nix [b]
West Virginia University Extension Service

Kelly Crane [c]
Friends of Family Farmers

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Abstract

Farmers markets provide social and economic benefits to farmers and communities. In West Virginia, local food, farm, and community development organizations are collaborating to strengthen local food networks. In this reflective essay we discuss the development and execution of a statewide pilot training program for market managers and volunteer leaders and provide results from first year evaluations. Launched in 2012, the West Virginia Farmers Market Training Network Pilot Program (FMTNPP) was designed to address the needs of 10 markets in various stages of development across the state. Originally envisioned as a direct technical assistance model, the program organizers rapidly recognized the benefits of peer-to-peer learning and shifted its focus to a hybrid model that embraced both expert and practitioner knowledge. Today, the program emphasizes shared knowledge creation and problem solving, along with strong networking and data collection components. We believe the lessons and strategies learned during the program's implementation will be valuable for food system organizers and service providers trying to encourage the growth and sustainability of small, rural farmers markets.

Keywords

farmers markets, market development, producer development, training program, business planning

[a] * *Corresponding author*: Daniel Eades, Community Resources and Economic Development; 704 Knapp Hall; West Virginia University; Morgantown, West Virginia 26506-6031 USA; +1-304-293-8697; Daniel.Eades@mail.wvu.edu

[b] Kelly Nix, Community Resources and Economic Development; 702 Knapp Hall; West Virginia University; Morgantown, West Virginia 26506-6031 USA; +1-304-293-8680; Kelly.Nix@mail.wvu.edu

[c] Kelly Crane, Friends of Family Farmers, 249 Liberty Street NE, Suite 212; Salem, Oregon 97301 USA; +1-503-581-7124; kelly@FriendsofFamilyFarmers.org

Disclosure

Kelly Crane is the former director of the West Virginia Farmers Market Association and served in that capacity during the study period described herein.

Introduction

In West Virginia, where 75 percent of farms have less than US$10,000 in sales annually (United States Department of Agriculture [USDA], National Agricultural Statistics Service, 2014), farmers markets play a critical role in the economic and cultural fabric of the state's local food communities and emerging food economies. Markets serve as essential entry points for beginning producers into the local foods economy, acting as incubators for growing and diversifying food businesses (Cameron, 2007; Feenstra, Lewis, Hinrichs, Gillespie, & Hilchey, 2003). With low costs of participation (such as an annual fee US$15 to US$30 in many West Virginia counties) and limited barriers to entry, markets allow vendors to test marketing and merchandising skills, evaluate consumer responses to their products, and build a "brand" for their farm valuable in other opportunities, such as agritourism or volume sales.

Local food and farm and community development organizations across West Virginia recognize the impacts farmers markets have on communities and have collaborated to strengthen the network of those involved in improving access to locally produced food. In 2012, the West Virginia Farmers Market Association (WVFMA) launched a statewide initiative, the Farmers Market Training Network Pilot Program (FMTNPP), to address the needs of markets and co-ops in various stages of development. The program linked markets to technical support, established a statewide community of markets, and created a standard tracking system to evaluate program success, while simultaneously increasing the WVFMA's organizational capacity to continue serving markets in the future. Although the program was initially envisioned as a straightforward direct technical assistance program, leadership recognized the value of practitioner expertise and the role market leaders could play in educating both their peers and technical resource providers often unfamiliar with the unique needs of farmers markets and farm based businesses. The program has evolved into a blended approach that emphasizes the roles of both content experts and practitioners, and collaborative knowledge-sharing between markets and technical assistance providers.

This case study outlines the origins of the West Virginia FMTNPP, the programmatic and operational challenges experienced during program development and delivery, the lessons learned and strategies employed to address these challenges, and the ways in which the program has evolved to better meet farmers markets' needs and more effectively deliver training and expertise. There are few examples of face-to-face development programs in the literature and no evaluations of program outcomes. We believe the lessons learned during the WV FMTNPP and the resulting program improvements will be relevant for food system organizers and service providers across the nation, especially those encouraging the growth and sustainability of small and/or rural farmers markets.

The Needs of Market Stakeholders

Over the past 20 years the number of farmers markets across the country has increased significantly. Data from the United States Department of Agriculture (USDA), Agricultural Marketing Service (AMS) currently list more than 8,000 markets, a 371 percent increase from 1994 (USDA AMS, 2014). While increased demand is good news for markets, many continue to experience obstacles to growth and success. Low et al. (2015) note that between 2007 and 2012 the value of direct-to-consumer sales has remained essentially flat, despite growth in the number of farms reporting direct sales. Research suggests that approximately 50 percent of new markets fail within the first five years (Eggert & Farr, 2009), and even in more stable markets a lack of training and understanding of topics such as risk management, business planning, producer development, and market structure can dampen success and ultimately lead to market closure (Stephenson, Lev, & Brewer, 2008; Connell & Hergesheimer, 2014).

In West Virginia the number of markets roughly tripled over the past decade, from 34 markets in 2005, to 90 markets operating in more than 110 separate locations in 2014 (Gardner, 2014). This rapid growth has increased competition among markets to recruit vendors and growers, especially in the state's rural regions, where numbers are scarce. Additionally, many markets

experience growing pains with regards to leadership, management, and effective business models. Organized and run by a wide range of entities including volunteer advocates, local governments, community and faith based organizations, or producers themselves, markets have a diversity of experience, funding, facilities, and capacity (Spellman, Lyons, & Lower, 2012).

Farmers market advocates and stakeholders across the nation recognize that markets' long-term economic viability requires technical experience in business planning and marketing (Tropp & Barham, 2008). This includes vendors and market leaders' abilities to accurately gauge production costs and prices and to remain current on emerging consumer trends, product varieties, and improved season extension techniques (Tropp & Barham, 2008). Unfortunately, markets rarely have the internal expertise to provide technical assistance in these key areas or spearhead long-term business planning projects that are necessary for business expansion (Cowee, Curtis, & Gatzke, 2009).

To overcome these barriers, attendees of the 2007 National Farmers Market Summit in Baltimore, Maryland, recommended that market representatives increase their collaborative efforts with both traditional government and community partners, and reach out to nontraditional community organizations (Tropp & Barham, 2008). Partnership opportunities identified at the summit include agricultural Extension representatives and state university personnel to address production techniques, emerging technology, and season extension, and local microenterprise development entities for business plan development and training. Successful partnerships, especially with nontraditional organizations, require that markets communicate their public value for individuals and communities. Summit attendees encouraged the development of programs that train market managers and advocates on how to best capture, document, and report information that quantitatively measures a market's impact on the local economy and community.

Eggert and Farr (2009) specifically recommend mentoring and training programs at the regional or market level to strengthen entrepreneurship and marketing skills among vendors. National data from the Farmers Market Coalition indicate that 73 percent of state farmers market associations (FMAs) provide some form of educational resources, including fact sheets, guides, and other materials and technical assistance; however, distribution and use of these resources are often limited to market managers and start-up markets (Wasserman, 2009). Research by the Project for Public Spaces (PPS) (2008) suggests that FMAs are struggling to meet their constituents' evolving needs. The PPS notes that while markets have gained increased support from customers and politicians, and are significant players in sustainable agriculture, "buy-local," and community hunger initiatives, little of this support has translated into increased resources to develop or support the capacity of vendors, market managers, or key partners. The Farmers Market Coalition's 2009 needs assessment identified similar issues, with many FMAs citing insufficient financial and labor resources as significant challenges in identifying, developing, and delivering resources to address market challenges.

The West Virginia Response

As the sole entity providing support for farmers markets in West Virginia, the WVFMA is recognized as the key organization for addressing farmers market issues and serves as a valuable link between new farmers and the state's and larger agriculture community. When the WVFMA was formed in 2007, its goal was to strengthen the viability of West Virginia farmers markets by fostering cooperation among members and service providers for problem-solving, identifying and adopting best practices, and improving policy and regulations (Spellman et al., 2012). The WVFMA is governed by a volunteer board of directors, composed entirely of managers from member markets, and meets annually with its advisory group, which includes representatives from local foods advocacy groups, community development organizations, and the state's two land-grant institutions.

In 2011 the organization included 30 member markets, less than half of the approximately 80 known farm markets in the state. The organization maintained a website with communication resources and educational materials and hosted

four, one-day trainings for farmers markets across the state. Its outreach activities included partnering with the WV Department of Health and Human Resources to improve and clarify market food-safety guidelines; operating a chapter of the Buy Fresh Buy Local program to provide branding and marketing for member markets; and organizing a "Winter Blues Farmers Market" at West Virginia University Extension's annual Small Farm Conference to demonstrate best practices, such as collecting gross sales, accepting EBT and credit cards, and requiring local, producer-only ingredients (Spellman et al., 2012).

In addition to education and outreach, the WVFMA partnered with the USDA to create and update the state's farmers market census. The 2011 census found rapid growth in the number of markets in the state, but also found limited resources and capacity among markets and market managers. Interviews and anecdotal observations suggested that only one-fourth of WV markets were firmly established, "mature" markets with adequate structure and management. An additional one-fourth were classified as "marginal" markets, so small or new that their future success was uncertain. This left approximately half of the state's markets classified as "developing" markets, whose future would be determined largely by their ability to successfully identify and utilize existing energy and resources (Spellman et al., 2012).

Market managers frequently described the isolation they experienced and their struggles to assist producers in planning production and growing sales. Many managers are volunteers and often producers themselves, which limits opportunities for researching or implementing new production and marketing techniques (Spellman et al., 2012). These challenges were well understood by the WVFMA volunteer board, which experienced similar time and resource constraints, especially during the growing season, which limited the organization's ability to sustain and expand year-round assistance and support to member markets (Spellman et al., 2012).

In order to address the needs of producers and markets, and to strengthen the organization's capacity to serve additional markets in the future, the WVFMA partnered with the West Virginia Food & Farm Coalition, the West Virginia University Extension Service, and the West Virginia Community Development Hub to develop the Farmers Market Training Network Pilot Program (FMTNPP), a technical assistance program that would integrate components of group training, direct technical assistance, and peer networking. The long-term goal of the project is to strengthen community economies and rural local-food value chains. The program engages three tiers of stakeholders by increasing the profitability of vendors, bolstering the long-term viability of farmers markets, generating data for advocacy, and increasing the membership base and organizational capacity of the WVFMA (Table 1).

Program Development and Delivery

Program organizers began by surveying state markets and technical assistance providers, and reviewing national market support organizations' previously identified needs and best practices for engagement. Based on published documents and discussions with in-state stakeholders, the WVFMA identified common issues that clustered around four broad areas of need: risk management; business planning and marketing; producer development; and structure and unity (see more detail in the Appendix). A review of market associations' education and outreach activities to address these needs produced a wealth of resources. However, in line with the findings of the Farmers Market Coalition, the depth and breadth of engagement around topics were limited. For example, organizations often provided toolkits or fact sheets, but provided significantly fewer opportunities for in-depth learning and sharing around these topics. In-person trainings were often limited to annual conferences that spanned one or two days and covered an array of topics, or one-off training sessions that only addressed single issues. Frequently, materials or trainings were limited to the needs of a single stakeholder (markets and market managers), ignoring the specific needs of growers and producers. Finally, materials were most often oriented to new markets, rather than the "developing" markets recognized as a target audience by the WVFMA.

While the WVFMA saw room for improvement in the development and delivery of

Table 1. Stakeholder Engagement in FMTNPP Activities and Expected Outcomes

Stakeholder	Proposed Engagement Activities	Outcomes
Farmers/ Producers	• Business planning templates • Consumer data • Risk management • New sales opportunities (winter marketing, partnerships with market buyers)	• Increased sales for vendors • Market growth
Farmers Markets	• Risk management • Business planning • Producer development • Strategic planning and organizational development • Standardized data tracking system	• Stronger rural local food value chains • Incubation and support for vendor development • Improved data for advocacy
West Virginia Farmers Market Association	• Increased collaborations with partner organizations • Resources to hire full-time staff • Board development • Training for strategic and financial sustainability	• Increased organizational capacity • WV Farmers Market Toolkits • Increased membership and fund-raising base for organizational sustainability

resources, they also identified best practices that could be employed in the development of their proposed program. The group drew particular inspiration from the outreach activities conducted by the Michigan Farmers Market Association (MIFMA), specifically its Market Manager Certificate Program, which requires multiple in-person learning sessions that emphasize both content and manager networking; and the Michigan Market Manager Mentorship Program, which pairs market managers with experienced mentors to overcome challenges surrounding food access and the use of SNAP benefits (food stamps) at markets.

With the WV Community Development Hub as fiscal agent, the group applied for and received an US$80,300, 18-month grant from the Claude Worthington Benedum Foundation to hire a full-time program coordinator to implement pilot project activities. The technical assistance model proposed by the WVFMA was a multipronged approach that consciously engaged all levels of stakeholders through integrated components of group training and direct technical assistance, all in a schedule conducive to the seasonal time constraints of growers and of the volunteer market and WVFMA board members.

In 2012 the WVMFA formally launched the FMTNPP. Markets participated in a competitive selection process that evaluated their organizational stability and prior experience managing projects, clarity of need, willingness and ability to commit to the program requirements, and geographic distribution. Ten markets were chosen for participation in the pilot program. Markets received training in best practices in all four of the areas of need (see the Appendix) and on the importance and use of data (sales and visitation) tracking tools. To further add value to the training and resources provided around the broad areas of need, market representatives were paired with technical assistance providers for one-on-one assistance on a specific project. Similar one-on-one assistance was provided to each market to implement the tracking system in order to ensure consistency across all markets participating in the pilot. Markets were also eligible to receive minigrants of up to US$1,000 midway through the two-year program to undertake projects related to their identified need.

Similar to the MIFMA's Market Manager Certificate Program, the FMTNPP included four statewide convenings. These meetings provided opportunities for educators and resource providers to present content related to the areas of need, and for market leaders to network and collaborate in regional subgroups. Convenings were held in different regions of the state; each one was co-hosted by a well established market that could showcase its efforts to less established markets.

The sequence of four statewide convenings was designed to build community, create enthusiasm for the established farmers markets that hosted the convenings, and encourage markets to remain accountable to follow through on plans and projects initiated at previous convenings.

To further improve the program and sustain learning and technical assistance beyond the grant period, the WVFMA committed to and developed online educational materials (Farmers Market Toolkit) based around educators' content and market experiences, using market data, and content generated by resource providers.

Program Evaluation

To ensure the effectiveness of the pilot program and identify areas for future improvement, the WVFMA in partnership with the WVU Extension Service collected program evaluation data at multiple points during the program. An intake tool asked two questions addressing market representatives' confidence in the long-term future of their market, and the development and use of long-term business plans; a midpoint and final evaluation included additional questions that assessed the FMTNPP's success in addressing market needs and challenges, improving sales, and connecting the markets to resources and technical assistance. Multiple market representatives completed evaluations; however, the final evaluation was completed by only nine of the 10 markets. The evaluation tool and sample size are not sufficient to draw statistically valid conclusions about the program's effectiveness; however, they do shed light on participants' satisfaction with program outcomes.

At the completion of the program all respondents reported increased confidence in the long-term future of their markets. Additionally, all respondents reported feeling more connected to existing resources and technical assistance, and as a result were better able to access information from experts and their peers. By matching the needs of the markets with technical resources, the FMTNPP began to address many of the challenges identified by participating markets at the start of the program: at the final evaluation, five markets indicated their challenges had been somewhat addressed, and four markets indicated their challenges had been addressed. Specific technical assistance programs, such as those focusing on low-cost season extension practices like low tunnels and row covers, were regarded as valuable. Four markets used minigrant funds to purchase equipment and supplies for their vendors to implement season extension practices, and one market held a workshop open to all growers in the county. The workshop was attended by 23 people and distributed row cover and other needed materials to nine market vendors. The market reported that vendor participation in the workshops helped increase both the quantity and variety of early and late produce, particularly salad greens, a high-value farmers market crop.

A challenge frequently cited by past literature (Connell & Hergesheimer, 2014; Stephenson et al., 2008) and the FMTNPP's participating markets was the need for formalized business plans. Results from initial data collection indicated that only one of the 10 pilot markets had a long-term business plan. Over the course of the program, three markets worked one-on-one with business consultants to address long-term visioning, goal-setting, and budgeting. With the assistance of consultants, two of the markets crafted formal business plans based on input from their governing bodies. One smaller market utilized its consulting time to develop workshops for individual vendors. Additionally, one market used elements from its newly developed business plan to establish a consignment booth to incubate new producers and expand the market's reach in the community. The market used minigrant funds to hire a social media marketing manager to coordinate online communications, specifically those targeted to low-income consumers. The project is credited with attracting 31 new, regular SNAP customers, increasing market sales by 39 percent, and generating 100 new subscriptions to the market's e-newsletter.

In addition to the technical assistance, all 10 participating farmers markets received training and support on how to collect and submit sales data to WVFMA representatives. Use of the data collection toolkit generated robust data on gross sales, WIC and Senior Voucher Coupon sales, SNAP/EBT sales, customer headcounts, vendor participation in data-gathering, and more. At the close of

the 2012 market season representatives were presented with collective trends for the group and individualized reports for their market. This allowed the markets to benchmark and quantify their efforts and compare their progress to peers across the state. The reports were well received; 100 percent of the participants indicated they would continue to collect data after the pilot program's completion.

At the program's conclusion, all responding market representatives indicated that sales had improved (five markets) or somewhat improved (four markets) as a result of their participation in the program. An analysis of the data indicated a 13 percent increase in gross sales for the participating markets between 2012 and 2013; however, these increases cannot be directly attributed to program participation.

Program Outcomes and Lessons Learned

Evaluation results suggest that the FMTNPP produced many successes regarding the needs and challenges of participating member markets. Even during implementation, however, program organizers recognized shortcomings and areas for improvement. The lessons learned during the pilot program led to improvements in program structure and content delivery for later program iterations and improved outcomes and impacts for stakeholders.

Learning from Peers

The importance placed on peer networking and peer learning to address market challenges is key feature of the FMTNPP. As the program developed, the emphasis on practitioners' expertise continued to expand and today is central focus of the program. With the exception of MIFMA's mentorship program, we are unaware of any similar programs nationwide. Additionally, the WVFMTNP was the only program that used the peer approach to address a breadth of market needs, as MIFMA's mentorship programs until this year were specific to food access needs.

Although the program's initial emphasis was a top-down, expert-led model focused on connecting market leaders to experts and/or consultants in high-need training areas, program coordinators quickly learned that "experts" often did not have a sufficient working knowledge of farmers markets and agriculture in general to adequately help the markets solve their issues. This was especially true for business and marketing consultants. Recognizing that the experiences of market leaders were often the best teaching tools, the WVFMA encouraged participants to mentor each other; however, no formal structure was created to facilitate this knowledge exchange. Without a structured approach, volunteer managers' time demands limited the amount of peer learning that occurred. Future convenings were modified specifically to include presentations by market participants on topics of expertise, as well as organized group activities and networking opportunities where participants could ask their peers for assistance, trouble-shoot challenges, and share successes. The current program also includes scheduled, mandatory monthly conference calls between WVFMA staff and all participating market representatives. Agendas include an "ask the expert" activity, where questions are posed to the group either by staff or other group members, and participants share advice, resources, and information. The success of the peer learning model has led to its use in other WVFMA initiatives, including the "New Vendor Launch," a producer development program that pairs producers with less than two years of experience with seasoned vendors.

Training the Trainers

In addition to encouraging leaning between peers, the next iteration of the program specifically included funding for consultants and WVFMA staff time to collaborate on the creation of Farmers Market Planning Toolkit modules to address high-need subject areas. The learning modules were structured so that could be used by both markets *and* service providers and consultants. Topics currently include "Marketing Your Market," "Structure, Management, and Finance," and "Vendor Recruitment and Retention." Authors and contributors include representatives from food and farm organization, state agencies, university Extension programs, and participating markets. These collaborations between content experts and farmers market leaders bridge the gap between

technical assistance providers and the markets they are trying to help. The result is improved access to information for markets and more effective service provision by technical assistance providers. Iowa State University Extension has recently adapted and expanded the "Structure, Management, and Finance" module to apply to the specific needs of Iowa farmers markets and other local food organizations. Additional information on these resources is available through the WVFMA website (http://wvfarmers.org/).

Data Collection

The data collection and submission process is key to successful program evaluation, especially when success is defined by customer attendance and vendor sales; unfortunately, time constraints and lack of perceived value limited market leaders' willingness to participate in the process. Data for the 2013–2014 market year was often spotty because of poor reporting. In later iterations of the WVFMTNP, the WVFMA hosted an in-person data collection during the kick-off meeting to help engage participants and minimize confusion. The group also hired staff to follow up with markets and ensure timely and accurate data submissions. As a result of these efforts, the WVFMA recorded 100 percent participation and submission for the 2014–2015 season.

Five of the markets participating in the 2012–2013 pilot returned to participate in the 2014–2015 program. Comparisons between 2012 and 2014 data for the five markets reveal a 150 percent increase in average customer attendance and approximately US$250,000 in increased sales. SNAP/EBT acceptance increased from two markets in 2012 to five in 2014; SNAP/EBT receipts increased from US$296 in 2012 to US$8,679 in 2014, a nearly 30-fold increase.

Commitment

The success of the FMTNPP requires significant time commitments from market managers and is most successful with buy-in from the vendors, organizers, and other stakeholders, especially for program elements such as data collection and submission. Due to WVU Extension's involvement in the program, several markets in the FMTNPP were represented by local agents. Unfortunately these markets were by far the lowest-performing of all the markets in terms of timely data submission, reporting, and participation in activities. As community "activators," the agents would often apply for grants or agree to participate in projects *on behalf* of their markets. However, other time commitments coupled with a lack of buy-in from market leaders and stakeholders ultimately caused these projects to suffer. Future rounds of the FMTNPP required that the primary program contact and the submitter for market and project data was an elected officer of the market, not an external party.

Carrots, Sticks, and Strategic Requests

Many small, rural markets have at most one paid manager, the majority of whom only work part-time, and few local stakeholders from whom to draw support. Program organizers recognized the need to manage expectations and be as strategic as possible when making requests, from communications to reporting. For example, in initial meetings the WVFMA provided monetary resources and helped secure resource providers, but asked market leadership to coordinate meeting logistics. As a result, many market leaders devoted time and resources to planning meetings rather than carrying out program requirements and implementing projects. The second round of programing relied on WVFMA staff to coordinate meetings, freeing market leaders to develop content and recruit vendors.

In addition to strategic requests, program leaders became more strategic in their use of resources and incentives to encourage compliance with program requirements. Incentives for the 2012–2013 pilot program included US$1,000 toward markets' minigrant projects. Some markets received half the money in the spring of 2013 and the remainder upon completion of data reporting for the year. Others with capital-intensive projects were given US$900 up front with the final US$100 reserved for reimbursement. The markets that had 50 percent of their funding held back were much more diligent about reporting their data, and all completed their final reports. In contrast, two of the three markets who received 90 percent of their

funding failed to fully report. Going forward the program has retained the 50/50 model to incentivize full participation in program requirements.

Conclusions

The lessons learned from the FMTNPP are valuable and have set the tone for forward movement in the organization and the state's regional food system development efforts. Pilot markets are continuing data collection and face-to-face networking. The program's success has led to the establishment of a formal training network based on the effective approaches learned. The network will allow the WVFMA to stay abreast of the emerging market training needs and available resources of service providers. The organization is expanding its educational reach through formalized Farmers Market Planning Toolkits and targeted education delivered at regional farm gatherings and market localities, reducing the time and financial burdens to markets. The hiring of a project coordinator is increasing the WVFMA's long-term organizational capacity, strengthening existing partnerships, creating economies of scale, and reducing duplication of services. Partnerships forged with other organizations and technical assistance providers have exposed these groups to the benefits and unique needs of farmers markets, thereby increasing the effectiveness of program delivery and strengthening the stability of West Virginia's farmers markets and local food economy.

The FMTNPP evaluation results suggest that the program was successful in connecting markets to needed technical resources, increasing markets' confidence in their own long-term future, and increasing sales. However, these successes required program leaders to consciously reflect on what did and did not work, and modify the program along the way. The lessons learned during the pilot program's implementation shed light onto what market leaders need and value in terms of training, expertise, and delivery. Specifically, these efforts revealed the value of peer learning and networking, the need to educate service providers and partners on the unique needs of markets and farm-based businesses, and the importance of incentives and managed expectations. These lessons have benefited future iterations of the program and all levels of market stakeholders and should benefit similar organizations and programs across the country.

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Appendix. West Virginia Farmers Market Training Network Pilot Program's Identified High-need Subject Areas, Topics Covered During the Program, Market Resources, and Contributing Partners

High-need Subject Areas	Topics Covered	Resources Provided	Contributors

Risk Management	• Insurance requirements
	  o When is insurance necessary?
	  o Selling at markets
	  o Selling at on-farm markets
	• Types of insurance
	  o Liability insurance
	  o Homeowners insurance
	• Where to purchase and how to shop
	• Reducing risk
		• Factsheets and FAQ sheets
		• PowerPoint presentations
			• WV Small Farm Center (Extension)
			• WV Farm Bureau
			• Fayette, Monroe, and Morgantown Farmers Markets

Business Planning and Marketing	• Brand strategy development • Signage and graphics • Earned media • Social media • Events	Direct technical assistance in business plan development. • Examples of successful WV marketing • Surveys • MESH Brand brainstorm survey • Target audience survey • Print vendor resources • How-to guide for media outreach • Storytelling toolbox • Social media strategy planning document • Event planning guide	• WVFMA board and staff • MESH Design and Development • Value Chain Cluster Initiative[a] • *Charleston Gazette* • Dream Creative • Charleston Area Alliance[b]

Producer Development and Vendor Recruitment and Retention	• Vendor recruitment
	  o Targeting growers
	  o Barriers to recruitment
	  o Orienting and integrating new vendors
	• Vendor retention
	  o Market culture
	  o Participation and trust
	  o Managing funds
	  o Engaging customers
	  o Investing in vendor education and growth
	• Season extension techniques
		• Direct technical assistance on season extension, including high and low tunnels
		• Vendor recruitment and retention checklist
		• Example vendor application
		• Example of rules and grievance policy
		• Planning worksheet for good and transparent governance
		• Surveys
		  o Designing dot surveys
		  o Vendor interest in education
			• Value Chain Cluster Initiative[a]
			• WVFMA board and staff
			• Wild Ramp, Williamson, and Putnam County Farmers Markets
			• WVU Extension Service

Structure and Unity	• Defining the organization • Mission and vision	• Sample mission and vision statements • Stakeholder analysis worksheet	• WVFMA board and staff • WV Food and Farm Coalition

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High-need Subject Areas	Topics Covered	Resources Provided	Contributors

	• Stakeholders
	• Goal setting and strategic plans
	• Effective facilitation
	• Legal structure
	  o Nonprofits vs for-profits
	  o Cooperatives
	  o State and federal filings
	• Governance
	  o Bylaws
	  o Rules
	  o Membership
	• Building a board of directors
	• Funding the market
	  o Vendor fees or commissions
	  o Merchandise sales
	  o Donations
	  o Sponsorships
	  o Crowdfunding
	  o Grants
		• Board member commitment form
		• Strategic planning template
		• Sample bylaws from 501(c)(3) market
		• Secretary of State nonprofit registration
		• Strategic planning template
		• Mission and vision group activity
		• Member recruiting matrix
		• Fundraising plan template
		• FM budget template
			• Office of WV Secretary of State
			• WVU Extension
			• WVU College of Law
			• Ohio Cooperative Development Center
			• Morgan County Association for Food and Farm

[a] The Value Chain Cluster Initiative provides hands-on business development and coaching services to new or existing producers, processors, aggregators, and distributors of local food in 17 West Virginia counties.
[b] Charleston Area Alliance is a regional Chamber of Commerce that also provides workforce development and small-business support services.

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The benefits and challenges of machinery sharing among small-scale fruit and vegetable growers

Georgeanne Artz [a] * and Linda Naeve [b]
Iowa State University

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Abstract

We worked with five groups of Iowa farmers who shared different pieces of machinery. Under our mentoring, each group developed sharing agreements; some groups continue to share equipment and other inputs. In this paper, we provide an overview of the project and case studies of machinery sharing as well as summarize the benefits and challenges faced by growers during the first year in machinery-sharing arrangements. Our results suggest that in addition to allowing growers to cost-effectively access specialized equipment and improve their labor efficiency, sharing can provide other benefits, including improved access to skilled labor, reduced risk, and idea sharing among peer groups of like-minded individuals. Commonly cited concerns with machinery-sharing arrangements, including having access to the equipment when most needed, can be alleviated with careful advanced planning and open communication.

Keywords

equipment, fruit, local foods, machinery sharing, small-scale producers, vegetable

Introduction and Literature Review

Interest in local foods has been growing among both consumers and producers. According to U.S. Secretary of Agriculture Tom Vilsack, "The demand for local food is growing rapidly nationwide, creating more opportunities for American farmers and ranchers and growing the entire country's rural economy" (U.S. Department of Agriculture [USDA], 2014). While the growth of direct-to-consumer sales, such as farmers markets and CSAs, is peaking, sales to intermediate markets

[a] * *Corresponding author:* Georgeanne Artz, Assistant Professor, Department of Economics; 478B Heady Hall; Iowa State University; Ames, Iowa 50011 USA; +1-515-294-6260; gartz@iastate.edu

[b] Linda Naeve, Program Specialist, Extension Value Added Agriculture; 1111 NSRIC; Iowa State University; Ames, Iowa 50011 USA; +1-515-294-8946; lnaeve@iastate.edu

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are skyrocketing. As a result, the current economic opportunities in local food extend beyond small markets, and an increasing number of local growers are entering the marketing mainstream through wholesale markets (Low et al., 2015).

Supplying wholesale markets presents a challenge for the local foods industry. While direct-to-consumer sales is a good entry point for beginning producers, wholesale markets typically require growers to supply much larger volumes and greater delivery consistency in product at lower prices than retail markets. The challenge facing the local food movement is farmers' capacity and willingness to scale up to meet the demand of these intermediate market channels (Mount, 2012). Most farms engaged in local foods production are small and many are not profitable, if unpaid family labor is included (Brown & Miller, 2008). These farms make up 85 percent of farms selling local foods, but account for only 13 percent of the total local food sales, primarily through direct-to-consumer channels (Low et al., 2015). Approximately 60 percent of the value of local food sales is marketed through intermediate channels, such as grocery stores and restaurants, by larger volume food farms (Low & Vogel, 2011).

Increasing production for intermediate markets can increase farms' efficiency and profitability (Low et al., 2015). To scale up their production level, meet the growing interest, and increase profitability, local fruit and vegetable growers need to find ways to increase labor input or improve labor efficiency through mechanization and other means. The financial constraints faced by most small-scale growers, particularly those who are new to agriculture, create an obstacle to scaling up production. Small-scale local food production is typically less mechanized, and therefore more labor intensive, than large-scale production. However, expansion using labor-intensive practices is limited in many cases, because additional labor is unavailable or too costly. Alternatively, farms can adopt more capital-intensive, labor-saving production methods. This strategy has challenges as well. Labor-saving machinery, particularly specialized equipment, is a "lumpy input" that must be adopted in discrete amounts. Purchasing machinery, even used machinery, usually requires a significant financial investment and adequate cash flow, making the investment economically infeasible for small-scale growers. While expanding production to take advantage of size economies helps to manage the associated rise in fixed costs of equipment (Johnson & Ruttan, 1994), purchasing the machinery complement required to expand from a 5-acre (2-hectare) market farm to a 20-acre (8. ha) vegetable farm requires more cash than many small-scale producers can afford.[1]

Given these constraints, some growers are considering alternative ways to access machinery, including the option of sharing equipment with other growers. Evidence from a survey of forty-four fruit and vegetable growers, undertaken in January 2012, supports the idea that such growers have an interest in sharing machinery to reduce costs (Artz, Edwards, & Jarboe, 2014). Seventy percent of the respondents answered they would consider sharing equipment with other growers. Additional post-workshop surveys conducted with producers in the winter of 2014 showed that 39 percent had shared machinery and 85 percent were interested in sharing machinery. The reasons cited for sharing included: enabling access to machinery that would otherwise not be affordable, saving time and cost, and intending to scale up but lacking access to sufficient labor to do so. Among the concerns raised about sharing machinery were not having immediate access to the machine when it is needed, financial and time constraints for transporting the equipment, and the challenge of finding suitable sharing partners.

Small-scale fruit and vegetable growers may face some unique challenges for sharing machinery, because, relative to corn and soybean row crop operators, they use more diverse and specialized equipment, such as transplanters, bed shapers, planters for multiple-sized seed, mulch layers, mulch removers, rotovators, and potato and root crop diggers. Also, because the density of fruit and

[1] John Hendrickson (2005) provides a sample of the purchase price of a machinery set for a 5-acre (2 ha) market farm costing US$35,400. His estimates for a 20-acre (8 ha) vegetable farm ranges from a low US$42,725, if all equipment could be purchased used, to as much as US$165,000 for purchasing all new machinery.

vegetable growers in this region is low and they tend to be dispersed geographically, sharing machinery among fruit and vegetable growers involves more complex transportation arrangements and logistics of scheduling use. In contrast, corn and soybean row crop operators in the rural Midwest typically have a large pool of nearby potential equipment-sharing partners. Finally, many specialty crop growers are new to agriculture and are not experienced equipment operators, raising an additional question of whether these growers possess the necessary skills required to safely and properly operate machinery that may be shared.

Equipment and labor sharing among farms is not a new concept. For example, U.S. farmers in the early part of the 20th century routinely worked together to harvest crops on threshing rings (Olmstead & Rhode, 1995). Harper (2001) describes the practice of "changing works" in upstate New York, in which neighboring farmers worked cooperatively to harvest oats, hay, and corn, moving from one farm to the next. This tradition of working together on collective tasks virtually disappeared after World War II, he argues, a result of declining agricultural labor supply and technological changes in production, including increased mechanization. Today, informal and occasional machinery and labor sharing among farms in the U.S. is still relatively common. However, more formalized, routine equipment sharing among non-related partners seems quite rare; at least, U.S.-focused research on the topic is limited. Artz, Colson, and Ginder (2010) describe several cases of regular, on-going equipment sharing among conventional row crop growers in the Midwest. A few simulation studies have examined the potential costs and benefits of machinery sharing, showing conditions under which it may be profit-enhancing (e.g., Kenkel & Long, 2007a; Wolfley, Mjelde, Klinefelter, & Salin, 2011) and a handful of University Extension publications provide guidance on ways to organize joint ownership of machinery (e.g., Artz, Edwards, & Olson, 2009; Edwards, 2013; Kenkel & Long, 2007b; Weness, 2001).

Machinery rings and other more formal farm-level cooperative arrangements among non-related producers appear to be more common in Europe and Canada than in the U.S. Harris and Fulton (2000a) report more than 1,000 member farms in forty-seven CUMA's ("Coopérative d'Utilisation de Matériel Agricole—loosely translated as "co-operative for the use of farm implements") in Quebec. A report on the socio-economic impacts of rural business rings in Scotland includes an estimate that 23 percent of Scottish farmers belong to machinery rings (Scottish Agricultural Organisation Society, 2008). de Toro and Hansson (2004) report 5,000 members in 20 associations in Sweden (about six percent of Swedish farmers). They compare this participation rate to that in Germany, noting that Swedish activity would need to increase fivefold to reach the level in Germany. While it remains an open question whether more U.S. growers would adopt machinery sharing strategies in their operations, the successful models in other regions of the world suggests the possibility.

We investigated the potential for machinery sharing among small-scale fruit and vegetable growers in a project conducted in Iowa in 2013. We worked with newly established groups of producers with different types of machinery and different sharing strategies. Our first objective in the machinery-sharing project was to explore alternative strategies for equipment ownership that growers could implement in their operations to enhance profitability and reduce risk when scaling up production. Our second objective was to document the economic and other costs and benefits experienced by the growers participating in the sharing arrangements. Third, we sought key lessons to guide other growers considering sharing equipment.

A Conceptual Framework for Machinery Sharing

Machinery sharing is a form of horizontal cooperation that involves trading-off potential savings and increased costs. The savings arise from reduced investment and internal economics of scale. Added costs include both explicit costs, such as transportation costs of moving equipment between farms, and implicit costs, especially increased transaction costs due to lost timeliness, monitoring, and group decision-making (Allen & Lueck, 1998; Hansmann, 2000; Valentinov, 2007). The potential benefits and costs of sharing machinery relative to individual

ownership can vary greatly depending on a variety of factors, such as size of the group, type of equipment shared, size of members' farming operations, and even members' personalities (Artz, Colson, & Ginder, 2010; Wolfley et al., 2011). A motivating factor for many producers considering sharing machinery is the reduced upfront investment required to acquire the equipment. Dividing the cost of equipment among multiple farms can dramatically lower the amount of capital investment needed at the time of purchase, but the cost savings can extend beyond the initial investment. Some studies of machinery cooperatives have reported cost savings as high as 30% to 35% (Harris & Fulton, 2000b; Kenkel & Long, 2007a), while others have found more modest, yet still positive gains, depending on the organization of the arrangement and the type of farming system (de Toro & Hanson, 2004; Wolfley et al., 2011). Savings arise from an ability to improve efficiency in the production process as the size of a farm increases, because the number of acres serviced by the machinery increases (relative to individual use), lowering per-unit costs of production (Basnet & Kenkel, 2012; Gertler, 1981; Gertler & Murphy, 1987; Weness, 2001). Sharing may allow producers access to more efficient, larger, or more specialized equipment and technology than they could otherwise afford (Groger, 1981; Harris & Fulton, 2000a, 2000b; Samuelsson, Larsén, Lagerkvist, & Andersson, 2008). The access to such farming equipment can improve productivity and quality, and replace expensive or hard to find labor (Artz, Colson, & Ginder, 2010; Nielsen, 1999). If the sharing arrangements allow for timely access, higher capacity equipment can reduce the time spent to complete critical operations (e.g., planting or harvesting), both lowering costs and production risk (Andersson et al., 2005; de Toro & Hansson, 2004; Kenkel & Long, 2007b; Wolfley et al., 2011). Working cooperatively, group members can improve labor productivity by specializing in the tasks they are best at or most enjoy, and by coordinating tasks to reduce duplication (Allen & Lueck, 1998).

The practice of sharing equipment and perhaps labor may spark other forms of collaboration among cooperating farms, generating further benefits. Working cooperatively with others may facilitate sharing of experiences and ideas. The cooperative relationships may lead to coordinated purchases of inputs to access volume discounts, or to working jointly to obtain better terms for credit, storage, services and marketing, and distribution opportunities (Johnson & Ruttan, 1994). Cooperators may be able to coordinate production processes to attract specialty contracts that pay premiums for delivery of a product in bulk or of a certain quality (Sexton & Iskow, 1988). Finally, sharing may create opportunities for custom work, adding an additional income source for small farmers.

At the same time, sharing machinery across farms can introduce a number of costs not incurred when owning equipment individually, and it will not always be the case that the benefits of acting collectively outweigh the costs. As Ostrom (1990) notes, "the costs involved in transforming a situation from one in which individuals act independently to one in which they coordinate activities can be quite high" (p. 40). If member farms are geographically dispersed, the costs of transporting the equipment between farms can be substantial. Legal or accounting services may be required at the time of formation and also possibly on an ongoing basis. Beyond these explicit costs, a number of implicit costs of sharing may arise. Joint owners of an asset do not necessarily share equally in the costs and benefits of that asset. As a result, joint ownership inherently produces conflicts of interest (Holderness, 2003). Artz (2014) discusses five overlapping categories of potential conflicts associated with shared use and ownership of an asset: scheduling of use and timeliness concerns; moral hazard or free-riding problems; costs of collective decision making; opportunism and hold up problems; and risk. Studies of sharing have documented examples of these, including less timeliness in field operations, less control over decision making and reduced independence, more complex management, potential problems with lenders and split lines of credit, and challenges in unwinding arrangements (see Andersson et al., 2005; de Toro & Hansson, 2004; Gertler, 1981; Gertler & Murphy, 1987; Groger, 1981; Harris & Fulton, 2000a, 2000b; Nielsen, 1999; Samuelsson et al.,

2008; Wolfley et al., 2011). Many of these potential costs, however, can be minimal in cases of machinery sharing among small, relatively homogeneous groups of producers with common interests. Frequent interaction among group members can allow for monitoring to prevent moral hazard problems. Personal relationships and repeated interactions, or in some cases, legally enforceable contracts, can help solve problems with free-riding and opportunism (Hansmann, 2000; Larsén, 2007).

Applied Research Methods

We examined the trade-offs between the added benefits and increased costs of interfarm cooperation through equipment sharing in a set of five cases of newly formed machinery-sharing groups located in Iowa. We focused our study on small-scale fruit and vegetable producers, but the cases represent variety in the type of equipment shared, farming experience, and number of producers involved. These differences in inter-farm cooperation allow us to better understand how group size and nature of equipment shared affect the effectiveness of the groups.

We used a multiple case design in which the unit of analysis is the machinery-sharing group. While case-study approaches are well-suited for gaining a deeper understanding of emerging or relatively rare events and for asking "why" and "how" questions, there are limitations (Kennedy & Luzar, 1999; Sterns, Schweikhardt, & Peterson, 1998; Westgren & Zering, 1998; Yin, 2003). In particular, while our findings should not be interpreted as representing the characteristics of the population of farmers (Yin, 2003), the case approach we use in this study enables us to illustrate a range of organizational forms and strategies used in sharing machinery among Iowa fruit and vegetable producers, to document differences across these cases, and to analyze the situational characteristics that were associated with successful and unsuccessful outcomes.

We identified potential case study participants using a snowball sampling approach. In February 2013, we contacted farmer organizations, Extension media resources, and individuals involved in the local foods movement, value-added agriculture, and fruit and vegetable production. We asked them to publicize our project among commercial fruit and vegetable growers in Iowa and to solicit applications from growers. Interested growers completed an application form that included the contact information of the lead partner and one or more committed partners, the total number of acres in fruit and vegetable production among all participants, and the piece of equipment they planned to purchase and share. We used this information to select a diverse set of five groups of various production scales and products.[2] Eighteen farmers received compensation for participating in the project, paid in two installments: one at the beginning of the project and the remainder after the final survey was completed. Participants were encouraged to use the monetary compensation toward the purchase price and/or maintenance of the shared equipment. Prior to the growing season, an orientation teleconference was held with the farmers to discuss expectations of participating in the project, procedures, the timeline for accomplishing project goals, and how the compensation for their participation would be dispersed. All participants completed a preliminary questionnaire (see Appendix) to collect information about the respective group members' motivations for sharing and basic information about their farming operations. All groups had purchased or acquired their respective machinery by late spring. Tables 1 and 2 provide brief descriptions of the case study participants.[3] The groups varied in size from two to eight members. Each group shared a different type of equipment. While four of the groups had relatively simple operating agreements, one group organized as a limited liability company. This was the largest group in the study, with eight participating farms,

[2] We submitted our research proposal to our university's Institutional Review Board and were granted 'exempt' status for the study.

[3] Six groups were originally selected to participate. However, one group dissolved before they purchased the equipment, primarily because the key organizer for the group decided to pursue a full-time opportunity off-farm and quit farming. In addition, another member in the group worked full-time off-farm, which made it difficult to meet with the other farmers. He was a beginning commercial vegetable producer who farmed approximately 30 miles (48.2 km) from the other two members in the group.

and also the group which purchased the most expensive equipment, a US$30,000 aronia berry harvester.[4]

Each group was required to develop a machinery-sharing agreement and follow it throughout the 2013 growing season. We provided operating agreement templates with suggested provisions to the groups and we assisted them in developing their sharing agreements, which provided detailed answers to the following questions:

Ownership

- Who owns the machinery? (Percentages per owner)
- In the event an owner withdraws, how will his/her shared ownership be liquidated? How much advance notice is required to withdraw from the agreement?
- May the machinery be loaned or custom hired to parties not included in the agreement?
- Who will be responsible for insuring the jointly-owned machinery?

Storage

- Where will the machinery be stored (short term and long term)? Will compensation be paid for storing machinery?

Operation, Maintenance, Record-keeping

- How will fuel be supplied for tractors and self-propelled equipment?
- Who will be responsible for performing repairs and maintenance? How will operating and repair costs be calculated, collected, and paid? Who will have responsibility for paying joint expenses and other obligations?

Table 1. Brief Descriptions of the Cases

Holland Mulch Layer Model 1275 Two producers, located about 30 miles (48.3 km) apart, jointly purchased a Holland Transplanter Mulch Layer. Neither farmer had additional hired labor and both were looking to expand production. Given the infrequent use of the plastic laying equipment, and the ability to adjust the machine to different tractors, sharing was a good option. They financed the purchase 50/50 and share equally in operating costs.
Univerco ECO I Weeder This group of three older small-scale vegetable growers was looking for a cost-effective alternative to labor-intensive weed control. They jointly purchased a single-row ECO 1 mechanical weeder, each contributing one-third of the purchase cost. They have managed the challenge of sharing a piece of frequently used equipment by keeping the group small and staying in close communication during the growing season.
Three-point hitch tool bar and attachments Three younger women growers who were already collaborating through a multi-farm CSA were looking to share equipment that could be easily transported and would serve a variety of needs in their operations. They selected a three-point hitch tool bar with an undercutter and other attachments including high-wing furrowers, cultivator tines and disc hillers. Two of the group members purchased the equipment 50/50, giving the third member the option to rent the equipment for US$40 per use.
Garlic clove separator A grower with a seed garlic business built a motorized garlic clove separator as a way to efficiently break and clean over 4,000 pounds (1,800 kg) of garlic each season. Although the machine cannot easily be moved, he shares it with two other nearby growers who bring their garlic to his farm to be separated. The two cooperating growers each provided 10 percent of the original cost, and they share in annual maintenance costs.
JOANNA-3 aronia harvester Eight aronia berry growers formed an LLC to collectively purchase the aronia berry harvester to machine-harvest their increasing number of bearing acres of aronia. Under the direction of a group leader, they share the harvester and labor. Members are charged usage and maintenance fees based on their acreage in aronia production. These fees are contributed to a joint fund from which machinery-related expenses are paid. The usage fees also adjust for the relative usage of the machine by the various members.

[4] For more detailed case study descriptions, see Artz, Naeve, and Edwards (2014).

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- How will each owner or lessee contribute to the operating costs of the machinery?
- How will records be kept and who will be responsible for keeping them?

Labor

- How will labor for operating the machinery be contributed?

Replacement

- What is the goal or strategy for replacing the machinery?

Each group completed an equipment-use time log and financial recordkeeping forms that we developed for their shared equipment. Participants also provided input and suggestions regarding the operation of their specific equipment-sharing model. We evaluated the success of the arrangements in two ways. We held on-site follow-up meetings with three groups to observe their equipment in operation and to discuss their particular equipment-sharing models. For the other two groups, we conducted follow-up interviews by phone using open-ended questions to generate discussion. The following questions guided our post-season, follow-up interviews with each of the groups:

- Did your group work together to develop the sharing agreement? Was it useful?
- On how many acres was the shared machinery used?
- What markets were used to sell farm products?
- Did your group use the time log to determine the amount of time the machinery was used and the time required for transport and setup? Was this information helpful and how was it used?
- How was the machinery moved between farms and who was responsible for transportation?
- Were adjustments needed prior to each use?
- Was labor shared?
- Was the machinery efficient and effective? How much time do you estimate that it saved?
- Any additional thoughts of sharing other equipment in the future?

Table 2. Equipment Sharing Groups

Case: Equipment Shared	No. of Members	Total No. of Acres (Hectares)	Approximate Distance Between Farms	Age Range of Growers	Type of Ownership	Members with Off-farm Employment
Holland Transplanter Mulch Layer	2	2.25 (0.91)	30 miles (48 km)	27–51	Equal co-ownership	2 work full-time off farm
Multi-use tool bar and attachments	3	4.5 (1.8)	18–20 miles (29-32 km)	30–56	Equal co-ownership by two members	2 work part-time off farm
Joanna 3 Aronia Harvester	8	40 (16)	50-mile radius from a centrally located farm (80.5 km)	40–65	Equal co-ownership	3 have full-time off farm employment
ECO 1 Weeder	3	10 (4)	20–25 miles (32–40 km)	59–70	Equal co-ownership	1 grower works part-time in winter & 1 works full-time year round
Garlic separator	3	5 (2.02)	10–30 miles (16–48 km)	26–38	Co-ownership: 80:10:10	1 works part-time off farm

Both interviewers took detailed notes during the interviews and wrote summaries of the conversations shortly after the interviews occurred. We also conducted a brief survey of the 21 participating farmers one year later, in January 2015, to gather information on the effectiveness, growth, and sustainability of their machinery-sharing group and agreement.

Results

Benefits Realized from Sharing Equipment

Our case studies show a number of benefits from sharing machinery consistent with previous literature on the topic. These include reduced machinery costs, access to more specialized equipment than would otherwise be attainable, improved efficiency particularly through labor savings, reduced production risks, and additional collaboration.

Reduced costs

In four of the five cases, sharing machinery did not actually reduce outright expenses since it involved purchasing equipment not previously owned, albeit at a lower expense than would have been the case if each grower had purchased the equipment individually. Since few of these small-scale growers hired labor, the increased equipment expenses were not offset by reduced labor expenses. In these cases, the main benefit of the equipment was realized through reductions in their own labor and improved timeliness of operations.

In the case of the aronia berry harvester, however, the machine did replace hired labor for hand harvesting for the established producers in the group. Based on the group's records, two people operating the harvester could harvest an acre (0.4 ha) of berries in 1.75 hours. Thus, growers with small acreage could harvest their crops in a day, including about 90 minutes for setup and cleanup and 90 minutes for transportation. In contrast, hand harvesting an acre of aronia requires an estimated 771 hours of labor.[5] Clearly, the cost of equipment would be quickly recovered in the labor savings in this example.

Given that our study was confined to the first year of equipment sharing for these groups, we did not observe that any of the growers expanded acreage in this year, although several indicated an intention to do so in the future. For example, the group sharing the aronia berry harvester purchased their machine in anticipation of more acres under production in the near future as their members' young plants reached maturity. However, one of the partners in the mulch layer group did report being able to more fully utilize his available land and produce a greater quantity on the same acreage. In this case, the machinery allowed him to complete the plastic laying task in a fraction of the time and effort required by hand labor.

Access to specialized equipment

Growers in several cases indicated that they would not have found it affordable or economical to purchase the equipment individually. Certainly, in the case of the US$30,000 aronia berry harvester, individual ownership would have been cost prohibitive for the beginning and very small-scale producers in the group. Yet even for a relatively less costly piece of equipment, available funds can be limited for small-scale producers. For example, one grower in the study noted, "I just don't have the funds to purchase a mulch layer on my own."

Improved efficiency and/or labor savings

Sharing equipment improved efficiency for some of, if not all, the members of the groups, primarily through reduced labor input. For example, in the case of the mulch layer, the growers reported that laying 350 feet (106.7 m) of plastic previously required two people and two hours; with the equipment, one person could accomplish this same task in minutes. Not only did access to equipment save time, it also saved physical effort. "The weeder saves an awful lot of expenditure of energy. If I had to do it by hand, I couldn't physically get that much done in a day," said one 70-year-old producer in the Eco-Weeder group. One of the women in the toolbar sharing group noted, "the main thing was, we're breaking our backs here [digging root crops]. The tool makes it so much easier."

[5] Assumes 620 plants per acre (0.4 ha), 20 lbs. (9.07 kg) of production per plant, and a picking rate of 16.1 lbs./hour (7.3 kg/hour).

The one case in which efficiency was not improved for all of the members was the garlic separator group. For the producer who stored the equipment on farm, and for those in very close proximity with ready access to the machine, sharing did save time and effort and made sense. Data from this group suggests that by hand, one person can break and clean about 25 pounds (11.4 kg) of garlic per hour, but, due to hand fatigue, can't work at this for more than a few hours at a time. The separator, however, cracks and cleans roughly 500 pounds (226.8 kg) of garlic per hour. Two of the initial five collaborators ultimately decided not to participate because the machine did not save enough time given that they would have needed to travel a significant distance (20 miles (32 km) or more) to use the machine, which was not portable. Relative to the other growers, one of whom had a garlic seed business, these growers ran more diverse vegetable operations and had much smaller quantities of garlic to separate.

Other benefits

In addition to cost and labor savings, one group noted the benefit of having "backup" should something go wrong. In the toolbar group, when one grower's tractor broke down during the growing season, she was easily able to borrow a tractor from one of her partners. She noted: "We've learned that working together has been such a great asset, you know when one farmer has a hard time or has a crop failure or has personal issues, and has to pull back a little, the other farmers fill in the gaps." Sharing equipment can lead to other types of sharing as well. Of particular importance is sharing labor. In the Eco-Weeder case, the sharing arrangement gave one partner access to additional help that he did not have before. Labor sharing may happen on a more occasional basis as well; "If we ever have a big project or something that needs to be done, we all kind of work together and share our efforts." Some groups extended their collaboration to purchasing bulk quantities of supplies, such as fertilizer, pesticides, harvest containers, boxes, and plastic mulch. As one grower phrased it, there is "power in numbers for purchasing."

Another benefit of collaboration is companionship, "farming can be lonely sometimes, it's really nice to have a group of like-minded people all working toward the same cause." Similarly, a group of people with whom to share ideas is helpful. One of the aronia growers noted, "The group's dynamics are a plus in decision making. The group has compatible, complementary business and farming skills. If you are the sole owner, the whole burden of problem solving falls on one person, but when you have many heads working on solutions, it is a lot easier and gets done quicker."

Overcoming Potential Challenges Encountered in Sharing Equipment

Previous studies of equipment sharing have documented a number of potential challenges encountered in these groups. Similarly, in our surveys of growers, we find many growers express a reluctance to consider sharing machinery with others. They worry about having access to the machine when it is needed, dealing with increased communication and transportation costs, and finding compatible partners. For the most part, growers in our study were able to deal effectively with these challenges through advance planning and through frequent and transparent communication.

Timeliness, transportation, and communication costs

In the literature, interviews with study participants, and grower surveys, one of the most frequently voiced concerns about sharing equipment with other growers is fear of not having access to the shared equipment when it is most needed. This is less of an issue when the use of the equipment is not highly time-sensitive and when it is used relatively infrequently. However, in our study, even groups who shared equipment that was both time-sensitive and used often, for example, the Eco-Weeder, did not report any major issues or concerns with having access to the shared equipment when it was needed. This is likely due to the advanced planning the groups undertook when formulating their written operating agreement, as well as their constant communication throughout the growing season.

Transporting the equipment between farms was generally not a problem for the equipment-

sharing groups in this study. In some cases, the equipment was used infrequently and only needed to be moved once or twice during the season. In cases where the equipment was used frequently, having a plan and communicating frequently resolved any issues regarding transportation and access to the machines. In the case of the Eco-Weeder, the most frequently used piece of equipment in our study, the three farmers kept in close communication and could usually move the weeder on short notice. They agreed in advance that the weeder would stay at the farm of the last user until requested by another member. The farmer requesting it was responsible for picking it up, but sometimes they would meet the other halfway between the farms. Since the farms were only about 20 miles apart, the sharers found that they could leave home, pick up the weeder, return, and have it ready to use in their field in less than two hours. Portability of equipment is also an important factor in the workability of sharing arrangements. In the toolbar case, the attachment was small enough to fit in the back of a pickup or small SUV, which made it easy to move between farms. In contrast, the garlic separator was not portable, and this restricted the ease of use.

Similarly, the additional communication required for working in a group was not viewed as a burden in these cases, but the need for transparent communication cannot be understated. Only the aronia berry group, the largest in our study, held regular, formal meetings during their formation process. Communication among the other groups occurred on an "as needed" basis, for example, calling or texting the other partners to ask questions or to arrange for transportation. In the case of the garlic separator group, two of the original five partners ultimately chose not to participate, citing lack of clear communication from the group's leader as a major concern. In particular, the specifications of the equipment to be shared were not clearly communicated in this case; the withdrawing producers thought the separator would be moved from farm to farm rather than be fixed in place.

The relative ease with which the groups in the study handled the potential challenges of timeliness, transportation, and communication stemmed from advanced planning, the willingness to be flexible when needed, and limits to the group size. Each of the groups seemed to have a sense of the optimal group size for their sharing agreement. For example, the two partners who shared the mulch layer felt that two to three partners would be the maximum for sharing that piece of equipment, explaining that it would be less effective with more members due to a relatively short window of opportunity for using the machine each season. A member of the Eco-Weeder group noted, "having fewer people sharing it gives us more flexibility on when we can get the machine. It wouldn't work as efficiently with more people or larger farms." Similarly, the aronia berry group limited their membership to no more than ten participating farms.

Compatible partners

A related concern of many considering sharing equipment is how to find compatible partners with whom to share. One grower said that she met potential partners at farming events and continuing education conferences, as well as at the farmers markets where she sells her produce. The aronia group employed an informal "interview" process to screen potential members before inviting them to join. A leader in that group described a suitable partner as someone who "is willing to get their hands dirty." Lack of compatibility in various dimensions can undermine a group's efforts to share equipment. Three fruit and vegetable growers who intended to participate in our project by sharing a plastic mulch remover dropped out because their farm and off-farm job schedules prevented them from adequately communicating with each other. Also, the significant distances between their farms posed difficult and costly transportation logistics. In addition, these growers were at different stages in their lives and differed greatly in their farming experience, which complicated the development of a feasible, mutually agreed upon sharing agreement, given divergence in their willingness to commit to a potential long-term partnership.

In addition to compatible personalities, groups also may need to consider the compatibility of each other's equipment and production systems. Differences are not necessarily insurmountable, but plans must be devised to address potential issues. For

example, some of the aronia growers are certified organic, while others are not. The group met this challenge by adopting a strict policy of cleaning and washing the machine after each use at the place of harvest before it was moved to the next location. A gas-operated pressure washer travels with the harvester, an organic-approved cleaning solution is used, and the cleaning is recorded on equipment log sheets that travel with the harvester.

For many beginning small-scale fruit and vegetable operators, an additional challenge is finding a skilled equipment operator. There can be a significant learning curve for operating farm machinery safely. For groups sharing more complex machinery, having a member of the group who is an experienced operator is a big advantage. In the aronia berry group, they chose a dedicated operator to run the machine.

Unlike a lawn mower that works the same in most backyard situations, farm equipment may not perform the same from field to field, under a variety of soil types and terrain, and when pulled by different sizes and types of tractors. Even equipment that appears relatively easy to operate, such as the plastic mulch layer and the Eco-Weeder, requires some initial time to learn how to adjust and run in different fields. When a shared machine is complicated to operate, having a lead partner or coordinator experienced with operating and maintaining the machine may be helpful. In such cases, machinery-sharing agreements should identify this individual and specify how and by whom the machine will be maintained or repaired.

Grower Feedback After First Year

A follow-up, post-project anonymous survey was completed by nine of the 18 participating farmers. Although none of the farmers reporting said they recouped the investment costs in the first year as a result of labor savings, five individuals reported that it has helped improve efficiency on their farms. Four farmers said that although they haven't yet recouped their costs, it was valuable to them to work within a group. Results showed that all of the groups continue to share equipment in the year after the study. All respondents said that the practice of sharing in their group has improved, with eight reporting some improvement and one farmer noting it has improved considerably. However, one farmer added that sharing equipment was often more work that it was worth.

Forming a business group to share machinery also led to some other joint ventures, with six respondents reporting that their group purchased additional equipment to share, while four shared labor, three purchased inputs together, and two jointly marketed produce as a group.

The written machinery-sharing agreement each group developed as part of the project was rated as being of different value and use among the groups during the first year. One farmer said it was very important to their group and they referred to it often; five of those responding felt their agreement was somewhat important to their group and they referred to it occasionally; and two respondents said that members of their group have not referred to their agreement.

Discussion

This research extends the existing literature on machinery sharing, which has focused primarily on row crop and livestock operations, to sharing among small-scale fruit and vegetable farmers. Many of our findings are consistent with previous research on equipment sharing among row crop and livestock producers. We find that inter-farm cooperation through machinery sharing gives growers access to specialized machinery that improves production efficiency, reduces labor, and facilitates scaling-up production. In some cases, sharing equipment led to cooperation in other areas, such as input purchases and marketing. We found that many of the challenges cited in previous studies, such as scheduling of use and added management costs, were overcome with careful planning and frequent, transparent communication among partners.

One feature that distinguishes the growers in our study from previous research is the very small-scale and local market orientation of their farms. The existing case study and simulation studies have focused on more conventional commodity row crop and livestock operations that have already achieved large-scale production, often sharing machines costing several hundred thousand U.S. dollars or more. Among growers oriented toward

local foods markets, however, interest in sharing has several strategic motivations. Sharing may reduce variable costs by substituting capital for more expensive labor, but also free up labor for valuable management time of the grower-manager. The potential to increase scale by sharing can lower fixed costs by spreading investment over greater output. Increased scale may also create new marketing opportunities.

This is important as demand for local foods grows, especially among institutional and wholesale buyers, as the ability of producers to meet the demand will depend on their capacity to deliver consistent products in large quantities at lower margins. There are a variety of ways to accomplish this, including aggregating product from many small producers. However, while aggregating output may create marketing opportunities, it does not help lower production costs. Economics suggest that both the explicit and implicit costs will be lower for larger scale operations. Larger farms have lower costs per unit, making them more competitive in wholesale markets, where they can supply large volumes of product at lower prices and still be profitable. Due to transaction costs, procurement managers prefer to deal with fewer suppliers, giving growers with scale an additional edge in the market.

For small-scale growers, the decision to mechanize is not always straightforward. Machinery costs are a large share of total expenditures for the smallest farms. According to the USDA's Farm Production Expenditures 2014 Summary, expenditures for farm machinery average 20 percent of total farm production expenditures for farms reporting US$10,000-US$49,999 gross sales. The corresponding percentage for farms in the next size category (US$50,000 to US$99,999 gross sales) is 11 percent, and the proportion continues to fall as size increases. On the smallest farms, machinery ownership can be difficult to justify because without sufficient size, the equipment will be underutilized and the cost per output unit will be very high. Sharing equipment with others is one way to spread the machinery costs over more output, achieving some of the advantages of scale without necessarily expanding. More importantly for small-scale growers in our study, sharing is a path to mechanization. Mechanization, in turn, facilitates expansion. Sharing can be a transitional strategy for some growers, freeing up some cash flow and labor to facilitate expansion by reducing machinery expenses during the growth stage.

These results provide examples of successful cooperative arrangements among very small-scale growers, and contribute to an understanding of "best practices" for machinery sharing among farmers. The cases also help build awareness of machinery sharing as an option for growers and can be part of a "toolkit" for resource providers working with growers in the local foods industry.

While there is no "one-size-fits-all" model, we learned several lessons that are applicable to most machinery-sharing arrangements. First, trust among the partners and clarity in communication are critical factors for making shared equipment arrangements successful. This is especially true during the formation stage of the partnerships. Written operating agreements that both are legally enforceable and detail the rules of the sharing arrangement can help create trust among the partners. Having the terms of dissolution if one or more partners should decide to leave the group described in an operating agreement can make the process much smoother, as occurred in the toolbar case when one partner, and then another, quit farming and no longer had a reason to participate in the sharing arrangement. The third partner, who is still farming, was able to purchase the toolbar from her exiting partner at a price they had agreed to in advance. She noted, "I'm very glad we made that agreement because it made decision making a lot easier. It was really easy to figure out how I was to legally acquire that piece of equipment."

A second lesson is the importance of finding compatible partners. The participating farmers often noted the importance of working with "like-minded" individuals, while at the same time valuing a diverse and complementary set of skills, strengths, and interests among the members that strengthen the overall team. Participants conveyed a sense that "the sum may be greater than the parts." Having farms with similar production methods, such as certified organic, makes the use and maintenance of shared machinery much easier and less complicated.

Conclusions

Machinery sharing has the potential to help small-scale fruit and vegetable growers gain access to specialized machinery and improved efficiency in cost-effective ways. For growers considering expanding production, sharing can be a practical option. Furthermore, sharing can provide other benefits, including access to skilled labor, reduced risk, and a peer group of like-minded individuals with whom to share ideas. Commonly cited concerns with machinery sharing, including having access to the equipment when most needed, can be overcome with careful advanced planning and open communication. Cooperative Extension services and farmer organizations can play a supporting role for the formation of machinery-sharing groups by providing educational resources and membership networking opportunities.

It is important to note that equipment sharing is not appropriate in all situations. Depending on the labor a machine would replace, the difficulty of the task to be mechanized, and the costs of mileage and time spent in transport, sharing may not make economic sense. Furthermore, sharing equipment is not for everyone. Group collaboration requires trusting other members and a willingness to be flexible when things do not go as planned. While machinery sharing is not a one-size-fits-all solution for expanding production, our study demonstrates that in some cases it has the potential to help growers reduce labor and increase both efficiency and profitability. In the end, growers must weigh the risks and benefits of collaborating specific to their particular farming operation.

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Appendix. Preliminary Questionnaire

ABOUT YOUR GROWERS' GROUP

Is this the first effort you have made to share equipment as a group? Yes No

What is the approximate distance (road miles) between farms in your group?

What factors played a role in determining what piece of equipment you intend to purchase and share? (check all that apply)

____ Cost

____ Portability

____ Priority need by all in the group

____ Easily adjusted to fit different tractors

____ Timing of use isn't as critical

____ Easy to store

____ Seasonal equipment

____ Opportunity to save labor

____ Other:

	Member 1	Member 2	Member 3
Name			
Address			
Telephone Number			
E-mail			
Total number of acres farmed?			
Acres in fruit/vegetable production?			
Number of years in commercial fruit and/or vegetable production?			
Livestock operation?	Yes / No	Yes / No	Yes / No
Do you have other equipment (besides the field equipment purchased for this study) that could be shared among your group of growers. If so, what?	Yes / No	Yes / No	Yes / No
Do you work full time off-farm?	Yes / No	Yes / No	Yes / No
Do you work part time off farm?	Yes / No	Yes / No	Yes / No
Number of people who work on the farm full time (40 hr/wk) during the growing season?			
Number of employees who work part time on the farm?			
What are your markets for your fruits and/or vegetables?	Wholesale CSA On-farm Farmers' Market U-Pick	Wholesale CSA On-farm Farmers' Market U-Pick	Wholesale CSA On-farm Farmers' Market U-Pick

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Understanding perceptions of fresh produce safety and barriers to Good Agricultural Practices (GAP) use among Amish growers in the Holmes County Settlement of Ohio

Jason Shaw Parker [a] *
University of Vermont

Pamela Schlegel,[b] Douglas Doohan,[c] and Jeffrey T. LeJeune [b]
The Ohio State University

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Abstract

Addressing the complex problem of ensuring on-farm produce safety entails processes that allow for participation of affected groups, and integration of their knowledge and perceptions into the solutions. Such participatory processes, however, are difficult to develop among underserved groups, like the Amish communities of Ohio, where members seek deliberate separation from mainstream society and have insular social networks and limited trust in government agents. Using a mental models framework, we present research findings that will be used to help develop an outreach program to address produce safety in Amish communities in Ohio. These findings expand our understandings of Amish growers' perceptions and knowledge of on-farm produce safety practices in the following areas: the microbial risks to fresh and fresh-cut produce; practices that can prevent contamination; perceptions of the economic feasibility of adopting these practices; preparedness for a contamination event; and information needs and preferences. Information was collected to aid the development of outreach that respects the values and goals of the Amish produce growers, which is a key factor for program success, and that encourages the adoption of food safety principles in scale-appropriate ways by addressing barriers and building rapport and trust with community

[a] * *Corresponding author:* Jason Shaw Parker, Plant and Soil Science, University of Vermont; 202 Jeffords Hall; Burlington, Vermont 05401 USA; +1-802-656-2824; jparker7@uvm.edu

[b] Food and Animal Health Research Project, Ohio Agricultural Research and Development Center.

[c] Horticulture and Crop Science, Ohio Agricultural Research and Development Center, The Ohio State University.

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members. We believe that the information learned in this study is useful to a variety of people working with Plain Communities and other non-mechanized, small-scale farmers in addition to these communities.

Keywords
food safety, Amish, Plain Communities, fresh produce, small-scale farms, underserved groups

Introduction

Many Amish communities are experiencing extensive demographic and social change associated with increased population (Donnermeyer, Anderson, & Cooksey, 2013), historically low commodity milk prices, increased feed costs, and land scarcity in settlements near larger urban areas. This is the case for the Holmes County Amish settlement near the Cleveland-Akron metropolitan area. Over the last two decades, Ohio Amish communities have adopted strategies to deal with these changes. These strategies include intensification and specialization of farming (Long, 2003) and continued diversification by adding or expanding produce to their list of farm products (Parker, 2006). For these new or beginning produce growers, the small scale of most Amish operations will likely exempt them from regulations created under the Food Safety Modernization Act (FSMA). (Those Amish who market through local auction houses or who grow non-exempt products, however, will likely be required to have GAP certification.) Indeed, among new and beginning Amish growers, produce production is seen as an affordable entry into farming because land and input costs for expanding or start-up are low (Weaver, personal communication, 2010). Assuming these growers have reliable produce safety information is difficult because Amish intentionally live separately from mainstream American society and have a contested history of negotiated legal and socio-cultural behaviors and separations on issues involving government mandates and regulations (e.g., Social Security, compulsory military service, public schooling) that have paradoxically accompanied increasing economic integration. These conflicting values of socio-cultural separation and federal oversight create tensions when policy-makers seek consumer protections through government-mandated programs. The expansion of produce production in Amish communities increases the need for food systems professionals to understand the food-safety information needs of this unique population of growers.

Evaluating the adoption of new ideas and technologies in similar farming communities is important to understanding their effects. Extension professionals describe Amish communities as underserved (Hoorman & Spencer, 2001), a designation related to Extension offering fewer programs that serve them compared to other communities. Conversely, there are fewer Amish growers than those from other communities seeking programming from Extension professionals. The characteristics of both the message and the messenger in the dissemination of knowledge are important to the diffusion of innovations (Brown, 1981; Wejnert, 2002) and are critical considerations when dealing with any underrepresented community such as the Ohio Amish. This paper presents a subset of findings from data collected among Amish produce growers in the Holmes County Settlement, Ohio, as part of a 2011 study to better understand the range of food safety perceptions and beliefs. The project aimed to understand produce grower perceptions and beliefs of contamination sources and prevention practices across a variety of grower groups that included growers of small, medium, and large farms and two underserved grower populations, Amish and African Americans. Our goal in this paper is to identify educational needs in order to enhance Amish growers' understanding and capacity to fulfill market demands for safe food with culturally and technologically appropriate practices. This project expands understandings of Amish growers' perceptions and beliefs in the following areas: the microbial risks to fresh and fresh-cut produce; practices that can prevent contamination; perceptions of the economic feasibility of adopting these practices; preparedness for a contamination event; and information needs and preferences. Findings from this study provide information to aid the development of outreach efforts to both support the values and goals of the Amish produce growers and encourage the adoption of produce safety

principles. The scale-appropriateness of practices is emphasized to address grower concerns for food safety regulations, address real and perceived barriers, and build rapport and trust with Amish and other underserved communities. These latter three points are important to enhancing or creating successful engagement with Amish communities. Finally, a program of the local auction house, the Grower's Code of Excellence, is identified as a potential model for collaboration with members of the Amish community to develop a locally supported and technology- and scale-appropriate produce grower safety program. While the specific characteristics of community organization and perceptions and beliefs of community members may vary among stakeholders, the lessons learned from this study can be applied to assist other small-scale farmers outside the Plain Community.[1]

Background

While adhering to tradition, many members of Amish communities are viewed as entrepreneurial and inventive, even looking forward and cautiously anticipating change that allows them to explore potential impacts of new behaviors and technologies (Landing, 1970; Lowry & Noble, 2000). As one Amish farm implement dealer and respected community leader stated, "The Amish do not fear modern technology; they chose not to be controlled by it" (Parker, 2013, p. 163). Traditional Amish household livelihoods include production of diverse farm products and income sources derived from low-input, intensive practices that include small fields, multiple crops, multiyear rotations, and several cottage industries. Other characteristics include the use of animal traction as their power source, reliance on animal manure fertilizers, a well-balanced ratio of acres farmed to animal numbers, and the use of local ecological indicators for planting and harvesting times (Kline, 1990; Moore, 1995; Moore, Stinner, Kline, & Kline, 2000). Yet social and economic pressures of the last three decades, such as the increasing population in their communities (Donnermeyer et al., 2013), increased herd sizes and the resulting reliance on external feed sources (Bender, 2003), low commodity milk prices, and both a decreasing availability and increasing costs of agricultural land, have attracted established and beginning Amish growers to higher cash returns available from fresh produce production (Parker, 2013).

While the Amish are a patriarchal society, they seek nonhierarchical community outside of the household and family. Members of Amish communities affiliate through Church Districts (CD), each consisting of 20 to 30 families with their own set of rules for living, called an *Ordnung,* and leadership (ministers and bishops) chosen by lottery. The cultural and religious similarities across CDs, such as interpretations of doctrine, dress, and behavior (including use of technology), further aggregate Amish households into Orders that are determined by the degree of adherence to tradition (for a detailed discussion of tradition, see also Parker, 2013). In the Holmes County Settlement, these socio-spatial groupings often cluster around valleys, establishing communities within sub-watershed boundaries (Parker, 2006). Church Districts of multiple Orders are spatially grouped, forming settlements such as the Holmes County Settlement in Ohio or the Elkhart-LaGrange Settlement in Indiana.

The socio-cultural data collected in this study are necessary to understand Amish farming systems and decision-making processes at the household and community levels, which are valuable for enhancing outreach programs. Many Amish in the Holmes County Settlement sell through local auction houses, making it necessary that they comply with FSMA produce safety rules. There are 66 such auction houses across the Midwestern U.S. that serve mostly Amish and Mennonite growers. They range in size from smaller auctions of 50 growers to 600 growers at some larger auctions. Yoder (2009) estimates that 20,000 families are supported by selling produce at auction houses.

[1] Plain Communities are affiliations of Anabaptist Christians, whose lifeways minimize hierarchy and emphasize living separately from the world, living plainly in technology and dress, and value community over the individual. The extent to which these ideas are acted on and practiced in daily life varies across groups. Some notable Plain Communities include various affiliates of Amish, Mennonite, Hutterite, and Brethren.

The Mount Hope Auction House where most growers in this research sell their produce has a voluntary program called the Growers' Code of Excellence. Those who comply with the program standards are permitted to use the auction house's *Seal of Quality* label on their produce. The criteria for this program include:

- Use the Auction House Farm Production Record Book (FPRB).
- Keep accurate records of growing, harvesting, packing, and sanitation practices in the FPRB.
- Keep a copy of current coliform water test in the FPRB.
- Attend grower education meetings at the Auction House.
- Follow an Integrated Pest Management (IPM) program.
- Keep pesticide spray records as required by law (e.g., follow the Ohio Vegetable Production manual).
- Apply manure to fields no sooner than 90 days before planting any produce crops (with some exceptions), and maintain records in the FPRB.
- Attend GAP meetings and practice GAP requirements on the farm.
- Agree to inspection of the farm's facilities and FPRB by Auction House staff.
- Apply *Seal of Quality* stickers or grower produce number on each unit of Grade 1 produce. (Mount Hope Auction House, n.d.)

Applied Research Methods

We used a modified mental models approach guided by the Expert Model of Fresh and Fresh Cut Produce Food Safety[2] (Parker, Wilson, Rivers, LeJeune, & Doohan, 2012a) that outlines expert perceptions of influences shaping grower decision-making. This model, consisting of input from scientists, educators, farmers, and policy-makers, shaped our program development and analysis on the range of perceptions for produce safety in this Amish community. Knowing the content of this range will better facilitate engaging with community members, understanding their perspectives, and providing content to reshape produce safety attitudes and beliefs.

Guided by the widely used risk analysis and mental models approach (Atman, Bostrom, Fischoff, & Morgan, 1994; Bostrom, Fischoff, & Morgan, 1992; Fischhoff, Bostrom, & Quadrel, 1997; Johnson-Laird, 1983; Morgan, Fischoff, Bostyrom, & Atman, 2002), this research used a multistage methodology to assess Amish produce growers' perceptions and beliefs of on-farm produce safety. The expert model outlined important content areas that were aligned with GAP certification criteria for on-farm food safety and the influences that shape farmer decision-making. The mental model stages included (1) the development of the expert model and its dissemination to other experts for input and refinement. Using this model, we (2) developed an interview protocol that was tested with small-scale Amish and African American growers as well as growers representative of other Midwestern farm sizes. The final stages of the research were (3) to develop and test educational tools for working with Amish communities, and (4) disseminate the results through educational programs and risk-based messaging. These include tools that can enhance the ability of food systems professionals to engage Amish communities in salient food safety education. Our findings identified the need for scale-appropriate recommendations that Extension could offer to growers using preferred channels in order to enhance better dissemination and adoption (Kline, Keen, Barrett, Kleinschmidt, & Doohan, 2012).

Our modification of Morgan et al.'s (2002) mental models framework included the following: We incorporated participant observation at the auction house in which at least two team members spent additional time observing and interacting with Amish produce growers. These visits were focused on understanding the practices that auction house staff and farmers used that could ensure the safety of produce through the auction

[2] Developed by the authors using the input from food safety experts participating in a 2007 symposium and workshop on the topic (Parker et al., 2012a).

house chain of custody. This information was used to improve our understanding of the relationship and interactions among auction house staff with growers and its role as a community institution. Informal interviews were conducted with community leaders, agricultural suppliers, and Amish growers and staff at the auction house. The final modification of the methodology was to make the process reflexive. That is, most risk analysis uses an elite-driven approach where expert knowledge is privileged over practitioners' knowledge, and gaps in practitioner knowledge become the focus of analysis. In this research, we enhanced the expert knowledge with what was learned from practitioners to provide feedback in our model design.

Twelve mental models interviews were conducted with Amish household members in the Holmes County Settlement using a judgment sample. The sample was created in consultation with local Amish leaders, Amish farm suppliers, and Extension agents who recommended growers based on the following farmer and farm characteristics:

- Amish produce growers;
- Farm development stages: beginning, post-startup, established (Sheils, 2002); and
- Participation, or not, at produce grower meetings with a produce auction house.

We began our sample with a short list of four Amish growers, suggested by local Amish agricultural supply dealers with a shared rapport. Some of these growers market their produce at the local Mount Hope Auction House. Additionally, candidates were identified through a snowball sample of participating growers who referred an additional eight growers with characteristics matching our criteria. Parallel to the experiences reported by Guest, Bunce, and Johnson (2006), data saturation occurred in 12 interviews, which we believe to be representative given our collective experience working in the community, the acute domain of analysis, and the relative homogeneity of this Amish society. The duration of the interviews ranged from 45 to 70 minutes, with an average time of 60 minutes. Unlike the other 50 interviews with growers from small, medium, and large-scale farms in Ohio and Indiana as well as very small-scale African American growers in Kentucky, these interviews used no recording devices and instead relied on handwritten notes that were later transcribed for coding.

Using a semistructured interview format, participants were encouraged to expand on the following six areas: (1) farm and farmer background; (2) pre- and post-harvest sources of contamination; (3) contamination prevention practices; (4) perceptions of the economic feasibility of prevention practices, and preparedness for a food safety incident; (5) information preferences and needs; and (6) grower demographics and farm structure. Each participant was asked the same questions with scripted follow-up prompts offered for respondents when elicited answers did not provide enough information on the topic. Table 1 lists the content areas covered for each category.

The information obtained during these interviews was discussed among the members of the research group, who together have over 30 years of experience working in Amish and other small-scale farming communities. This background of working with Amish growers provided additional basis for observation and framing of research findings. Because produce safety risks come from pathogens and chemical sources, we use the term "contamination" to refer to introduction or spread of these sources of foodborne illness.

Study Limitations

There are limitations to this study related to unique considerations that are needed for conducting interviews and questionnaire surveys in Amish communities. While there is much similarity across Amish Settlements and among the Orders within Settlements, the data and experiences shared in this paper are drawn from one Settlement and explore the range of thinking about produce safety among the New Order and Old Order Amish only. The views of those interviewed and other groups, like the more traditional Swartzentruber Amish who declined to be interviewed, may differ. Practitioners may note other differences exist across Settlements inspiring opportunities for further research.

Many Amish growers in the study Settlement found it uncomfortable to rank-order phenomena

particularly related to other people, which is a cultural barrier to survey methods that has been encountered in other research. The interview format provided us the opportunity to work with participants to improve the validity of responses. Several participants perceived the labels of "labor," "workers," and "employees" as too abstract, or were uncomfortable using them to refer to people

Table 1. Interview Content Areas and Question Topics

Question Category	Relevant Question Subject Areas	Examples of Question Topics*
Farm Information	• Description of farm size, type, produce grown, number of workers • Role of workers on the farm	• Please tell me about your farming operation. • What are your goals for the farm? How do you define success? • What are the roles people have on your farm? What work needs done and who does it?
Contamination Sources	• Pre-harvest contamination sources • Post-harvest contamination sources	• Types of produce safety concerns faced by farmer (bacterial, viral, or chemical, with specific prompts for melons, tomatoes, leafy greens). • Water sources for rinsing, washing, or irrigation, types of irrigation used. • Use of manure and compost. • Use of animals in farming. • Facilities and farm equipment. • Worker and other people (e.g., customers) sources of contamination.
Prevention Practices	• Prevention practices that minimize contamination	• Types of prevention activities used or available for each of the above topics and perceptions of practice effectiveness.
Barriers to Adoption & Preparedness	• Perceived economic feasibility of prevention practices • Level of preparedness for dealing with an on-farm outbreak	• Barriers, real and perceived, that prevent growers from adopting specific prevention practices. • Barriers can be social, economic, physical, technological, etc. • Self-assessment of preparedness for dealing with a foodborne illness outbreak.
Information Preferences	• Information channel preferences for: Farming, produce safety, and dealing with an immediate outbreak	• Preferences for sources of information (e.g., industry, experience and testimonial, scientific, trial and error). • Preferences for channels of information (e.g., Extension, friends and family, print media, seminars, consultants). • Differences between preferences based on general information seeking versus produce safety information seeking. • Current produce safety information needs.
Farm Information & Respondent Demographics	• Age • Sex • Farm income—farm scale • Acres farmed—farm scale • Number of Workers • Years Farming	• Age and sex of respondent. • Farm income ranges based on USDA income-based farm size (less than US$250,000 = small; US$250,000 to US$500,000 = medium; greater than US$500,000 = large). • Number of owned and leased acres farmed in the current growing season (there is one growing season in Ohio). • The number of family and non-family workers, full and part time status, and the duties they perform. • Total number of years of farming experience (apprentice and operator years included).

* A full list of questions in each category is available from the author.

who were mostly family members. It is also possible that the aversion to these labels was to avoid potential legal issues or because of a lack of familiarity with employee hiring categories and farm labor. While there is little likelihood that this interfered with data collection, it was mentioned often enough to be consideration for future work in this community. Due to the generally quiet and modest mannerisms of most Amish growers, their responses can appear understated. This was addressed by using probing or follow-up questions. Responses were interpreted within this context using this cultural knowledge. These limitations are taken as additional data and insights in our analysis and findings.

Results

Amish Farm Types, Goals, and Values

Amish growers raise a very diverse mix of fresh produce and rarely specialize in one type. Most Amish growers do not participate in the USDA Census of Agriculture, so an exact quantification of this diversity is not currently possible. Produce grown by interviewees is typically sold fresh and includes sweet corn, cantaloupes, cabbage, broccoli, onions, strawberries, leafy greens, zucchini, cucumbers, green beans, squash, eggplant, potatoes, tomatoes, and peppers. Less than 20 percent of participants reported being USDA Certified Organic. The average farm is 60 acres (24.3 hectares), reports less than US$100,000 in gross sales, and has 7 workers (mostly related household members). The average Amish grower in this study is 45 years of age with 9 years of produce-growing experience, indicating a relatively young cohort of late-entry or expanding produce growers (Table 2). All interviewees were male and reported selling their produce through an auction house, a farmers market, and/or their farm stand. The few USDA Certified Organic participants marketed through Green Field Farms,[3] a Certified Organic Plain Community farming and marketing cooperative.

Over half the Amish growers focused on goals of "having work for the family" and providing a "good family environment." Believing strongly that "work's good for them," the Amish expressed the importance of these values "to teach children to work and have them all involved." This differs from other similarly scaled farmers in their desire for exclusively on-farm occupations to ensure that household members do not need "to work away [from the farm]." Other motivations included farming "in a way that the children enjoy," and having "enough to sustain expenses and provide a wage for everybody [in the family and community]." Two growers concisely summarized these as their goals for their farm:

> To supply an occupation and a living for the family in a sustainable manner so that my children can do it after me.

> Our goals are to have the farm be self-sustainable so that it paves the way for the next generation.

Table 2. Participant Demographics and Descriptive Data

Age of Participants		Farm Income		Farm Characteristics			
Age Range	Number of Participants	Income Range (in US$)	Number of Participants	Descriptive Statistic	Farm Scale	Number of Workers*	Years Farming
20–29	3	<$50,000	4	Mean	60	11	10
30–39	3	$51,000–$100,000	7	Median	33	9	9
40–49	5	$101,000–$250,000	1	Minimum	6	4	2
50–59	1			Maximum	144	21	18

*This includes workers of all categories: full time, part time, household (adults and up to 14 children).

[3] Green Field Farms is an organic, Plain Community–only cooperative that was started by Amish produce growers in the Holmes County Settlement in 2003 in response to the continued decline of farming as a full-time occupation in Amish communities (Greenfield Farms, n.d.).

Growers reported that most of the obstacles and challenges to farming and achieving their goals are related to natural occurrences perceived to be largely out of their control. Half of the growers mentioned weather or pests (insects and weeds), and 35 percent mentioned plant diseases. Unlike other produce growers in the study, Amish growers did not mention, without specific prompts, labor, pathogens that cause foodborne illnesses, food safety issues, or the economics of farming as barriers to reaching their goals. Each of these challenges was mentioned by other small-scale produce growers in the study (reported in Parker, Wilson, LeJeune, & Doohan, 2012b). One grower noted that marketing is not a large concern since they "have the auction." Another grower jokingly replied that the greatest barrier is his role in the "mismanagement of the farm." No one mentioned government regulations, which is surprising given their history of contesting government mandates and their concerns regarding FSMA that emerged later in the interview.

Understanding and Use of Good Agricultural Practices

Amish growers were asked about their knowledge of the introduction and spread of contamination sources on the farm, if they practiced specific foodborne illness prevention activities and, if they did, whether the prevention activities were based on GAP. The local auction house implemented a voluntary produce safety program called the Growers' Code of Excellence that consists of standards with which all participants in the program must comply. As a benefit for participating, growers are allowed to sell their produce using the *Seal of Quality* label signaling program compliance to buyers. Two of twelve growers (17 percent in this study) responded that they use GAP.

Perceptions of Source and Prevention of Pathogens

In the interview guide, we differentiated between types of contamination and sources of contamination to distinguish between the specific type of contaminant (e.g., a pathogen such as norovirus) and the source or manner in which contaminants are introduced or spread on the farm (e.g., machinery, people, wildlife). When discussing types of contamination, 75 percent of Amish growers mentioned *Salmonella* and *E. coli,* but most growers did not discuss other pathogens such as noroviruses or *Shigella*. This is likely because of grower familiarity with these first two pathogens as sources of recent food safety contamination outbreaks that have been given higher profile coverage in the media (Webster, Jardine, Cash, & McMullen, 2010), as many Amish growers reported to us that they use print media as an information source.

We grouped potential sources of contamination into eight categories reflecting dimensions of the four "farm problem areas" identified by Parker et al. (2012a) (Figure 1). These areas include animals (livestock and manure) and wildlife, farm workers, water quality, and facilities and equipment. Chemical contamination and sources of contamination from horses were two additional categories used by participants. Off-farm pets and people were additional categories outside of those mentioned by experts.

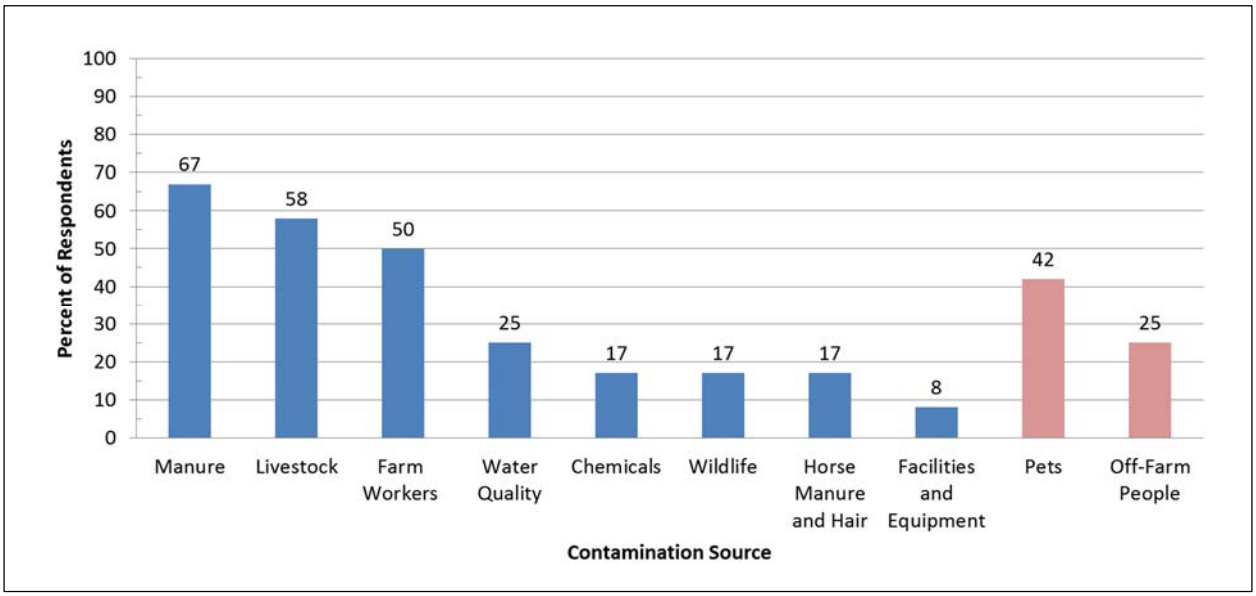
The Amish reported prevention goals and implementing practices that often mirrored the types of risks reported (Figure 2). Many of the Amish said their goal was to provide clean produce that does not pose a risk to their customers. Prevention activities targeted specific contamination hazards, such as worker hygiene, produce washing or rinsing (not sanitizing), facility and equipment sanitation, and water quality.

Farm Workers

Sources. On this topic, many Amish growers expressed unease or difficulty with the concept of referring to their family members as labor, employees, or workers. Fifty percent of growers discussed worker hygiene and habits in terms of personal hygiene practices, such as hand washing, boot cleaning, and produce handling that are necessary for produce safety. A few framed their concerns as an issue of hired workers not receiving proper training or not complying with hygiene requirements. This suggested to us that the hygiene and habits of household and family members are adequately addressed and not perceived to be a problem.

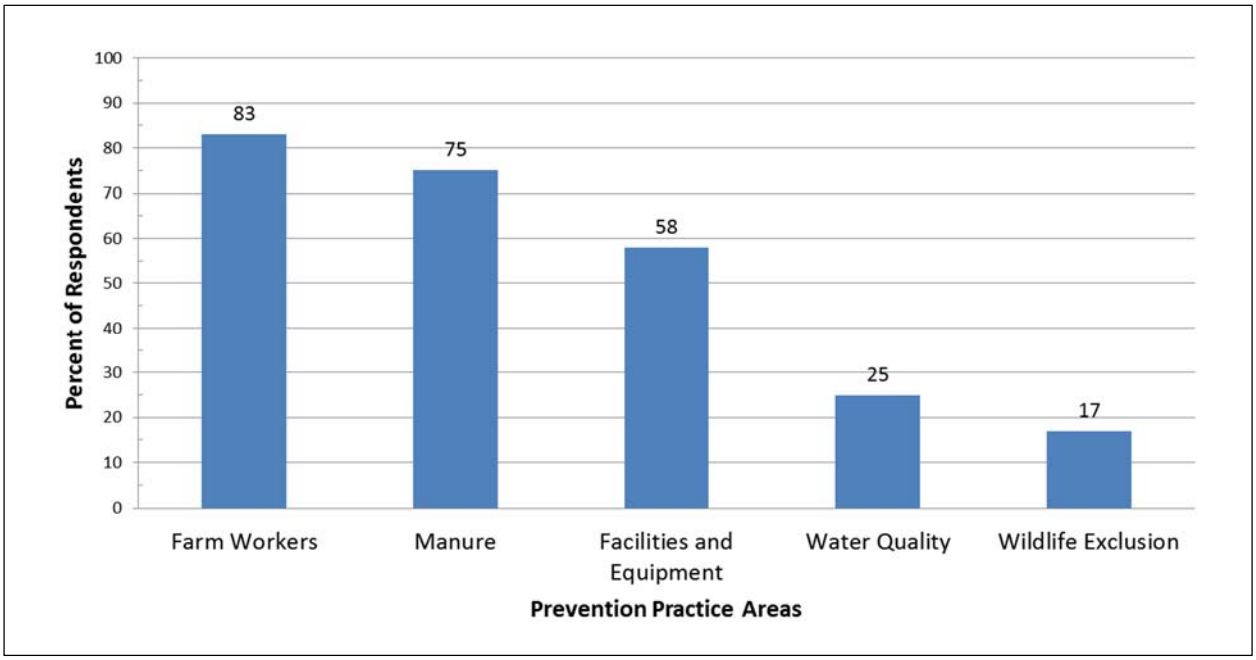
Most participants (67 percent) spoke generally

Figure 1. Perceptions of On-Farm Sources of Contamination Among Amish Produce Growers



of "people"[4] as contamination sources, sharing their perspectives that personal hygiene includes good hand-washing after bathroom breaks or manure handling, and access to and use of portable toilets and hand-washing stations. For some, this included establishing standard operating procedures (SOPs) for hand-washing between these activities and those involved in produce handling or produce-related field work. It was unclear for some whether the SOPs were implemented in

Figure 2. Perceptions and Beliefs of Prevention Practices Among Amish Produce Growers



[4] "People" refers to employees, but Amish are reluctant to label people as "workers," "employees," or "labor" because they tend to be family and friends.

written or oral form. Some growers (33 percent) discussed the importance of keeping their boots clean, washing their boots, or maintaining separate boots for working with animals and manure and when handling the produce.

Prevention. Eighty-three percent of growers said that hand-washing is a key part of preventing contamination from people. One grower said that workers participate in mandatory hygiene training, which occurs at the beginning of every field season.

Animals: Livestock and Manure, Wildlife

Sources. A majority of growers (67 percent) mentioned manure as a potential source of produce contamination. Livestock was mentioned by most growers (58 percent) who offered multiple concerns regarding livestock in the fields as well as having packing containers in a vehicle that previously held livestock. Alternatively, participants did not think that manure (33 percent) or livestock (42 percent) were potential sources of contamination. A reason for the lack of concern about animals is that the questions were not specific in distinguishing between production animals and work animals such as horses, an important distinction given the perception among many experts that horses are a pathogen source (Lengacher, Kline, Harpster, Williams, & LeJeune, 2010). Many felt that wildlife does not pose a threat, while the few who acknowledged this source felt there is little prevention that can be done because wildlife are viewed as a part of the natural environment in which food is produced.

Prevention. All Amish growers discussed using manure on their farms. A majority (58 percent) mentioned implementing practices for manure and animal use, but perceptions of best practices varied in the reported days-to-use of composted manure or days-before-planting of other manure:

- Composting manure before use in produce fields was discussed, but specific standards were not mentioned.
- Purchasing bagged, composted manure to avoid using raw or improperly composted manures. However, production standards for ensuring adequate pathogen kill were assumed and not confirmed.
- There are standards for farmers to follow for timing of manure application during pre-planting and pre-harvesting intervals, but there was confusion among some as to what these are, including the *Seal of Quality* rule:
    - Timing of pre-planting manure spreading: the application of manure to fields before planting seeds by following a protocol ranging from 90 to 120 days, with some up to one year prior. Some did not use raw manure in spring as a preventative measure and emphasized spreading composted manure a minimum of 90 days before planting.
    - Timing of pre-harvest manure spreading: the application of manure to fields before harvesting a crop by following a protocol of 120 days before harvest. One reported adhering to a 90-day schedule.
- Using separate equipment in produce fields and for use with animals, manure, "barn work," and other row crops such as corn and oats.
- While growers reported inspecting and cleaning equipment, none reported using a standard operating procedure for this. Equipment cleaning regimens are needed to establish a system to visually inspect and clean potentially contaminated equipment before use with produce.
- Changing or cleaning boots when moving between produce and areas where contamination may occur.

Focus Areas. Many who perceived produce growing and wildlife as existing in the same natural system felt that prevention of wildlife from entering their fields was unrealistic and did not believe they had the ability or resources to prevent this from being a problem. Those who said they make no extra effort to prevent wildlife from contaminating produce recognized that animal droppings should be removed from the field and they should not sell

any produce that came in contact with feces. There may be a need to provide guidelines for how to inspect and to clean equipment. The smaller scale of fields and implements may make the maintenance of separate equipment an acceptable alternative to cleaning, but information on the time and economic dimensions of cleaning versus maintaining separate equipment would be useful further research.

Irrigation and Wash Water

Sources. A quarter of growers (25 percent) mentioned crop irrigation and packing-shed wash water as contamination sources. Most growers (83 percent) mentioned concerns from surface waters such as ponds and creeks that are used for irrigation, with drip irrigation being the most common form mentioned. Half of growers (50 percent) discussed using well water primarily for washing produce and just a few (17 percent) discussed using it for irrigation. Some felt that deep wells that are sources of wash water do not need to be chlorinated regularly, but chlorinated either annually or biannually.

Prevention. Water quality was perceived as an issue by some growers who use bleach or other chlorine-based products in manual washers or with solar- or windmill-powered pumps. Soaps to wash equipment, like VEX, were also mentioned. Testing water for pH level and pathogens, such as coliforms, was mentioned by 25 percent of growers. Additionally, some growers reported using drip irrigation systems or installing livestock exclusion fencing or wildlife barriers around ponds and other surface waters used as water sources. Other practices included flushing wash-water supply lines prior to washing produce and irrigating under plastic to prevent water from contacting edible portions of produce. Despite the widespread recognition of the importance of these prevention practices, some growers said they do nothing to assure adequate water quality used for irrigation or washing.

Focus Areas. The study participants had questions about the risks of pathogen contamination from various combinations of water sources and irrigation methods in addition to water testing. Some said that irrigation or wash water is a potential source of contamination, but few, including those who do test, had concerns about their own sources.

Additionally, some stated they do not test for pathogens or use any contamination prevention practices. Some farmers perceived deep-well water sources as safe and believed they do not need to test for waterborne pathogens. While Amish assigned greater risk to surface water sources, few mentioned the need for testing this water source. There was no association between those who reported testing their water sources and those stating they practice chlorination of their well water.

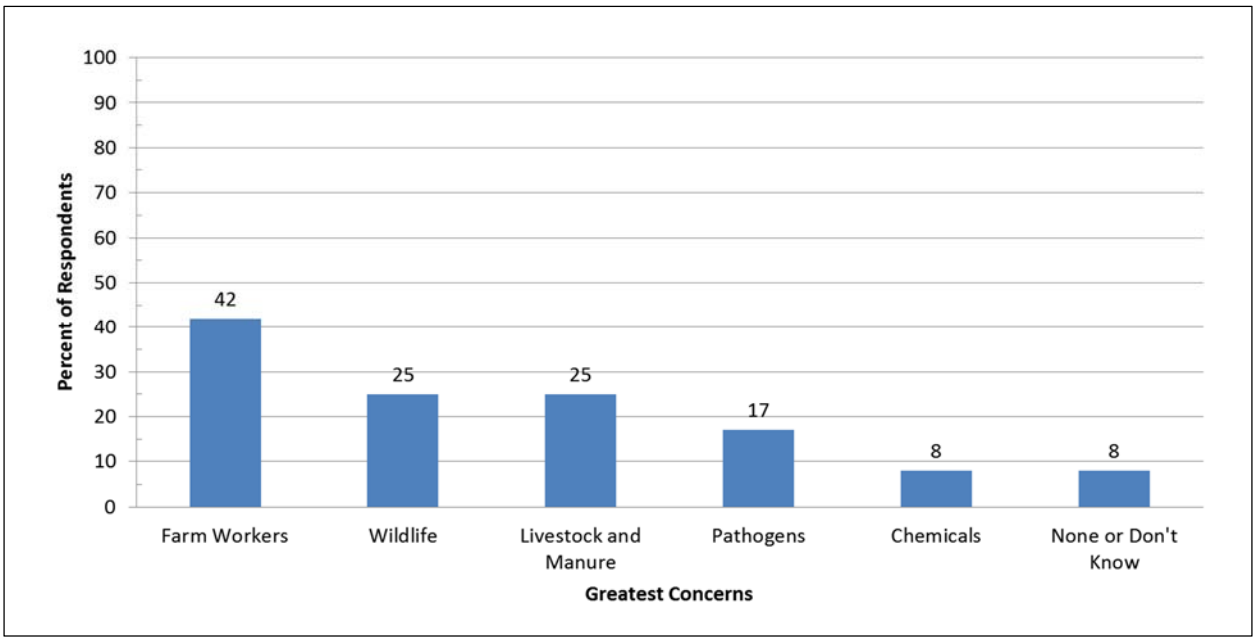
Chemical Contamination

A few growers (17 percent) discussed concerns related to foliar applications of herbicides and other pesticides that would leave residues on the plants and potentially contaminate irrigation or produce wash water (Figure 3). "Chemical contamination on vegetables" from applications and "from roadside spraying" were specific sources of contamination risk introduced from off-farm. These perceptions were shared from other smaller-scale produce growers in the study and differ with growers on larger farms (Parker et al., 2012b), and from those emphasized by experts. There was concern among these growers that produce safety standards would not address this issue.

Facilities and Equipment

Sources. When asked specifically about their equipment, half of growers (50 percent) said it could be a source of contamination when used in the fields and packing sheds. The rest felt there is little risk because they wash their equipment before using it with produce. One grower stated that he uses "dedicated equipment" for produce. Amish growers differed from other groups of produce growers (i.e., small, medium, and large; see Parker et al., 2012b) in their concern for pets and horses (50 percent for each category). This latter concern was expressed with an emphasis on expert assumptions that horse manure is a source of *E. coli,* which is a contested position among the Amish. Growers focused their concern on draft horses being in the

Figure 3. Greatest Concerns for On-Farm Sources of Contamination Among Amish Produce Growers



fields where they could defecate near produce or surface waters used for irrigation or packing shed water. Many spoke of minimizing this risk of pathogen transfer by ensuring that the people driving horses are not harvesting produce and providing paths in their fields for horses to walk and avoid contact with produce.

Prevention. Equipment sanitation was mentioned by most growers in the context of other practices, such as washing equipment (58 percent) and keeping equipment that is around manure separate from produce equipment (33 percent). A few said they make no extra efforts to prevent equipment contamination. Examples of equipment sanitation focused on carts and implements, while harvest bin or basket sanitation and stacking practices were not mentioned.

Other Sources of Contamination

Forth-two percent of the Amish growers identified pets as potential sources of pathogens. This includes pets residing on the farm as well as those that accompany visitors to farms, auction houses, and farmers' markets. Horses, specifically their manure and hair, were viewed by a few (17 percent) as potential sources of contamination, though there was doubt because of the long history of horse use on farms. People not associated with the farm were viewed (by 25 percent of respondents) as sources that could not be controlled. Visitors, customers, and their children were included in this group.

Greatest Concerns

Regarding the greatest areas of concern for potential produce contamination on their farms, many Amish growers mentioned overlooking handwashing (42 percent), poor manure management (25 percent), and wildlife in the fields (25 percent) (Figure 3), which was similar to other small-scale growers in this study. Within the content area of livestock and manure, growers felt that "cross-contamination from the horses to the packing house" is the greatest concern. This is not because they see horses as a genuine risk, but due to their concern for regulations prohibiting the use of horses on produce farms; they contested the risks posed by horses by insisting that horses are less likely than calves or dairy cows to spread contamination, a position supported by recent research (Lengacher et al., 2010) and GAP produce recommendations (Barinas et al., 2010). The anxiety of potentially losing horses from their produce

operations overshadow their concerns for other risks. While this concern is contradictory to their stated belief that government regulations posed few barriers, participants' responses were consistent with the testimony of Amish produce growers at the USDA National Leafy Green Marketing Agreement hearings (USDA, 2009) regarding the ability of the proposed standards to damage their operations.

The proximity of "baby calves" to the barn and/or pack shed was named as the greatest concern. This may be a common concern because of the repurposing of animal facilities for produce washing and packing on many evolving farmsteads. In addition, risk from the quality of the water used by "the guy that sprays the roads" to control dust from cars and buggies highlights a perception among many growers, Amish and others alike, that risks outside the farm are not addressed in developing produce safety regulations. This intersects with perceptions that many sources of pathogens or contamination are beyond the control of most growers. A focus on the unknown or uncertainty in risk assessment is common among non-experts (Hansen, Holm, Frewer, Robinson, & Sandøe, 2003; Webster, Jardine, Cash, & McMullen, 2010), as it highlights the existence of uncertainty and contests the focus on the practices of the group in question (i.e., Amish or other smaller-scale farming practices). Alternatively, farmers tend to minimize risks involved in routine or familiar activities (Salamon, Farnsworth, & Rendziak, 1998).

Goals for Preventing Contamination

Most growers (67 percent) responded that worker hygiene and facility and/or equipment sanitation are high priority areas to prevent contamination. As noted by one grower, "Clean packing house, clean workers and hands, clean equipment, sanitized boxes" are the goals. A majority (58 percent) noted a goal of providing produce that poses no risk to their consumers. Additionally, some stated that their goal is to help consumers, believing that:

> Our public, the end consumer, is living in a pasteurized world and they have no natural pathogens to ward off *Salmonella* and *E. coli*.

A minor goal of some growers (25 percent) is to "stay within limits of spreading manure [between] 90 to 120 days before planting." While many Amish growers are aware that there are guidelines for manure composting and raw manure use, there is a degree of misperception regarding the timing of manure application with regard to pre-planting versus pre-harvest intervals. There may be a need to provide clear guidelines on the timing and rate of application.

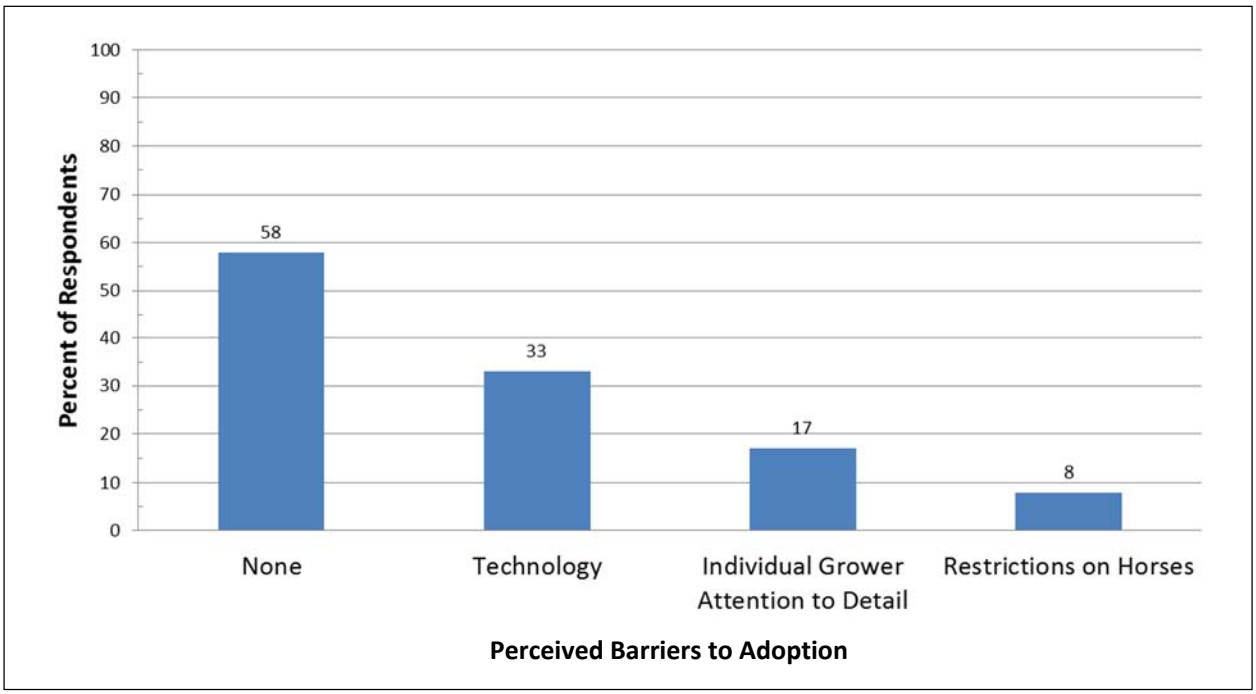
Most growers recognized that their buyers have the greatest influence on their prevention goals because buyers "don't have authority, but they influence how we do things" by deciding to buy from them. Government regulations have very little influence, as noted by one grower who said, "Not an issue. Not sure they have regulations." At the time of this research, many growers preferred to avoid government regulation and felt the Amish could do this if the auction house were to be proactive about food safety. The *Seal of Quality* program at the auction house is seen as an example of a proactive approach. This program was mentioned by some growers as a way of "making our own regulations to keep the government out of it."

Barrier to Prevention

A majority of the growers interviewed (58 percent) said that they do not perceive any barriers to adopting prevention practices on their farms (Figure 4). When prompted, however, a third of Amish produce growers (33 percent) perceived new technology as a barrier to broader implementation of some GAP because "we don't have access to modern technology." This is not just because of religious reasons but because the technology is not perceived to be locally available "unless [it is] brought in." One farmer each said that many practices, without giving specifics, "slows up harvesting," while another believed that their dependence on "horses are the biggest barrier to fully complying with GAP."

The two-thirds of growers who perceived no barriers to technology or specialized equipment felt that they could gain access to it if needed. This misperception of access is problematic because most preventative measures need to be in place to avoid an incident; there is little time to implement

Figure 4. Perceptions and Beliefs of Barriers to Adopting Prevention Practices



prevention practices when an outbreak is already in progress. The perception that many produce safety technologies are inappropriate for the Amish (one grower noted that "most everything is electric") is potentially both a real and a perceived barrier that will need to be addressed. There is a belief in this community that if federal-level food safety rules are created, then standards would be created, causing all produce growers to adopt the same or similar practices of large-scale operations. Further, there is concern that federal-level standards would necessitate technology-intensive practices because they would be led by larger-scale interests.

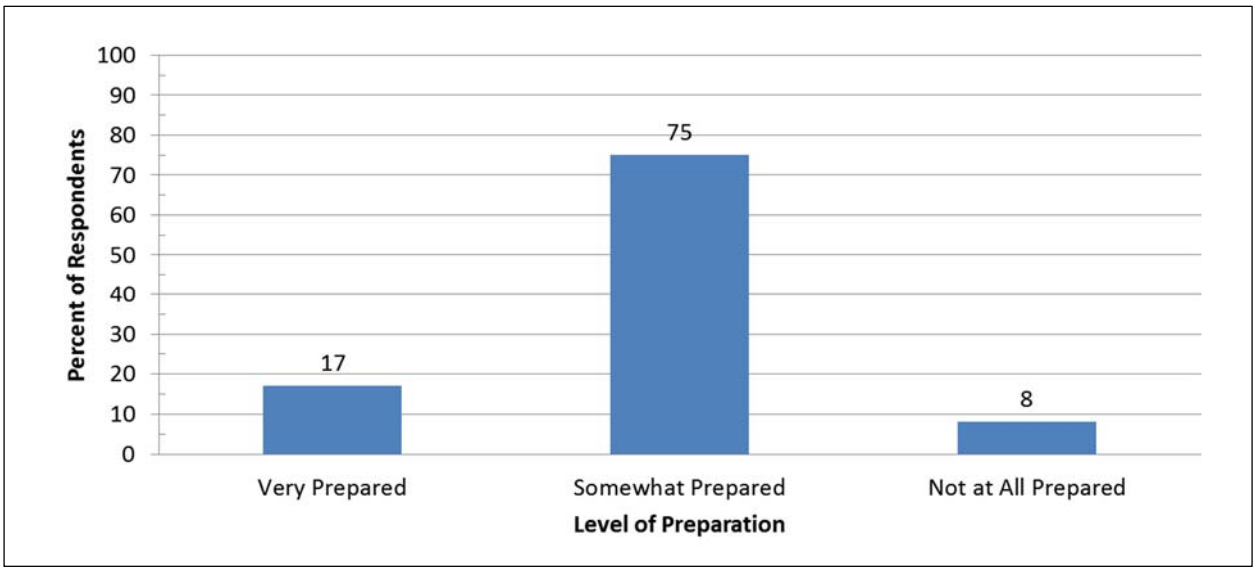
Information was specifically requested on *E. coli* and other contamination risks and best practices for using draft animals for moving produce through and out of the fields. Growers requested that information and best practices be adjusted for farmers operating at scales as small as 1 to 10 acres (0.4 to 4 hectares). They also need training with appropriate technology and delivery methods that contain scale- and risk-appropriate recommendations on prevention, traceability, and food safety practice documentation for small farm operators selling to the auction house or directly to consumers. This may include the use of stickers with producer "lot numbers" that include the field on that farm number and date of sale.

Amish growers mostly felt that the approach used by the auction house was appropriate, which gives it the potential to be adapted to other settlements, Plain communities, and other smallholder farmers.

Preparedness for On-farm Contamination

Growers discussed their level of preparation for dealing with an on-farm contamination incident (Figure 5). A few growers (17 percent) stated that they were "very prepared" because they had attended grower meetings on the topic and participate in a recall program through the auction house. Yet, most believed their teams were only "somewhat prepared" and talked about actively developing food-safety procedures for their farm but were "slow in getting it where it should be." Others felt that their lack of practical experience for dealing with an event was a barrier to being fully prepared, which is aligned with the common belief that experience in an activity is a good predictor of performance.

Figure 5. Self-reported Level of Preparedness for Dealing with an On-Farm Outbreak



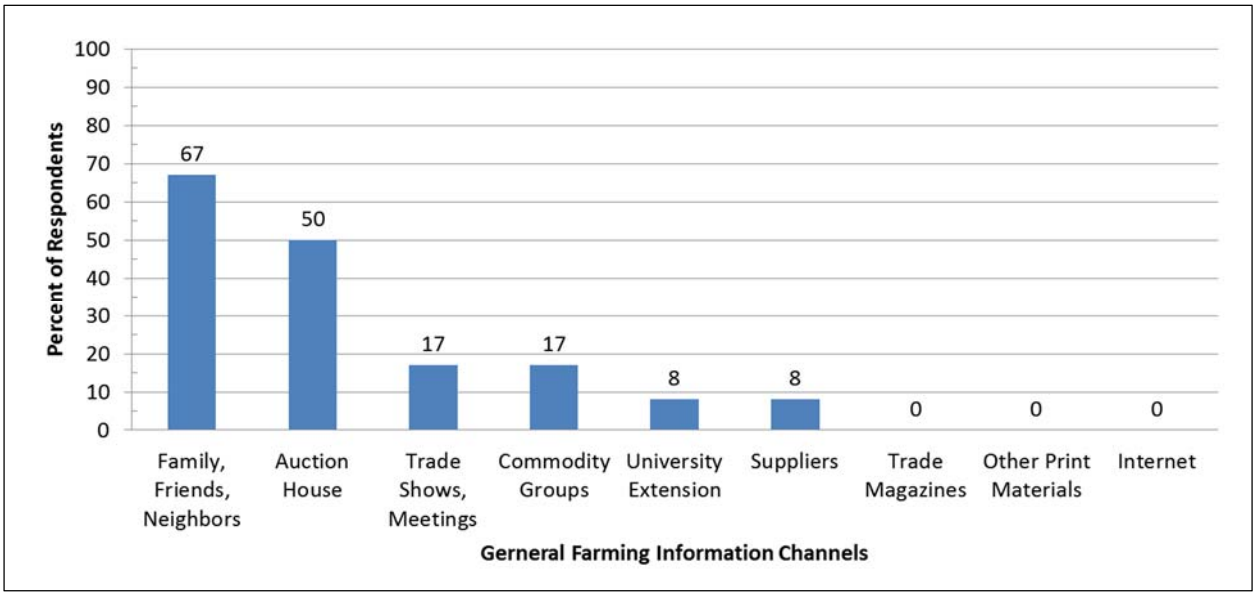
Most growers mentioned the produce auction house as the main influence on prevention practices they follow. As one grower indicated when asked if he practices GAP, "We don't strictly follow [GAP], but 'yes' based on [practice recommendations] supplied by produce Auction meetings." Responding to questions of how farmers would know there was an outbreak on their farm, half of growers (50 percent) said that a customer illness being traced to their farm would be the most likely way of learning there was a problem, while some (33 percent) believed the produce auction could trace contamination back to their farm using the lot stickers assigned to each unit of produce. One grower mentioned that he was able to visually identify the contamination on the produce. Most growers (67 percent) said they would respond to the contamination by testing, recalling, and destroying the crop and doing "everything needed" to address the issue. These perceptions prompt the question of whether farmers are prepared to adequately handle a contamination event when most report being only "Somewhat Prepared," have vague ideas of what GAP certification is, and at least one believed that a visual inspection could reveal such an event.

Impact to their Farm and Markets. Nearly all (83 percent) growers agreed that an incident on their farm would affect the ability to market the same or similar produce or could even "put them out of business." A small minority felt that personal relationships with their customers would buffer them from serious losses. One grower believed that an outbreak may not affect them because produce is not their main source of income, or "their bread and butter." Many (58 percent) growers felt that even an incident on another farm producing the same crop as theirs would have negative effects for them.

Information Sources and Needs

Growers identified three types of information sources on produce production for which they had unique preferences: general produce growing information, produce safety prevention practice information, and produce safety information for dealing with a produce safety breach. Growers reported that most of their general farming information comes from within their community (Figure 6). While growers could choose more than one source, just one grower (8 percent) said that "University Extension" would be a source of general farm-related information, while most (67 percent) responded that family, friends, and neighbors were their likeliest source and half (50 percent) reported relying on the auction house. A few growers noted the role Extension has for supporting the auction house as an information provider. While Extension

Figure 6. Preferred Channels Among Produce Growers for General Farming Information



rated low as a general information source, several growers mentioned specific Extension agents with whom they work and who would be their first contact. This preference highlights the importance of interpersonal relationships and the value of an individual's expertise and experiences rather than the institutional presence.

When discussing specific produce safety information sources (Figure 7), a majority (58 percent) said they would go to "University Extension." Some added that Extension agents have the most useful resources on the topic because of their scientific knowledge and most of them had a willingness to help. Commodity groups that work closely with growers, such as produce grower associations and dairy advocates, certifying

Figure 7. Preferred Information Channels for Sourcing Produce Safety and Contamination Prevention Information Among Amish Produce Growers

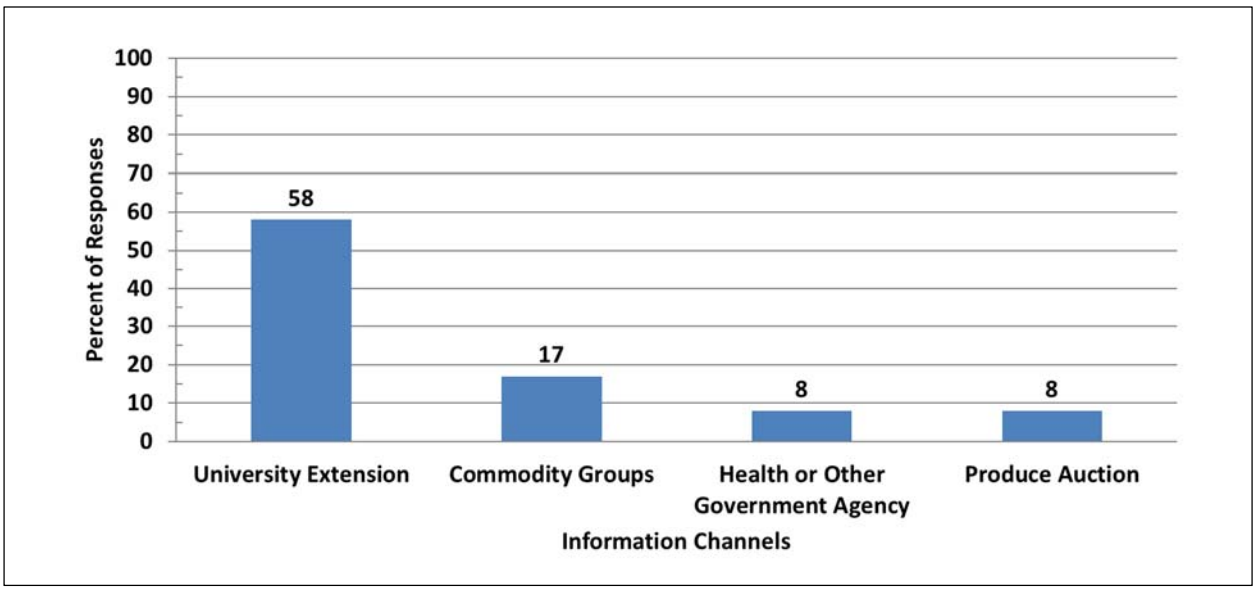
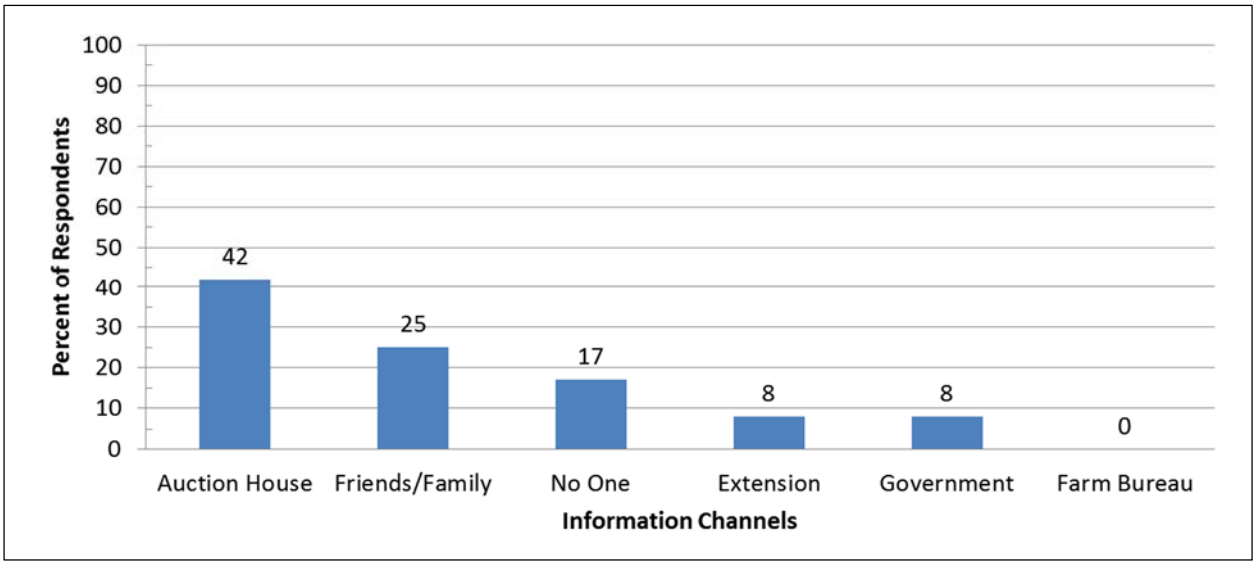


Figure 8. Preferred Information Channels for Dealing with an On-Farm Outbreak

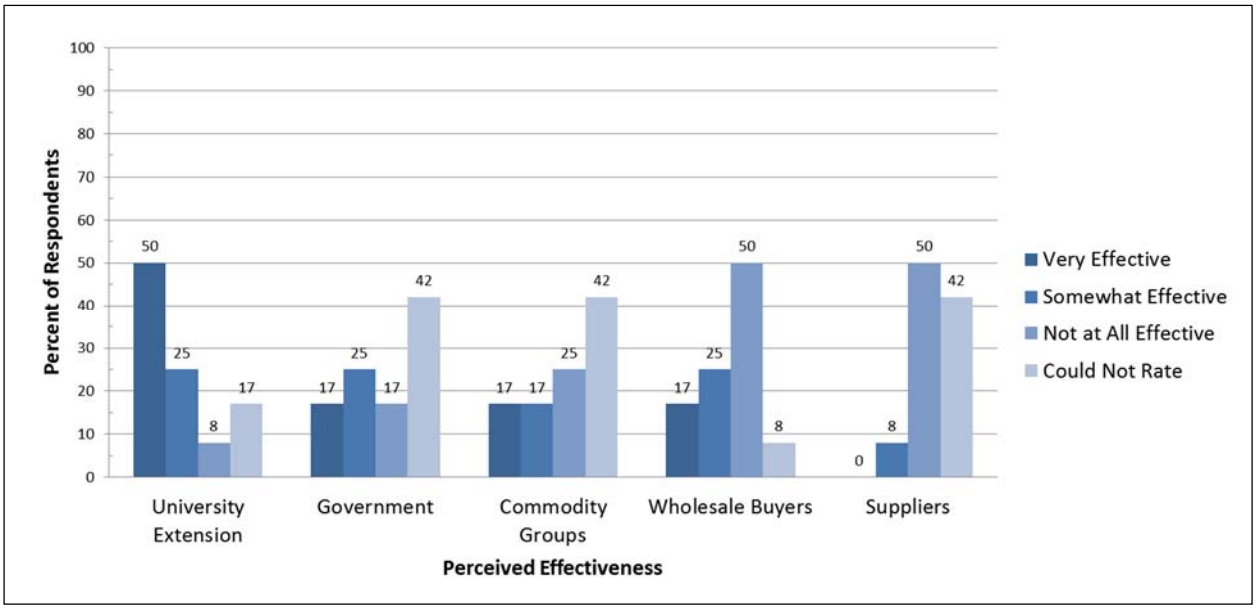


groups that facilitate NOP certification, and other growers were also mentioned by a few as potential resources. Growers rated the auction houses the same as they did "Health or Other Government Agency." We believe this low rating is due to growers knowing that much of the auction house information is likely to be sourced from Extension.

In seeking information specific to a contamination event, the auction house was the most cited source of support, with many (42 percent) saying they would contact them for help. No growers offered unprompted examples of seeking outside help beyond the auction house (Figure 8). When prompted, a few (8 percent) indicated that they would consult with "University Extension," consultants, salespeople or other sources for assistance. Government sources, particularly the health department, received little consideration (8 percent). Several growers (25 percent) would rely on friends, family, and other growers to help them deal with such an event, and some from this group mentioned specific local growers who were also agricultural suppliers in their community. Participants identified produce safety risks from horse traction in plowing and for transporting produce around fields and to markets as a paramount information need. The seemingly inconsistent response regarding the role of the auction house as information provider is the likely result of trust and high regard for the channel of information (e.g., a local community group) over the source (e.g., a science-based Extension publication). The trust placed in a local in-community information channel may be more important than the potential quality of that information, because local channels are perceived to have a lower risk of government involvement, which could reduce the risk of the outbreak threatening their livelihood. Quality and reliability of the information was of particular importance for sourcing farm-related and food safety information, but actually dealing with an outbreak incident was layered with the criterion of discretion.

When prompted about effectiveness in dealing with a produce-related foodborne illnesses, growers were asked to rate institutions as either "very effective," "somewhat effective," or "not effective" for helping to deal with an incident. Fifty percent of growers said Extension would be "very effective" and 25 percent "somewhat effective" in responding (Figure 9). Government agencies were viewed as less responsive with lower ratings of "very effective" (17 percent) and "somewhat effective" (25 percent) as growers felt that their operations were either too small for the government to care about, or that they simply "don't trust them." The ratings of commodity groups (e.g., the Farm Bureau) were relatively low for "very effective" (17 percent) and "somewhat

Figure 9. Perceptions of Institutional Effectiveness in Assisting in an Outbreak



effective" (17 percent), and a quarter responded that they were "not effective" (25 percent). Half of growers responded that both suppliers and wholesale buyers were "not effective" (50 percent). Wholesale buyer effectiveness was questioned because some felt their buyer, the auction house, was just a "middle man." A few believed that wholesale buyers would be "very effective" (17 percent) or "somewhat effective" (25 percent) because "they would stop me from selling my produce" which would control the outbreak. Most growers choosing not to rate, or could not rate, did so because they were unable to identify the role of the group for acting in this situation.

Many growers conflated the purpose or goals of the GAP standards, the *Seal of Quality* requirements, and the use of auction house lot stickers. Some perceived that the lot stickers, for instance, were part of the *Seal of Quality* and thus were a part of the GAP training that the auction house offered and could be used for tracing a contamination event to a farm. While this was a proposed additional use of the lot sticker, its purpose at the time of research was to identify the owner of the produce for sales records.

Despite many acknowledging that they were not fully prepared, 67 percent said they did not need more information, which may be the result of a barrier some Amish growers erect to avoid repeated contact with people outside their society and a preference for handling problems internally. A few inquired about the potential for field contamination resulting from using drip irrigation. A few (17 percent) were concerned about pathogens being absorbed into the plant through the root system and being transported through the vascular system to edible parts of the plant. Others said they needed more information sources on the spread of *E. coli* contamination. One grower was unsure about the tools or practices available to prevent wildlife contamination in their field, but stressed that their concern was about wildlife eating their crops. This expanded perspective could be used to combine grower interests with a need for addressing this risk.

Preferences for information-seeking match our expectations from past interactions with members of Ohio Amish communities. Most growers (83 percent) preferred to receive information related to produce safety through the mail. A few (33 percent) responded that trainings and other in-person visits were preferred. (Growers could choose more than one source.)

One-quarter (25 percent) of growers said they participate in food safety programs conducted by the auction house, half (50 percent) said they plan

to participate in the future, while the remaining quarter said they did not plan to participate. One grower said that he did so only because the auction house required it, a misperception given the voluntary nature of the *Seal of Quality* program. Many felt that the auction house already provided the information and trainings they needed to prevent or control an outbreak, despite responses noting that most were not participating.

Discussion

Produce safety is an issue that can greatly affect a wide range of farmers as a result of the feedback loop created through media coverage, consumer responses, and the evolving regulatory environment. As seen during the 2006 spinach outbreak, produce safety breaches can turn into nationwide incidents that harm or kill many people. In addition, as a result of the lack of transparency in most produce-commodity chains, industry-wide financial losses can occur as consumers use what information is available to them to alter buying patterns and reduce their own risks. The emphasis in this study was to better understand the perceptions, beliefs, and produce safety and GAP certification information needs of the Holmes County Amish. Additionally, many of these recommendations and lessons would be useful for engaging other small-scale, nonmechanized farmers outside the Plain Community. Similarities exist across underserved smallholder farmers (Netting, 1993) for land, labor, capital, and information needs. Many of the perceptions and uncertainties the Amish reported are likely to be held in common by other farmers with similar operation characteristics and marketing practices.

In addition to public health concerns, the effect of a produce contamination incident on Amish communities is potentially great since they are increasingly adopting produce as a viable economic alternative to dairy. The increasing scale and magnitude of produce safety risks, from both threats of contamination and threats of over-regulation (real and perceived), has increased the necessity for GAP training and compliance among all produce growers. For the Amish, this raises the importance of integrating produce safety practices informed by accurate information into current farming practices. What follows is a discussion of issues and recommendations for moving toward this goal.

Despite the promise of fresh produce production offering an alternative farming strategy for the Amish, the conflict among their values of separation, the need for consumer protection, and government regulations pose challenges. Like many farmers, Amish growers are unenthusiastic about government-mandated produce safety rules and have past experiences successfully resisting external directives. Few in this study reported seeking GAP training, discussed GAP compliance, or identified a need for more information, which, according to informal sources, is representative of this community of growers.

Much of this guarded approach among farmers is heightened among Amish growers who have a cultural preference, and possess social mechanisms for, in-group problem solving. This preference for handling problems internally is problematic from the position of implementing effective outreach with accurate produce safety information. This research indicates that collaboration with intermediaries, or cultural-brokers, such as auction house staff, could be a path to increasing GAP awareness. A strength of the auction houses are the social networks that intersect in this community space where more liberal Amish and Mennonite farmers historically share deep social and cultural connections across Orders. Moreover, our findings can serve as a benchmark for the range of perceptions and beliefs on produce safety in the Holmes County Settlement, with more general application for other Plain Communities.

Perceptions of Produce Safety

Holmes County Settlement produce growers have unique concerns. Many of the participants reported varying awareness of pathogens, sources of contamination, and practices to prevent or control them. Despite some awareness, most do not feel adequately prepared to handle an on-farm outbreak, and they perceived barriers to adopting some of the prevention practices. A self-reported lack of preparation and in-group problem-solving preferences can compound the issue of providing salient outreach, as described below. Few felt that

there were risks in their type of farming as long as they follow the practices prescribed by the auction house.

Amish Cultural Model of Responsibility

Findings reveal that the Amish both highlight and contest the high level of responsibility they feel is placed on farmers for ensuring produce safety. Many of their perceptions highlighted consumers as potential sources of their own contamination and risk. Connected to the perception of consumer responsibility is the belief that consumers share blame for their perceived susceptibility to illness by reducing their exposure to general pathogens that results in having underdeveloped immune systems. The logic of this is as follows: Amish perceptions of *E. coli* and *Salmonella* were related to the recent discourses on national foodborne-illness incidents, and perceptions of these incidents were shaped by the belief that people in non-farming communities have a weakened immunity to natural pathogens. Several believed that consumers have been removed from the production end of the food system and no longer experience daily or routine exposure to the natural environment and its pathogens. Further, they perceive that pasteurized foods, antibacterial hand sanitizers, and other antimicrobial household products work in the short-term to protect consumer health while ensuring that their immune systems remain unchallenged and unable to protect against illness. Further, many would like to see increased consumer outreach to promote greater awareness and improved produce safety practices, holding that most people do not properly clean their produce or food preparation areas before preparing or consuming food, and are responsible for some cases of foodborne illnesses.

Growers contest expert perceptions of horses acting as pathogen vectors. Some growers requested information that included proven findings on equine transmission of *E. coli* and other pathogens to produce fields. This is in addition to a reported need for increased research on general risks of horse use on Amish farms. Much of the contestation of horses-as-vectors arises in a charged environment that has farmers of different scales of operation, and consumers, looking for solutions to complex issues spanning the food system; these issues are often beyond the scope of current experience and knowledge of most people.

Growers shared perceptions that emphasize *control* rather than *prevention* of produce contamination. They viewed prevention practices as activities they could implement to control the introduction and spread, but not as practices that would prevent such incidents. This emphasis on control for an already present risk is shared across farm scales (Parker et al., 2012b). Like other produce growers in the larger study, many Amish growers asserted that produce is grown outdoors and they are unable to control all sources of contamination. Consequently, many growers believed that there is little control over the degree to which wildlife affects produce safety because it grows in a natural environment.

Social Networks, Cultural Brokers, and Best Practices in Adult Learning

Cultural sensitivity is important when developing effective outreach for any community. This requires outreach professionals to ensure that the characteristics of their messengers (e.g., verbal presentation style, appearance) are acceptable to audience members, and that messages are crafted and education events are designed with audience-specific educational needs and culturally appropriate practices in mind (Brown, 1981; Wejnert, 2002). It is best that growers communicate with experts who can provide scientifically based information and protocols for both contamination prevention *and* outbreak control. The Amish pattern of seeking information from different sources based on information needs effectively separates information for preventing an outbreak from information for controlling an outbreak. This creates a difficult situation for outreach professionals wishing to provide state-of-the-art resources on best practices if they are not a primary channel or source. The risks of negative outcomes are likely to increase if growers are sourcing prevention or control information from non-authoritative sources.

Bell and McAllister's (2012) best practices for adult learning can help integrate current knowledge and prior experiences of growers with new materi-

als to effectively disseminate information that connects with internal motivations for learning. Moreover, pairing the material with learning styles is important for this process. From our study and outreach experiences, many Amish value practical experience, experiential learning, and testimony from people with these experiences. Applying these principles for Amish audiences can take the form of field days and experiential workshops such as facility, equipment, and/or produce sanitation, anecdotal accounts from people with shared Amish or Plain Community backgrounds, and the use of culturally appropriate and non-electronic learning materials such as posters, workbooks, newsletters, and factsheets.

Social networks of family and other Amish growers are used daily and have significant influences on farming operations. These networks can be approached when developing outreach programs, particularly those designed to influence behavioral changes. A recent national study of environmental perceptions and beliefs (Macias & Williams, 2015) demonstrates the importance of integrating exogenous social networks in shaping perceptions of environmental issues. Macias and Williams found that people socializing more outside their family social networks tended to report using more environmentally favorable practices than those who socialized mainly within their family networks. These findings highlight the importance of fostering broader, community-level values and the effects on individuals of sharing information and material resources within this larger network.

The strength of existing social relationships between Plain Community farmers and their neighbors is likely to vary across settlements. For instance, one Plain Community may have a long-standing professional relationship with outside local service providers (e.g., the Soil and Water Conservation District) while another may have relatively little contact with people outside its community. Consequently, outreach professionals should be mindful of local trust and comfort levels with information and technical service providers. Building such trust and comfort may require working through different social networks. Relying on gatekeepers in these networks for guidance or assistance can help build program trust among Amish growers. Outreach professionals wanting to work in Amish communities can use the strengths of existing social networks to enhance collaborations and outreach. Such an approach was identified by Parker et al. (2006), where relationships within and across Amish Church Districts in the Holmes County Settlement were considered when addressing water quality remediation efforts in the Sugar Creek watershed.

Both a source of confusion and a potential instrument for change, the *Seal of Quality* is a program available for growers to identify their produce as higher quality at the market. Most study participants were aware of the program but did not participate in it, and nearly half of the Amish in this research have misinterpreted the *Seal of Quality* requirements as covering only pesticide application training and recordkeeping.

The Growers' Code of Excellence and *Seal of Quality* offer examples of nongovernmental solutions that can expand GAP compliance by shifting program participation from a voluntary to a universally mandatory participant signup. In collaboration with Cooperative Extension or other outreach providers, the auction house is a cultural broker that could require and provide additional guidance and GAP training to all its vendors.

Auction houses offer an entry point to social networks where the power dynamic between buyer and seller is less uneven, and members of local social networks interact internally and externally. Rather than focusing efforts exclusively on the Church District, we recommend working with trusted community members who potentially have different perceptions and beliefs of risks, of control and prevention, and appropriate means of ensuring produce safety. This nonfamilial yet nongovernmental approach pools the authority of local Church District decision-makers with the expertise of produce safety experts who can provide information externally through in-network people, such as auction house staff. To accomplish this, organizers will need input from farmers, GAP trainers, and auction house staff to develop a framework that is more nuanced than these recommendations and include marketing and organizational structures appropriate to each community.

Partnering with buyers and Amish growers to develop programs that go beyond the voluntary versus coercion dichotomy, and instead includes community leaders and farmers to develop local solutions, is the key. The *Seal of Quality* at the auction house is one example of a program with potential to achieve enhanced produce safety awareness and GAP compliance from a population of farmers who would otherwise prefer to remain separate.

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Principles guiding practice: A case study analysis of the principles of sustainable agriculture for diverse farms

Kelly N. Moore [a] * and Marilyn E. Swisher [b]
University of Florida

Juan Carlos Rodriguez [c]
Roca Consulting Group, LLC

Mark Blevins [d]
Brunswick County Extension Services, North Carolina State University

Michael Hogan [e]
The Ohio State University

Lauren Hunter [f]
Blain County Extension Services, University of Idaho

Christine Kelly-Begazo [g]
Indian River County Extension Services, University of Florida

Stephen Komar [h]
Cooperative Extension of Sussex County, Rutgers New Jersey Agricultural Experiment Station

Suzanne Mills-Wasniak [i]
Montgomery County Extension Services, The Ohio State University

David Redhage [j]
Kerr Center for Sustainable Agriculture

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Abstract

Early proponents of sustainable agriculture faced considerable resistance and initiated a long-lasting discussion over strategies for sustainable agriculture. This controversy has re-emerged recently in the discussion of agro-ecology versus sustainable intensification. Fourteen agricultural professionals participated in a guided discovery

[a] * *Corresponding author*: Kelly N. Moore, School of Natural Resources and Environment, University of Florida; P.O. Box 110310; Gainesville, Florida 32611-0310 USA; +1-352-273-3508; kmon913@ufl.edu

[b] Department of Family, Youth and Community Sciences, University of Florida; mesw@ufl.edu

[c] Roca Consulting Group, LLC; jcrrivera@gmail.com

[d] Brunswick County Extension Services, North Carolina State University; mark_blevins@ncsu.edu

[e] College of Food, Agricultural, and Environmental Sciences, The Ohio State University; hogan.1@osu.edu

[f] Blain County Extension Services, University of Idaho; lhunter@uidaho.edu

[g] Indian River County Extension Services, University of Florida; ckellybe@ufl.edu

[h] Cooperative Extension of Sussex County, Rutgers New Jersey Agricultural Experiment Station; skomar@njaes.rutgers.edu

[i] Montgomery County Extension Services, The Ohio State University; mills-wasniak.1@osu.edu

[j] Kerr Center for Sustainable Agriculture; dredhage@kerrcenter.com

learning process on six agricultural operations in Florida that are considered to be good examples of sustainability. The six operations included large and small farms, organic and conventional farms, livestock and crop enterprises, and traditional and direct sales marketing approaches. The objective of the process was to identify the principles that the operators use to guide their specific management decisions, including decisions with economic, environmental, and social consequences. Participants studied information about each operation and created a set of questions to ask the manager(s) about the underlying philosophy and principles that guide the management and then spent one to six hours at each site. The information was analyzed in small groups after each visit, and a summative analysis was completed after all site visits were completed. Although these operations are very diverse in terms of characteristics like size, enterprise mix, farm capital, technologies used, marketing strategies, and manager experience, the study showed also similarities across the farms in the principles that guide their decision-making. From these principles, nine broad principles of sustainable agriculture were identified. Most contemporary theoretical concepts about social, economic, and environmental sustainability are reflected in the operating principles of these businesses.

Keywords
sustainable agriculture, principles, case study, discovery learning, community engagement, business principles, financial risk

Introduction

Sustainable agriculture has grown from an ideal championed primarily by environmentalists like Wes Jackson (1971) to a mainstream program of the U.S. Department of Agriculture (USDA) (Kirschenmann, 2004; USDA, Sustainable Agriculture Research & Education Program, 2012). The call for a change in agricultural practices seemed unjustified to most in the 1970s when land values, yields, and profits were sky high, but the 1980s ushered in one of the worst farm crises in U.S. history. Thousands of farms became bankrupt. In Iowa, land values fell from US$2,147 per acre in 1981 to US$787 in 1986 (Duffy, 2014). Midsize farms, the traditional American family farm, were particularly hard hit, as was the Midwestern rural heartland (Brasier, 2005; Murdock, Leistritz & Hamm, 1988). The expression "sustainable agriculture" took on a new relevance for many who had paid little attention to the concept during the booming farm economy of the 1970s. By the mid-1980s, leadership for an alternative to traditional agriculture emerged and the term sustainable agriculture was adopted to embody its ideals.

The term took root, but a controversy about what sustainable agriculture is or means started almost as soon as the term appeared. Jackson's call for sustainable agriculture very quickly inspired some responses, but the formative discussion developed later, in the late 1980s and 1990s. This extended interchange was largely among proponents of the concept as a whole, as is often the case when there is a paradigm shift in any field and proponents engage in intensive debate about how to define the new paradigm (Dahlberg, 1991; Fautin, 1995; Friend, 1990; Kirschenmann, 1991; Lovett, 1990; Norman, Bloomquist, Janke, Freyenberger, Jost, Schurle, & Kok, 2000; Reganold, Papendick & Parr, 1990). This early dialogue focused in large part on identifying and defining the key characteristics and requisites of sustainable agricultural systems. Given the origins of the concept of sustainability in the environmental movement, it is not surprising that deliberation among proponents tended to emphasize the relationships between agriculture and the environment (Altieri, 1989; Barbier, 1989; Edwards, Grove, Harwood, & Colfer, 1993; Hoag & Skold, 1996; Rosegrant & Livernash, 1996; Rosset & Altieri, 1997; Ruttan, 1996, 2000). Proponents also soon turned their attention to the importance of economic viability for sustainability (Hitzhusen, 1992; Lighthall, 1996; Lu, Watkins & Teasdale, 1999; Lyson & Welsh, 1993; Madden, 1987; Marra & Kaval, 2000; Painter, 1991; Saltiel, Bauder & Palakovich, 1994; Walsh & Lyson, 1997).

Although discussions of what constitutes sustainable agriculture have addressed many topics over the years, a lasting difference in conceptions has to do with the degree to which individuals see conventional and sustainable agriculture as fundamentally different *ways* of farming. This discussion

has emerged most recently as a debate over the merits of ecological agriculture or agroecology versus sustainable intensification of agriculture (Entz, 2015; Illge & Schwarze, 2009; Kershen, 2013). Two critical challenges fuel this ongoing debate about the fundamental characteristics of a sustainable food and agricultural system. One is the anticipated increase in demand for food due to population growth and increased animal protein consumption, particularly in Asia (Kastner, Rivas, Koch, & Nonhebel, 2012; Prasad, 2013; Pretty, 2009; Tilman, Balzer, Hill, & Befort, 2011). The other is the imperative need to allow large tracts of land to remain as natural ecosystems that will help protect as much of the planet's remaining and threatened biodiversity as possible (Dobrovolski, Loyola, Guilhauman, Gouveia, & Diniz-Filho, 2013; Kirkegaard, Conyers, Hunt, Kirkby, Watt, & Rebetzke, 2014; Krausmann et al., 2013; Laurance, Sayer & Cassman, 2014; Nori, Lescano, Illoldi-Rangel, Frutos, Cabrera, & Leynaud, 2013).

Ecological or agro-ecology bases agricultural research and practice on the principles and theories of ecology (Bonaudo et al., 2014; Kremen, Iles & Bacon, 2012; Kremen & Miles, 2012). Agroecologists conceptualize agricultural systems as human-dominated ecosystems that are simpler than natural ecosystems, but have similar complex systems of interactions as natural systems. Agro-ecology proposes using these feedback loops to create more self-regulating, resilient, and resource-conserving production systems (Gleissman, 2013a; Lengnick, 2015; Miller & Menalled, 2015; Nelson & Coe, 2014; Omer, Pascual & Russell, 2010; Perfecto, Vandermeer & Philpott, 2014). These ideas reflect the deep roots of agro-ecology in a naturalist vision of agriculture (Berry, 2000; Cornes, 2011; Leopold, 1949, 1966) and to some degree in transpersonal ecology (Cox, 2014; Fix, 1995). Given these roots, it is not surprising that agroecologists have emphasized reducing energy and material flows in agro-ecosystems (Altieri & Rosset, 1996; Odegard & van der Voet, 2014; Pearson, 2007). Organic agriculture, which predates the concept of sustainable agriculture, has epitomized the practice of sustainable agriculture for many agro-ecologists (Bellows, Alcaraz & Hallman, 2010; Cairns, Johnston & MacKendrick, 2013; Lockie, Lyons, Lawrence, & Mummery, 2002; Rigby & Caceres, 2001; Seufert, Ramankutty & Foley, 2012; Zander & Hamm, 2010). However, organic agriculture is no longer regarded as synonymous with sustainable agriculture for many. Increased government regulation, the growing commercialization of organic products through traditional market channels, and the development of an international system of trade in organic foods leave some questioning whether organic agriculture is now distinguishable in philosophy and approach from conventional agriculture. Many criticize this "conventionalization" of organic agriculture (Darnhofer, Lindenthal, Bartel-Kratochvil, & Zollitsch, 2010; Gleissman, 2013b; Guthman, 2004; Jaffee & Howard, 2010; Levidow Pimbert & Vanloqueren, 2014; Lockie & Halpin, 2005; Oelofse et al., 2011; Pratt, 2009). Some call for a new "beyond organic" approach that uses organic farming techniques and also builds local food systems and independent distribution networks of collaborating farmers and consumers (Cross, Edwards, Opondo, Nyeko, & Edwards-Jones, 2009; Mundler & Rumpus, 2012; Sonnino, 2013; Woods, Valandia, Holcomb, Dunning, & Benefeldt, 2013). Despite the differences among those whose vision of sustainable agriculture grows out of ecology, this approach remains one of the key approaches to sustainable agriculture among researchers and farmers today.

In contrast to agro-ecology, sustainable intensification focuses on increasing yields, particularly on land already converted to agriculture (Pretty & Bharucha, 2014). The overall strategy is to meet food needs while curbing agricultural expansion into marginal lands and into the relatively few remaining large tracts of land in natural habitat (Doré, Makowski, Malézieux, Munier-Jolain, Tchamitchian, & Tittonell, 2011; Jordan & Davis, 2015; Sabto, 2014). Adherents argue that ecological agriculture, especially organic agriculture, inherently leads to more land in agriculture because yields are lower than yields in more intensive production systems. Sustainable intensification is therefore characterized by some as "land saving" (Balmford, Green & Scharlemann, 2005: Ceddia, Bardsley, Gomez-y-Paloma, & Sedlacek, 2014; Hulme et al., 2013). Like conventional agriculture, intensification relies on the application of a wide range of

technologies to meet production needs while preserving land and other natural resources (Barnes & Thomson, 2014; Elliott & Firbank, 2013; Tilman et al., 2011). However, sustainable intensification differs from conventional agriculture in its greater emphasis on technologies and practices that reduce resource use, protect ecosystem functions, and build resilience against shocks like climate change (Balwinder-Singh, Humphreys, Gaydon, & Sudhir-Yadav, 2015; Fish, Winter & Lobley, 2014; Lal, 2015; Rochecouste, Dargusch, Cameron, & Smith, 2015; van Ittersum, Cassman, Grassini, Wolf, Tittonell, & Hochman, 2013). Some of these technologies, such as biological control, protected production systems, and soilless production systems, excite little controversy as legitimate components of sustainable agriculture (Albaho, Thomas, & Christopher, 2008; del Amor, López-Marin, & González, 2008; Delgado & Berry, 2008; Maurino & Weber, 2013; Pinkington, Messelink, van Lenteren, & Le Mottee, 2010; Pliego, Ramos, de Vicente, & Cazorla, 2011; Rovira-Más, & Sáiz-Rubio, 2013; Wang & Pang, 2013; Yang et al. 2014;). More controversial, a growing number of proponents of sustainable intensification are convinced that application of biotechnology is a necessary element in any strategy to meet world food demand (Albajes et al., 2013; Bennett, Chi-Ham, Barrows, Sexton, & Zilberman, 2013; Berkhout, 2002; Flavell, 2010; Jacobsen, Sorensen, Pedersen, & Weiner, 2013; Mackey & Montgomery, 2004; McGloughlin 2010; Teixeira, Proença, Crespo, Valada, & Domingos, 2015; Wield, Chataway & Bolo, 2010).

Embedded within the broader, underlying discussion of "ecology versus intensification" are differences in the perceived importance of various farm characteristics or production practices. Much of the discussion of what constitutes sustainable agriculture has revolved around the role of these specific practices in the achievement of sustainability. For example, for some, especially those who argue for an agroecological approach to sustainability, farm size (Gaurav & Mishra, 2015; Kull, Carrière, Moreau, Ramiarantsoa, Blanc-Pamard, & Tassin, 2013; Woodhouse, 2010) and the structure of farm ownership (Dogliotti et al., 2014; Fernandes & Woodhouse, 2008; Hamilton, 2014; Woods, 2014) are central to sustainable agriculture. Some argue that sustainable agriculture can *only* be achieved on small or family farms. For others, specific techniques define sustainable agriculture (Wezel, Casagrande, Celette, Vian, Ferrer, & Peigné, 2014). Examples are integrated systems (Khan, 2011; Klinger & Naylor, 2012; Ogello, Mlingi, Nyonje, Charo-Karis, & Munguti, 2013), biodynamic farming (Ingram, 2007; Pechrová, 2014), and permaculture (Ferguson & Lovell, 2014). Some practices, like the use of cover crops and crop rotation, are mandated in the U.S. National Organic Standards, while others, like the application of composted bio-solids from municipal waste processing, are specifically prohibited.

The research reported here examined the broad, underlying principles that farmers and other actors in the agri-food system use in the practice of sustainable agriculture. We explored these issues as part of a field experience supported by USDA's Sustainable Agriculture Research & Education (SARE) Fellows Program. Each year a small cohort of members of the National Association of County Agricultural Agents (NACAA) is chosen to participate in a two-year training program, which includes field experiences in each of USDA's four regions (South, West North Central, and Northeast). Fourteen agricultural professionals participated in the 2011 field experience hosted by the University of Florida. Participants included 10 county agricultural extension agents from around the country and four regional and national SARE program representatives. They had an average of over 20 years of experience in agriculture. The group spent three days examining six agricultural operations located in the central and southeastern regions of Florida, all of which had been identified by farmers and other agricultural professionals in Florida as models of the practice of sustainable agriculture. Our overall goal was to examine whether there are generalizable principles that inform how farmers practice sustainable agriculture and that provide the platform for both daily decision-making and long-term planning.

Methodology

We used a comparative case study design for the study. Comparative case studies are explanatory in

nature and differ from purely descriptive case study designs in important ways (Crowe, Cresswell, Robertson, Huby, Avery, & Sheikh, 2011; Jones & Lyons, 2004; Radley & Chamberlain, 2012; Rubaie, 2002; Yin, 2009). Explanatory or comparative case-study designs usually have objectives associated with reaching conclusions that are universal, at least to all of the cases examined and often that are more generally applicable to a population of cases that are similar to the cases studied in terms of their key attributes (Lloyd-Jones, 2003). Although comparative case studies are used in many sciences (Smerdon, Cook, Cook, & Seager, 2015; Zimmermann, Aurich, Graziano, & Fuertes, 2014), there is not a large body of literature about sustainable agriculture that uses the case study design. However, there are some studies that extend beyond description to comparison and explanation, which was our objective (Bisht et al., 2014; Boogaard, Oosting & Bock, 2008; Cerutti, Beccaro, Bagliani, Donno, & Bounous, 2013; Crivits & Paredis, 2013; Davies-Jones, 2011; Girard, Magda, Nosedaz & Sarandon, 2015).

A case-study design uses replication logic rather than statistical logic to sample and often consists of relatively few cases due to feasibility issues of larger samples (Yin, 2009). Descriptive case studies sometimes rely on a single case, but this is not a strong design; explanatory case-study designs require multiple cases. We used a nonprobability, purposive sample, an appropriate choice when the researcher needs to identify rare, hard-to-find, or hard-to-reach populations (Abrams, 2010; Auerswald, Greene, Minnis, Doherty, Ellen, & Padian, 2004; Curtis, Gesler, Smith, & Washburn, 2000), as was our intention here in identifying farms revered as models of sustainability.

It was imperative that we identified farms perceived by their colleagues as models of sustainability. The goal of this research was not to define what constitutes sustainable agricultural practices; there is considerable discussion around this topic already (see above discussion). Rather, it was important that these farmers were *perceived* to be elite models of the practice of sustainable agriculture, as our objective was to determine a common set of *principles* that guide their decision-making. Therefore we did not choose the farms based on characteristics like size, enterprise mix, or form of ownership, but rather on their reputation as outstanding practitioners of sustainable agriculture by other farmers and agricultural professionals. The operations differ in many other ways (Table 1). They range in size from one acre (0.40 hectare) to 300,000 acres (121,000 hectares) and vary in management structure from family-owned to corporate. They produce a variety of products, including agronomic crops, horticultural crops, and livestock. They use both conventional and emerging

Table 1. Size, Certification, Enterprise Mix, and Marketing Strategies Used for the Six Cases Analyzed in the Study

Case	Size	**Certification** (Type of certification)	**Enterprise Mix** (Livestock, multi- or monocrop, other)	**Marketing Strategy** (Direct or commodity market)
1	Large	50% organic and 50% conventional by acreage	Multicropping	Commodity market
2	Small	Organically grown but *not* certified organic; is certified biodynamic	Multicropping, agritourism	Direct market
3	Large	50% organic and 50% conventional by acreage	Monocropping with rotation, agritourism, packaging, processing, and distribution center	Commodity market
4	Small	Cage free	Livestock	Direct market
5	Small	Organically grown but *not* certified organic	Multicropping, livestock	Direct market
6	Large	None	Livestock, monocropping, agritourism	Commodity market

marketing strategies, and some are managed conventionally while others are certified organic operations. This diversity permitted us to examine the degree to which differences in traits like size, ownership structure, and production system are important for sustainability. More important to us, we wanted to determine whether the operators of these farms do (or do not) share common principles that inform their practice of sustainable agriculture, regardless of differences in traits like farm size.

Our intent was to combine the SARE Fellows program learning experience with a structured or guided process of reflection and analysis drawing on grounded theory and discovery learning to identify broad principles of sustainable agriculture. Both discovery learning and grounded theory eschew *a priori* hypotheses and models, relying instead on the emergence of new knowledge through active experimentation. We use grounded theory as a way for researchers to approach the research process as a discovery of theory, rather than a test of theory, based on the idea that complex conceptual frameworks can emerge from the research process itself (Amsteus, 2014; Conlon, Carney, Timonen, & Scharf, 2015; Engward, 2013; Glaser & Strauss, 1967). However, we do not make the claim that it is a methodology that eliminates or is based on an *absence* of prior knowledge or ideas on the part of the researcher about the phenomenon under study (Urquhart & Fernández, 2013). Rather, we use the approach to build existing ideas and knowledge into broader generalizations based on a reflexive research process. We used discovery learning to inform the research process because this approach to learning shares fundamental features with grounded theory and provides guidance in using interaction, direct experience, communication and deliberation with others, and prior experience to identify key concepts, analyze the relationships between them, and ultimately create generalizations based on this analysis. Grounded theory and discovery learning can foster misconceptions if implemented with learners with little experience or knowledge relevant to the task (Marzano, 2011). We did not face this risk as the professionals in the SARE Fellows program have considerable experience with sustainable agriculture and were provided relevant information prior to starting the exploration of each of the six cases.

Prior to arriving at each operation, participants received background information about each farm. This information came directly from materials provided by the operation's management or its website. Specific study objectives for each site developed by the study coordinators were provided to participants (Table 2). The specific site objectives highlighted the particular reasons each farm was perceived to be a model of sustainability. For example, one farm was identified because it is an outstanding model of how to manage conflicts between agriculture and wildlife. Another farm was considered a superior model of sustainability for its regional marketing efforts. Altering the objectives between farms enabled us to conduct a more comprehensive analysis of various approaches to sustainable farming that captured the differences and similarities in the principles guiding decision-making across a broad set of sustainable practices. These objectives provided the initial foundation for the exploration of each case. We worked in small groups of three to four people. Each group reviewed the background information and objectives prior to visiting the individual operation. The groups used the information to develop a set of questions administered in a team-based interview, a technique that has been used by Conlon et al. (2015) to conduct research using grounded theory. The time spent at each farm varied from one to six hours. Interviews were conducted in a group setting and were combined with direct observation of examples of processes, procedures, and practices that the farmers indicated were important for their operations.

Our approach to data analysis was inductive analysis (Bigby, Frawley, & Radharan, 2014; Borer & Bowen, 2007; Hammersley, 2011; McMahon & Fleury, 2012), also sometimes referred to as analytic induction or concept analysis. This approach is closely tied to grounded theory as a discovery research process. Our data analysis process closely resembles what Saldaña (2012) calls analytic induction, in which "answers to research questions are emergently constructed as more and more data are collected and systematically examined" (p. 26). The

Table 2. Site-specific Learning Objectives Developed To Guide Observations and Team-based Interviews for Each Farm

Case	Specific Objectives
1	• Examine how farmers obtain, evaluate, and use multiple sources of information to develop and adapt technology and practices to their farming conditions. • Explore the role of diverse, multidimensional marketing strategies in sustainable farming operations. • Evaluate the opportunities and barriers that certified organic components create in the management of split operations.
2	• Identify and characterize the contribution of farms to community continuity, development, and revitalization. • Explore the role of farmer-to-farmer collaboration in developing sustainable farming systems. • Examine how farmers can respond to the limitations and opportunities of location.
3	• Investigate how farmers respond to changing environmental, policy, and economic climates to create sustainable agricultural systems. • Explore the impact of capitalization, infrastructure, and management capacity on farmers' ability to respond to changing restrictions on and opportunities for agriculture. • Examine the role of complementarity and multipurposing in creating sustainable agricultural practices and strategies.
4*	• Examine the role of on-farm innovation in creating sustainable farming systems. • Explore how farmers identify and develop specialized marketing strategies. • Analyze the trade-offs between responding to consumer demands and complying with regulatory requirements.
5*	• Examine the role of on-farm innovation in creating sustainable farming systems. • Explore how farmers identify and develop specialized marketing strategies. • Analyze the trade-offs between responding to consumer demands and complying with regulatory requirements.
6	• Analyze how scale of operation affects the role of agriculture in natural resource management and regional land-use policy. • Appraise the management capacity and strategies needed for sustainable long-term land-use management. • Consider the compatibility and role of intensive and extensive production systems in a single farm operation. • Evaluate how technological change and continuity contribute to sustainable agricultural systems.

* Sites 4 and 5 had the same site-specific learning objectives due to their proximity to one another.

process included several iterative and cyclical steps as are typical in inductive analysis (Bigby et al., 2014). After each farm visit, the small groups reconvened to reflect on their observations and the information from the interviews individually, share and compare what they had learned, and elaborate and discuss conceptual statements that emerged from the data. The groups tried to identify the ideas or concepts that the farm manager(s) employed to describe and explain their decision-making processes for the topics covered in the site objectives. For example, a site objective for one farm was to "examine how farmers obtain, evaluate, and use multiple sources of information to develop and adapt technology and practices to their farming conditions." A key part of inductive analysis is to identify one or more key words or phrases that emerge to describe a condition, process, or action. In this example, we focused on how the farmer describes his or her thinking about on-farm innovation: what it is, the role it plays in keeping the farm going, how she or he considers and compares different potential innovations directed to improve the farming system.

The group members then used their own prior knowledge and experience with sustainable agriculture *and* the concepts that had emerged through other cases to examine how the farmer's practices or approaches are related to sustainable agriculture to achieve collaborative results (Saab, van Joolingen, & van Hout-Wolters, 2005). Once the group members had exhausted their ability to identify specific instances of the ways an approach is used or implemented, they tried to create a higher order or broader concept that was applicable beyond the case, in this example a general concept about the role of innovation that can be applied more generally to inform the practice of

sustainable agriculture. At the end of each day, the entire large group discussed similarities and differences observed in the operations visited that day and discussed, criticized, and refined—or abandoned—the higher-level conceptualizations that had emerged as a result of the day's work.

On the last day we examined all of the broad concepts identified in the small groups. We identified shared concepts to emphasize the key ideas, while. eliminating some concepts from further consideration when participants felt that the concept was too narrow to address our objective of identifying common principles guiding sustainable decision-making. As the concepts were refined, combined into more inclusive concepts, or rejected, a final set of proposed principles of sustainable agriculture emerged.

The results of the inductive analysis consist of the identification of key ideas that are shared by several, or sometimes all, of the farmers or that are repeatedly stressed or emphasized by respondents. We identified nine key themes or ideas and explored how the themes are expressed in the different farm operations. The nine principles of sustainable agriculture are presented in the Appendix. We use examples from our sample to exemplify each principle in the presentation of results.

The principles that we identified are not intended as "rules" or absolutes. The principles are best conceived as components of an emerging model of "how farmers create sustainable agriculture," the kind of qualitative model that Northcutt & McCoy (2004) propose as a higher order level of qualitative data analysis that approaches explanation. We also see these principles as hypothetical statements about the norms and values that underlie farmers' "everyday practice of sustainable agriculture," that could be subjected to testing, corroboration, or disproof as hypotheses. The nine principles are listed in Table 3.

Results

Change

The farmers said that they continuously face new challenges in their operations, requiring them to adapt key aspects of their operations from

Table 3. Nine Generalizable Principles of Sustainable Agriculture Guiding Farmers' Decision-Making Regarding Their Operations

	Principles of Sustainable Agriculture
1.	Sustainable farmers anticipate change—they recognize, accept, plan for, and create change.
2.	Sustainable farmers recognize and identify limitations and resources and create a strategy to develop their resources and to minimize and overcome limitations.
3.	Sustainable farmers build strong, mutually beneficial relationships with individuals, institutions, and organizations based on a sense of responsibility to the community and the need to give back to the community.
4.	Sustainable farmers invest in their employees to create a loyal, dedicated, and engaged workforce that shares responsibility for the success of the farming operation.
5.	Sustainable farmers are not satisfied with average business practices or products; high quality characterizes every component of their businesses.
6.	Sustainable farming operations are management-intensive, distribute responsibility and decision-making among all employees, draw upon diverse skill sets in management, and integrate management functions and decisions across the farm operation.
7.	Sustainable farms are businesses first and foremost, but profits are used to both grow the business *and* address broader social and environmental goals.
8.	Sustainable farmers take appropriate risks, incur reasonable debt, and make investments based on mid- to long-term challenges and opportunities.
9.	Sustainable farmers have a passion for farming reflected in their dedication, integrity, and honesty as professionals, but their passion is *practical* because they understand that the success of the business makes it possible to pursue their passion.

production to marketing and finances to fit changing circumstances. All six operators indicated they expect many changes in agriculture in the future, but the kinds of changes they envisioned varied. Some of the changes they mentioned were new regulations, decreasing or increasing consumer demand, fluctuating market prices, and inevitable natural forces like weather. For example, several farmers mentioned regulatory changes, but their strategies for addressing new regulations varied. One farmer chose to implement a management strategy now to address these coming changes. Some examples of change were very specific to local conditions. Soil oxidation is a constant concern for growers in south Florida who farm on organic soils (having a high percent of organic matter, e.g. 10 percent) because these soils oxidize (or "subside") when drained. The soil can lose up to an inch (2.5 cm) of top soil each year, ultimately leaving the farmer with bare limestone (Wright & Snyder, 2009). Only one farmer cited this particular form of change, but he, too, sought a strategic approach, to adopt farming practices that will minimize soil oxidation and maintain or improve existing soil conditions. Thinking about and planning for change rather than ignoring change was a common thread in farmers' comments.
Principle #1: *Sustainable farmers anticipate change—they recognize, accept, plan for, and create change.*

Limitations and Resources
The kinds of limitations of and resources available to their operations were clearly recognized by these farmers. These were universal in some senses—all farms need land and capital—but the degree to which each operation faced a specific set of limitations and called upon a unique set of human, environmental, and fiscal resources was very revealing about the diversity of these farms. Every farmer identified resource limitations, ranging from capital to water to skilled labor. These farmers clearly voiced the need to make the best use of any limited resource. They discussed how they use existing resources, such as financial support or new technologies, to contribute to the success of their businesses. They tended to view the contemporary environment as one of increasingly limited resources and growing competition, and articulated the idea that failure to make good use of resources can be fatal. For example, one farmer recognized that she could not manage her small poultry operation effectively by herself. She recruited local individuals who shared her passion and vision for locally raised poultry to assist on the farm and at markets. Another livestock producer recognized that his strength lies in breeding. His operation ships steers to operations in other states that specialize in finishing steers rather than trying to raise finished animals.
Principle #2: *Sustainable farmers recognize and identify limitations and resources and create strategies to develop their resources and minimize and overcome limitations.*

Relationships
All six farm operators recognized that their farms are not isolated from non-farm (non-agricultural) people, businesses, and organizations in the communities around them, rural or urban. They knew that their relationship to the residents of the communities where they operate affects their operations, and they expressed a sense of responsibility to their community. Four of the six mentioned specific ways in which they integrate themselves into surrounding communities, and expressed the need to ensure that community residents realize that farms are a valuable asset to the community as a whole. This perspective focused on the total contribution that farms can make to a community, including giving back to the community. For example, a farm in the study actively participates in its local community by providing support to various grassroots organizations addressing education, wildlife, environment, and literacy. Another farm reaches beyond its immediate local community and is very well connected to its regional community. The operators open the farm to guests several times a month for a farm-to-fork dinner and donate the proceeds to various local charities. Another operation donates unsold or short-dated products to food banks and community groups.
Principle #3: *Sustainable farmers build strong, mutually beneficial relationships with individuals, institutions, and organizations based on a sense of responsibility to their community and the need to give back to their community.*

Human Resources

Employees were a critical asset to and component of the success of these farms. All the operators cited the importance of fostering an environment that enhances the work experience for their employees, including but not limited to financial rewards. For example, several farmers said that providing opportunities for employees to participate in decision-making about issues related to both operational and individual needs increases their employees' satisfaction. One farm responded to the needs of employees by ending their volunteer labor recruitment in order to enable paid employees to dedicate more time to their own interests on the farm rather than training and supervising volunteers. Employees at one farm receive professional development incentives and are provided with opportunities to advance within the company. All employees at every farm received livable wages and benefits. Benefits were not limited to traditional benefits like health insurance or retirement plans. Some farms offered benefits like transportation, housing, or a share of the products raised on the farm. For these farmers, employees were a critical key to success.

Principle #4: *Sustainable farms invest in their employees to create a loyal, dedicated, and engaged workforce that shares responsibility for the success of the farming operation.*

Quality

"Quality" was a word that emerged time after time in this study. A summative statement that illustrates what we heard was that "mediocre businesses that produce mediocre products are unlikely to prosper." The degree to which concerns for quality drive these farmers' decisions and practices was clear, and it was also clear that they saw quality as a key to a successful and sustainable business operation. Each farm we visited was proud to produce a premium product. While many farmers focus on keeping their product prices "competitive," five of the six farmers in this study were proud to make a high-quality product that sells for a premium price. They have worked to create a loyal customer base that appreciates the value of the high-quality products they offer. They have identified markets that appreciate and demand high-quality products. In some cases this was accomplished by establishing relationships with high-end purchasers, such as membership-only clubs and five-star restaurants. They also met or exceeded certification criteria and provided high-quality training for employees. The farmers in this study were not content until they felt their practices and products met their own and their customers' expectations, and they continually strive to improve their products.

Principle #5: *Sustainable farmers are not satisfied with average business practices or products; high quality characterizes every component of their business.*

Management

From the largest to the smallest operations, these farmers stress that management is a critical key to success in contemporary social and business environments. This was closely related to the importance of human resources. They view encouraging people to accomplish the farm's goals and objectives using available resources in an efficient and effective manner as central to a successful management plan. They use many techniques to improve management. Some allocate responsibility to key individuals at different stages of production to make use of individual strengths and maximize efficiency. Several stressed the need to have clear and precise operating procedures and expectations in order to help deal with problems and address issues before they become a problem. For example, one of the larger farms we visited divided the operation into smaller units managed by independent teams. Individual units were self-sufficient and able to make critical decisions, provided they complied with some standard farm operating procedures. Perhaps surprising, the same management technique was also used at several of the smaller farms. Employees were given freedom to make independent decisions and implement their ideas as long as they fit within the overall vision of the farm.

Principle #6: *Sustainable farming operations are management-intensive, distribute responsibility and decision-making among employees, draw upon diverse skill sets in management, and integrate management functions and decisions across the farm operation.*

A Farm Is a Business

While these farmers clearly had a love and passion for the land and for farming, they also clearly

understood that economic success and growth were prerequisites for sustainability. A clear theme was that economic success is not "just to make money," but rather is seen as a precondition to investing in many aspects of the farm as a business, a resource, and a home, and to permitting farmers, their families, and their employees to pursue their own personal interests within the context of the farm business plan. For example, all the farmers in our study discussed reinvesting capital into their operation to improve their efficiency or offer a new product. One farmer used profits to improve environmental conditions on his property and positively contribute to his community by devoting a third of his land to wildlife conservation. This farmer has also developed and implemented a plan to improve the quality of the water that leaves the farm and is used by neighboring communities. Nonetheless, all of these farmers clearly run their farms first and foremost *as businesses* because the success of the business is what allows them to pursue other personal and social goals.

Principle #7: *Sustainable farms are businesses first and foremost, but profits are used to grow the business* ***and*** *to address broader social and environmental goals.*

Planning

The farmers we interviewed were "planners," and they plan for the long term. They could articulate clear goals for their farms with timelines. Some of their comments associated these long-term goals with a framework within which decisions about investments and opportunities are made. One of the farmers adjusted his or her long-standing marketing approach to reduce economic risks in the increasingly volatile global marketplace. The farm now only grows those products that can be grown under contract with specific trusted buyers and will only work with buyers who pay the market price at the time of shipment. Another operator planned to offer new products to ensure that returning customers find variety. One farmer stressed the importance of making smart investments, such as purchasing new equipment that would allow her to diversify her operation and increase profits. Although small farmers are often described as "risk adverse" and "unwilling to assume debt," she is just one of the small farmers in this group who chose to take a financial risk. She purchased new equipment using a small farm loan because she saw an opportunity for her business to offer a new product no one else in the area was providing. These farmers were "fiscally conservative," but not risk avoiders.

Principle #8: *Sustainable farmers take appropriate risks, incur reasonable debt, and make investments based on mid- to long-term challenges and opportunities.*

Passion

All these farmers expressed the saying that "you'll never work a day in your life if you love what you do." These farmers viewed themselves as "professionals in farming" and all of them talked about their work as a passion—not a job. Producing a high-quality product that they could offer with pride was important, but for all of these businesspeople the product was only one important component of his or her "work." Every one of them valued his or her connection to the environment and community. But they also stressed that you have to be "practical." They saw being practical and prudent as keys to the success of their businesses, and for them their businesses are the pathway to do what they love.

Principle #9: *Sustainable farmers have a passion for farming reflected in their dedication, integrity, and honesty as professionals, but their passion is* ***practical*** *because they understand that the success of the business makes it possible to pursue their passion.*

Discussion

In the introduction to this article we referred to the ongoing debate about the degree to which sustainable agriculture necessarily requires a major shift in the values, theories, and assumptions underlying post-WWII agricultural science. This is by far the most commonly articulated debate in the sustainable agriculture literature and currently tends to center on the concepts of ecological or agro-ecological agriculture versus sustainable intensification.

Our research suggests that the distinctions drawn between the agro-ecological and sustainable intensification proponents may not be nearly as clear for farmers trying to practice sustainable agriculture as the literature would suggest. While

the importance of profitability is clearly reflected in Principles 5, 7, and 8, a deep concern for the environment is reflected in several principles, including these same principles. These businesspeople tended to tie profitability and environmental protection together and described using their profits to support environmental organizations and causes and to take steps to protect and enhance resources both on the farm and off. Principle 7 reflects this blending: *Sustainable farms are businesses first and foremost, but profits are used to grow the business* ***and*** *to address broader social and environmental goals.* Although there were certainly philosophical differences in their worldviews and goals for their enterprises, and some were organic producers and some not, they shared basic values related to environmental protection and resource conservation.

There are at least two other critical components of the discussion about how much and what kinds of change are required to achieve sustainable agriculture. One is the equally vibrant discussion about the economics of sustainability, and by implication the economics of sustainable agriculture. Just as there are two strongly contrasting views about the environmental requirements for sustainable agriculture, the economic debate tends to reflect two quite different concepts of what a "sustainable economy" demands (Baumgärtner, & Quaas, 2010; Illge & Schwarze, 2009). Although there are other perspectives, the two economic perspectives can be described as the degrowth and the green economy schools. The degrowth approach (or the less restrictive no growth approach) to the economics of sustainability argues that further economic growth is detrimental to the environment because growth of any sort implies a greater throughput of energy and materials (Kallis, 2011; Kallis, Kerschner, & Martinez-Alier, 2012). Some proponents of degrowth also point to the social benefits of a degrowth economy (Andreoni & Galmarini, 2013; Johanisova, Crabtree & Franková, 2013). Although not yet prevalent in the sustainable agriculture literature, the degrowth perspective underlies the critique of capitalist economics and the role of profitability in the beyond organic movement (Martínez-Alier, Pascual, Vivien, & Zaccai, 2010; Sekulova, Kallis, Rodríguez-Labajos, & Schneider, 2013; Sorman & Giampietro, 2013). In contrast, the "greening the economy" approach argues for incorporating environmental accounting into classic economic measures to achieve sustainable economic performance and growth (Bartelmus, 2010). Proponents of greening the economy address policy, governance, and investment components of a green economy (Graham & Bertels, 2008; Gupta & Sanchez, 2012; Martins, 2013; Meléndez-Ortiz, 2011) and more operational considerations like green jobs and sustainable consumption (Akenji, 2014; Cai, Wang, Chen, & Wang, 2011; Seyfang & Longhurst, 2013; Tiley & Young, 2009). Although better represented in the sustainable agriculture literature than the degrowth perspective, direct application of the key concepts of the green economy approach have not been addressed.

The principles that emerged in our analysis show little relationship between these managers' concepts of sustainable economics and the concept of degrowth—or even no growth. On the contrary, all but one of the managers saw economic growth as a positive and desirable outcome for their businesses. On the other hand, almost all the respondents did describe parts of their business models that reflect key ideas in the green economy literature. Examples were cited in our discussions of Principles 3, 4, 8, and 9. Perhaps most congruent with the concept of greening the economy is the strong relationship between growth and investment in human and environmental resources that was a focus for most of these managers. Overall, our results suggest that some of the key concepts of greening the economy, particularly as they relate to a broader range of economic goals than profitability alone, are key factors in these entrepreneurs' decision-making.

Finally, there is a rather poorly defined controversy about the social requirements for a sustainable food and agriculture system. The social requisites for sustainability in general have received much less attention than the environmental and economic components, and the distinctions between alternative approaches to social sustainability are not nearly as well defined as those of environmental and economic sustainability. From a farm policy perspective, much of the discussion of

the social component of sustainable agriculture has revolved around meeting the needs of small farmers and the economic health of rural communities (Ashwood, Diamond, & Thu, 2014; Hamilton, 2014; Kirner & Kratochvil, 2006; Pilgeram, 2011; Reinhardt & Barlett, 1989; Tavernier & Tolomeo, 2004; Woodhouse, 2010). However, a broader agenda of food and agriculture–related issues also exists and is perhaps growing in importance. There are two distinct approaches to the social aspects of sustainability that are directly relevant to sustainable agriculture: social justice and sustainable or ethical consumerism.

The increase of food insecurity in the United States and globally, including lack of access to safe, affordable, healthy food, is now a greater concern to a wider audience of researchers and practitioners. There is growing emphasis on the relationships between social justice and sustainable agriculture and how the objectives associated with each can be complementary (Ayres & Bosia, 2011; Connelly, Markey & Roseland, 2011; Hernandez & Pressler, 2013; Johnston, 2008; Mandell, 2009; Masters, Krogstrand, Eskridge, & Albrecht, 2014; Minkoff-Zern, 2014). At a more regional level, concerns about the potential for the local and organic food movement to *increase* social divisions through unequal access to venues like farmers' markets have grown (Agyeman, 2005; Alkon, 2008, 2013; Deutsch, 2011). The degree to which elite-serving value chains exacerbate social injustice globally by allowing practices like child labor or driving agricultural production for export to the U.S. and Europe instead of meeting food needs at home is now part of the sustainable agriculture agenda (Berlan, 2013; Bolwig, Ponte, du Toit, Riisgaard, & Halberg, 2010). Attention has also turned to the impacts of the conventional food production system on farm laborers and their families (Dorward, 2013; Fridell, 2007; Wilson & Curnow, 2013) and on rural communities globally (Crowell & Sligh, 2006; Meléndez-Ortiz, 2011; Wilkinson, 2009; Varul, 2008). Others have focused on gender and ethnic disparities in both natural resource conservation and destruction (Brady & Monani, 2012; Hecht, 2007; Robinson, 2011). There is an emerging consensus among these researchers that deeply embedded social and economic structures create and propagate these disparities, that these structures are globally systemic, and that the traditional emphases on environmental and economics in sustainable agriculture will not address these issues.

These concerns are not irrelevant to those who propose sustainable or ethical consumerism as a key to sustainable agriculture, but the emphases are certainly different. The key concepts of sustainable (or ethical) consumerism are well reflected in the sustainable agriculture movement and have been for many years (Fernandez, Goodall, Olson, & Méndez, 2013; Smaje, 2014). These concepts underlie much of the emphasis on alternative marketing. Purchasing organic, local foods through community supported agriculture operations (CSAs), farmers markets, and consumer cooperatives are all considered ways to express ethical consumerism and support sustainable agriculture (Cairns et al., 2013; Crivits & Paredis, 2013). Various certification schemes such as "just food" and "fair trade" are seen by many as fundamental to global sustainable agriculture (Cailleba & Casteran, 2010; Hutchins & Sutherland, 2008; Wilson & Curnow, 2013; Zander & Hamm, 2010). Nonetheless, there are dissenting voices that raise concerns about the efficacy and perhaps even the desirability of these approaches (Akenji, 2014; Fridell, 2007; Irvine, 2013; Johnston, 2008; Varul, 2008).

Our results show that the farmers and managers we interviewed recognize both social justice and ethical consumerism as important components of sustainable agriculture. The support provided by ethnical consumerism was mentioned repeatedly as a key component in both the success of these businesses and in the managers' approaches to managing their businesses. This was true for organic and conventional operations, large and small businesses, and operations relying on both conventional and alternative marketing approaches. The universal importance of ethical consumers willing to pay for quality products and loyal to the producers of those products for virtually all of these businesses was surprising. The common wisdom is that the strong consumer-producer tie is primarily a phenomenon for organic producers and consumers

or for producers and consumers who share alternative, nontraditional markets. Our results suggest that this is not true, and instead that the role of ethical consumerism is critical to sustainable farms and enterprises of all sorts. This concept was reflected in several of the key principles that emerged: principles 2, 3, 5, 7, and 8. Simply put, the values and norms of consumers were key to the principles on which these businesses operate. Another common farm value is that almost all of these businesses also incorporate key aspects of social justice in their operations, reflected particularly in the ways employees are valued, recognized, and supported (Principles 1, 2, 4, and 6) and in the strong commitment to local communities that many of these businesses have made (Principles 3, 7, and 9).

The common denominator among the businesses that we chose for the SARE Fellows program case study was that all were considered to provide good examples of sustainable agriculture in practice by professionals in the field. Among the businesses nominated for our program, we purposefully selected a sample of businesses representing a wide range of characteristics with regard to size, enterprise mix, conventional vs. organic production systems, and marketing strategies. Despite these differences, these operations shared many principles that inform their decision-making about both the day-to-day and long-term operation of their businesses. The degree to which these principles incorporate key ideas about the environmental, social, and economic components of sustainability varies. Nonetheless, most of the contemporary theoretical concepts about environmental, social, and economic sustainability are reflected in the operating principles of these businesses. This suggests that these principles are relevant for the practice of sustainable agriculture. We encourage other researchers to further explore the generalizability of our conclusions by examining the degree to which these principles are expressed in other contexts. For example, our research did not explore other contextual factors such as the political landscape, the recent recession, and natural disasters that could also affect farmers' decision-making and may be reflected in the principles that emerged. Comparisons of the degree to which agricultural businesses that are considered good examples of sustainability to those who are less involved in sustainable agriculture would be also be very useful.

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Appendix. Summary of Critical Characteristics of Each Case for Each of Nine Key Concepts that Emerged in Data Analysis

	Dimensions	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Change	1. Regulatory	• Exception: recognized labor regulations were coming and chose to pay fines rather than comply. • Recognized food safety regulations coming and invested in a state-of-the-art tracking system. • Large farm organically certified. • Has gone beyond wildlife protection standards and protects wildlife and canals on the property.		• Labor: encouraged their workers to join the union. • Hire only legal full-time employees—no migrant labor.	• Chooses to offer pet food-only product.		• Not sustainable, but foresee future water regulations and so are pumping water to establish usage. • Conservation easements on wildlife conservation land. • Pumping water because they knew urban communities were going to fight them for it.
	2. Consumer Interest and Demand	• Almost half the farm dedicated to organics; sees this as a growing market.	• Meeting high-end demand with premium products.	• Certified organic. • Certified carbon free. • Earth friendly. • Certified by Vegan Action. • Grown in USA. • Recyclable containers.	• Anticipates increasing interest in poultry.	• Started farming because recognized demand in local community.	

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	Dimensions	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
	3. Environmental	• Started having buyers pay up front to alleviate cost of losing crops to weather.		• Implementing soil conservation practices. • Traded land with Everglades Forever to create a buffer. • Measure amount of phosphorus going in and out. • Extract their own energy.			• Cleaning water that leaves the farm.
Limitations and Resources	1. Human	• Has a loyal workforce and ensures they are happy.	• Loyal, long-term employees who intimately understood the business. • Local community and other businesses.	• Turned a labor problem into an advantage: full-time skilled labor force and better reputation.	• Limitation: single owner → hired friend to help.	• Volunteer labor force (CSA members subsidizing their shares).	• Limitation: not good at finishing cows → focuses on breeding and ships elsewhere for finishing
	2. Environmental		• Small amount of land → maximized output in small space.	• Everglades. • Use waste on farm to generate profit.	• Limited space.		• Competition for water from population.
	3. Fiscal	• Only sells to reliable buyers.	• Uses credit.	• Counties pay them to take lawn waste • Sell energy to local communities.	• Operates on tight budget → purchases used equipment to leverage money.	• Not relying on the farm for primary source of income. • Permanent farm stand on property.	• Support from larger network.
Relationships	1. Service to the Community		• Open the farm to guests for farm-to-fork dinners; proceeds go to local charities. • Donates unsold or short-dated products to community groups and food banks.		• Works with Extension to offer education programs. • Active in policy to improve small farm poultry farmers.	• Open access for community members.	• Donates food to community. • Open facility to community groups and camps to use.

	Dimensions	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
	2. Being a Good Neighbor		• Very tied into community networks and takes care of the community in any way she can.		• Traded equipment and supplies with other community members.		• Used tractors to clear roads after hurricane.
Human Resources	1. Empowerment		• Openly valued and respected employees. • Encouraged employees to experiment and do things that interest them.	• Workers are part of a union.			
	2. Incentive Programs			• Advancement opportunities.			• Professional development. • Advancement opportunities.
	3. Life Satisfaction	• Livable wages and benefits. • Transportation to and from farm. • Atypical model: direct-hires his own field labor. • Restrooms in field.	• Ended volunteer program because employees weren't happy supervising volunteers and wanted to spend their time on the farm doing things they enjoy. • Livable wages and benefits. • Given food from farm.	• Livable wages and benefits.		• Livable wages.	• Livable wages and benefits with retirement accounts and profit sharing.
Quality	Quality	• Proud of premium price. • Superior eggplants. • Beating out competition (Mexico) in terms of product and safety. • Organic.	• Proud of premium price. • Sells at high-end restaurants. • Sells unique products: edible flowers, dehydrated products.	• Proud of premium price. • Offer a patented product that no one else is able to replicate. • Rice is unique.	• Proud of premium price. • Sells at high-end restaurants and country clubs.	• Proud of premium price.	• Strong breeding program producing more cattle than many other Florida ranches and with better cuts of meet.

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	Dimensions	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Management	1. Distribution of Responsibility	• Limited distribution of responsibility to family.	• Individual employees managed different units of the farm.	• Management divided into units.	• Individual employees managed certain aspects of the farm.	• Volunteers and paid employees had separate responsibilities.	• Divided farm into smaller units managed by independent teams.
	2. Diversity		• Employees pursue things on the farm that they were good at.	• Hire the most skilled people to manage. • Hire experts to accomplish their goals.			• Subcontract for things they aren't good at.
	3. Integration						• Standard operating procedures for the entire farm. • Monthly management meeting evaluating general procedures and processes and looked for ways to share resources across units.
A Farm Is a Business	1. Reinvestment	• Used capital to stabilize the business and be less vulnerable to brokers in the future.	• Reinvested profits into business to expand product offerings.	• Investing in research to improve practices and products.	• Purchased incubator to get a better hatch rate. • Feeders. • Shed. • Chick house.	• Built digesters/ vermicomposting • Hoop houses	
	2. Social Goals		• Donated to local organizations.	• Provides support to local organizations addressing education, and literacy.			

	Dimensions	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
	3. Environmental Goals			• Provides support to local organizations addressing wildlife and environment.			• Preserve the land forever. • Using profits to clean water as it leaves the farm. • Using profits to maintain a wildlife conservation area.
Planning	1. Risk and Investment	• Alleviated risk by only selling to brokers with a good track record,	• Took out a line of credit to purchase new equipment that would allow her to diversify the operation.				• Don't take on risk.
	2. Visioning	• 10 years.		• Plan for long term sustainability of the business and the environment.	• 5-10 year plan.		• Planning for eternal use of the land.
Passion	1. Love of the Job		• Sacrifices many other aspects of life to farm.	• Built farm from almost nothing to a very big firm. • Employees are passionate.	• Farming is a life goal, not just a business goal.	• Farming is the core of the life experience.	• Farming is a value and a vision of what human life means.
	2. Practicality	• Almost went broke due to untrustworthy buyers.	• Knows farm must make a profit to keep going.	• Invests heavily to grow the business.	• But makes sure the costs do not drive the farm under.		• The farm has to perform.

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Beyond Extension: Strengthening the Federally Recognized Tribal Extension Program (FRTEP)

Joseph P. Brewer II [a] * and Paul V. Stock [b]
University of Kansas

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Abstract

Most agricultural activities on Indian lands have been under the control of non-Indian managers since the reservation era began in the 1800s. Despite federal trust obligations dating back to the late 1700s, there has been little involvement by U.S. Cooperative Extension. Federally funded programs created to enhance tribal farming and ranching operations continue to be marginalized and severely underfunded. The Federally Recognized Tribal Extension Program (FRTEP) is tasked with supporting American Indians through scientific, economic, agricultural, and traditional information to solve local problems. FRTEP serves 19 reservation communities with an annual fluctuating budget of approximately US$3 million, which is nationally competitive. Recent litigation offers an opportunity for FRTEP to grow, serve as a catalyst for change, and energize economic stimulation. FRTEP also offers a potential model for community-based agricultural and food programs nationwide.

Keywords

American Indian, Cooperative Extension, *Keepseagle v. Venneman, Cobell v. Salazar, Pigford v. Glickman*

Introduction

The development of community-based agriculture and food systems can mitigate the effects of human-caused climate change and build both community and ecological resilience (van der Ploeg, 2009). Minority racial and ethnic groups, however, have been systematically and historically denied the right and ability to maintain or develop autonomous agriculture initiatives and food systems (Alkon & Agyeman, 2011). Like other

[a] * *Corresponding author:* Joseph P. Brewer II, Assistant Professor, Environmental Studies, University of Kansas; 252 Snow Hall; Lawrence, Kansas 66045 USA: +1-785-864-8992; joseph.brewer@ku.edu

[b] Paul V. Stock, Assistant Professor, Sociology & Environmental Studies, University of Kansas; 739 Fraser Hall; Lawrence, Kansas 66045 USA; +1-785-864-1468; paul.stock@ku.edu

marginalized farming groups, such as African-American farmers, Indian reservation–based farmers have suffered systematic and structural lack of federal support and infrastructure development. This is despite their offering diversified and sustainable methods, such as place-specific crops more attuned to bioregional aspects like water availability and soil type, and to traditional foodways, like buffalo harvests and gardening. In comparison, the food justice and food sovereignty movements establish food and community-level agricultural practices as keystone ideas for building a more just society (Wittman, Desmarais, & Wiebe, 2010). In spite of these positive developments, a full understanding of historical and structural inequality for Native Americans remains underdeveloped. Further, the situation is made more complex by the number of tribes, the colonial history of displacement, and unequal treaty relationships, all in concert with shifting land tenure status (Brewer, Hiller, Burke, & Teegerstrom, 2016).

Initial and ongoing political relationships between American Indian tribes ("Indian Country") rely on a system of treaties to allocate monetary, land, and support resources. As is common with colonized peoples in other parts of the world, Indian Country has not received all that it has been promised. Specifically, Indian agriculture is underfunded and historically neglected, and yet crucial to the maintenance and development of community-based agricultural and food systems in Indian Country (Vernon, 2015). Indian Country, while generally land wealthy, is monetarily impoverished. Thus, in terms of agricultural development, Indian Extension has the ability to partially unlock the potential of land wealth to provide livelihoods, work, financial support, and economic development. Many tribal communities currently have to struggle to balance identity and economy in nation-building.

In this paper we offer the Federally Recognized Tribal Extension Program (FRTEP) as a prime example of a marginalized federal program that provides a mutually beneficial relationship between the U.S. government and tribes. Cooperative Extension[1] often experiences budget shortfalls; Indian Country Extension is similarly underfunded and lacks political influence. Our paper is a policy analysis that explores the historic and contemporary relationship of Indian Country Extension and the federal government in a time of unprecedented land-related lawsuits. We conclude that the ingredients for equity for Indian Country farmers and collaboration between Indian and U.S. Cooperative Extension do exist. Our work builds on Hurt's (1987) call for more work on Indian agricultural extension, but is also supportive of continuing to pressure Congress to strengthen Cooperative Extension.

We develop in this paper a more thorough history of tribal agriculture as it relates to U.S. Extension, federal treaty and trust relationships, and ongoing lawsuits with an eye toward considering the potential effects of the lawsuits, all of which cite mismanagement of Indian trusts and reiterate the tenuous relationship between sovereign tribes and the U.S. government. Specifically, we discuss the FRTEP, which aims to assist tribes, individual farmers, and ranchers within reservation boundaries in developing agricultural potential. A brief comparative study between FRTEP and conventional county-based Cooperative Extension measures equity and Indian Country access to agriculture-based educational resources. The comparison reveals patterns of historic mismanagement by federal agencies responsible for upholding the trust obligation between tribes and the federal government (U.S. Department of the Interior [U.S. DOI], 2013).

Who's an Indian, What's a Tribe?

In striving to clarify the uniqueness of the American Indian *agricultural* experience, one must understand the unique *political* status American Indian tribes occupy. As the only ethnic groups within U.S. borders that negotiated treaties with the U.S. between 1700 and 1871, the American Indian legal context differs from those of other ethnic and racial groups. Indians enjoy "domestic

[1] Whenever "Extension" is used in this paper, it is referring to Cooperative Extension, Extension Programs, or Indian Country Extension. Thus Extension will always be capitalized throughout this paper, for consistency and clarity.

dependent nation" status, or what scholars refer to as "quasi-sovereign" status as determined by the decision *Cherokee Nation v. Georgia* (1831).[2] American Indians thus enjoy dual citizenship, of both the U.S. and their tribe, which is both a legal status and the product of a specific political relationship, and not a status born of a racial history, according to *Morton v. Mancari* (1974).[3] The relationship between tribes and the United States is based on a long and complex legal history including contracts, treaties, and executive orders, as well as numerous acts, laws, and policies. Significantly, the Supreme Court has stated in *United States v. Winans* (1905)[4]: "the treaty was not a grant of rights to the Indians, but a grant of rights from them—a reservation of those not granted" (Getches, Wilkinson, & Williams, 2005, p. 138). In other words, if the reserved rights in treaties have not clearly been taken away by the U.S., then they remain intact. These are rights allowing mobility through geographies outside reservation lands in order to practice traditional and customary lifestyles. Further, the inherent rights of tribes are those that existed *pre-contact*. Treaties demonstrate a full recognition that the U.S. intended to uphold its side of the negotiation. To illustrate the importance of these relationships to community-based food production, we offer the example of agricultural extension.

Emergence of Cooperative Extension

Origins of Extension

The roots of Extension reach back to the founding of the nation (True, 1928) and predate nearly every documented government or nongovernmental organization in the Americas. In the pursuit of building a great country, Extension aimed to enable farmers with the best agricultural techniques and knowledge. Two pieces of legislation, the Morrill Act of 1862 and the Smith-Lever Act of 1914, established a land-grant program to support state agricultural colleges (later known as land-grant universities or LGUs) in combination with the Agricultural Extension Service (later known as Cooperative Extension). This formalized Extension as the educational arm of the U.S. Department of Agriculture, housed at state LGUs and traditionally funded by a combination of federal, county, and state governments (Gould, Steele, & Woodrum, 2014). Since World War II, Extension has moved away from a local self-sufficiency model to one supporting commodity production in parallel with wider changes in global food production (Benson & Jafry, 2013).

Tribal Extension, A Brief History

The historical relationship between the federal government and tribal Extension efforts deviates from traditional Cooperative Extension. Since the 1790s, treaties with and policies directed toward American Indians—specifically, the Second Intercourse Act (1793)—obligated the United States to "provide Indians with agricultural implements and instruction" and agricultural agents (Hurt, 1987, p. 97). Generally, tribes sacrificed something, such as freedom of movement and a stable land base, in exchange for services, such as education, provided by the federal government in perpetuity (Deloria, 1977; Deloria & Lytle, 1984; Prucha, 1997; Williams, R. A., 1997). Deloria (1977) states that Indians tended to perceive treaties as sacred documents, as more religious text than legal agreement: "Thus Indians stubbornly anticipate *affirmative* [emphasis added] action by the United States in resolving their difficulties" (p. 5), and thus aim to avoid legal recourse to force treaty obligations.[5]

[2] *Cherokee Nation v. Georgia*, 30 U.S. 1 (1831), ruled that tribal sovereignty is inherent, and not dependent on federal law.
[3] *Morton v. Mancari*, 417 U.S. 535 (1974), ruled that the relationship tribes maintain with the federal government is not of a racial but of a historical nature.
[4] *United States v. Winans*, 198 U.S. 371 (1905), reserved treaty rights and upheld the inherent status of tribal rights.
[5] Alaskan Natives and Native Hawaiians, the only other federally recognized Indigenous peoples, have legal relationships with the U.S. government that are politically different from those of American Indian tribes. Both distinct peoples and their respective bands and communities have equally complicated land-tenure histories. The point here is that neither Alaskan Natives nor Native Hawaiians negotiated treaties with the U.S., and without treaties distinguishing their political status they remain separate in a legal context from American Indians.

While tribes saw treaties as sacred texts reserving hunting and fishing rights in the Pacific Northwest, or providing agricultural education services for tribes in the Great Plains region and beyond, the U.S. would often use the same language or template in treaties for consistency and uniformity, as discussed later. That contrast in understanding of what the texts represent (between those of sacred texts and simply legal contracts) is the foundational conflict between tribes and the U.S. government. The common language of boilerplate treaties has been useful so that courts can understand the original intentions of the negotiation in the affirmation of tribal rights (Ovsak, 1994). Despite conflicts over interpretations, it is important to note that federal Indian law and policy, as a distinct body of law, has continually recognized the significance of treaty language and federal policy created to delineate tribal land in hopes of assimilating tribal people into mainstream U.S. society (Deloria & Wilkins, 1999). For example, based on language in the Medicine Creek Treaty of 1854, *United States v. Washington* (1905) affirmed the reserved rights of tribes in the 1970s to harvest fish at all "usual and accustomed grounds," which in this case were outside of reservation boundaries. The decision was based not on an interpretation of law, but on treaty language that has specifically reserved the hunting and fishing rights of American Indian tribes (Getches et al., 2005). The Medicine Creek Treaty serves as an example of how treaties clearly state the original intentions of the negotiation, and other landmark court decisions have upheld reserved fishing rights based on similar treaty language.[6]

From the perspective of U.S. policy, agricultural support served to help assimilate Indians by turning them into farmers (Hurt, 1987; Iverson, 1994). For example, the Treaty of Fort Laramie (1868) between the U.S. and various Plains tribes clearly supports these ideals: "with the assistance of the *agent* [emphasis added] then in charge, a tract of land within said reservation" and "so long as he or they may continue to *cultivate* [emphasis added] it"[7] (Kappler, 1904/n.d., Article 6). The Navajo Treaty of 1868 included similar language. These examples are representative of separate treaties with the common language of "agent" and "cultivate" intended to utilize agriculture for assimilation (Hurt, 1987). The "agent," as a resident of the reservation and employee of the federal government, supervised and documented that assimilation was taking place and was to assist (as indicated in the quotation) in the assimilation process through the "cultivation" of crops, not as a preservation and encouragement of traditional practices of farming, but instead centered on European agronomy practices. For tribal peoples, the transition from indigenous farming societies to a European-style farming society would have been impossible without constant pressure as well as indoctrination into European farming styles (Hurt, 1987).

In summary, agricultural support in the form of Extension in Indian Country is a result of a sovereign-to-sovereign relationship. Just as other treaties (and court decisions rendered from treaty language) use treaty language to support hunting and fishing rights, agricultural support via Extension or an agent provides agricultural support. Therefore, agricultural support in the form of an agent, that is, Extension, can be viewed as a reserved right by tribes for the benefit of tribal communities. In sum, there was "support" in terms of agents and access to capital and crop seeds when there was a push to assimilate, but now that the assimilation projects have been largely abandoned that same support has dried up, despite treaty obligations remaining intact.

Reemergence

Extension service in Indian Country has never been fully funded, and therefore is severely limited (Select Hearing, 1989). A severe drought during the 1980s in the Northern Plains states reignited the

[6] Other cases that speak directly to the point at hand can be found in Getches, Wilkinson, and Williams (2005), chapter 12.

[7] The term "agent" recurs in treaties as an authoritative figure and consultant in tribal agricultural endeavors. Agent refers to the "Indian agent" (later, "superintendent"). Early Indian agents hired "boss farmers" to manage tribal agricultural operations, and later evolved into the present-day extension agent or educator under FRTEP (Brewer, Hiller, Burke, & Teegerstrom, 2016; Hiller, 2005; Rooks, 1910).

debate—mostly among tribes—about expanding Extension services to Indian Country. A report followed in 1986 with specific recommendations for Extension in Indian Country, although targeted only to the drought-afflicted states (Racine, 1995). To address agricultural issues in Indian Country, the Indian Agriculture Working Group (IAWG), established after the 1986 report, made 32 recommendations based on a national inquiry of tribes gathered from numerous states during 14 meetings throughout the U.S. (Racine 1995). One prominent recommendation was the re-envisioning of Indian Country Cooperative Extension programs (IAWG, 1987). The report summarized nearly 70 years of Cooperative Extension program efforts by noting, "the solutions they [past committees] have recommended have not been implemented" (IAWG, 1987 p. 1). A 1989 congressional hearing provided a national platform for Indian agriculture to redress the issues at hand (Select Hearing, 1989), which in turn prompted the re-creation of Extension in Indian Country, initiated in the 1990 farm bill. What started as the Extension Indian Reservation Program (EIRP) is now formally the Federally Recognized Tribal Extension Program (FRTEP).[8]

The Federally Recognized Tribal Extension Program (FRTEP)

The Intertribal Agriculture Council (IAC) and other agriculture-based organizations, including the U.S. Department of Agriculture (USDA), were charged with designing a Cooperative Extension program for reservation tribes following the 1989 hearing. FRTEP was initially designed to support approximately 90 agents across as many reservations on a US$10 million budget. Priority was given to large reservations (of at least 120,000 acres or 49,000 hectares) with significant agricultural needs and opportunities (Racine, 1995). Ultimately, 12 offices were established in the first year of the program and were supported by a budget of US$1 million (R. Racine, executive director of IAC, personal communication, September 14, 2015). Instead of working with county governments, as regular Cooperative Extension does, FRTEP aligns with tribal governments (Hiller, 2005; Tuttle, Moore, & Benally, 2008). Where conventional county-based Cooperative Extension primarily works with established farming and ranching communities, FRTEP generally works with under-established farming and ranching programs and economically poor communities. FRTEP agents directly address the issues of tribal agriculture and natural resources management by implementing research-based practices in conjunction with culturally sensitive approaches (Racine, 1995).

Throughout Indian Country, FRTEP Extension agents have played a pivotal role in the development of tribal agriculture and natural resources management. In essence, the FRTEP agent has to understand tribal, county, state, and federal programs and their governance structures (J. Hiller, former head of the American Indian Studies program at the University of Arizona, personal communication, September 10, 2014). For example, agents are tasked with understanding how tribal governments function, such as how they pass resolutions, and must work with tribal offices to share resources and networks for programs like gardening. FRTEP agents therefore must be versatile and understand what it takes to successfully manage and operate a relevant tribal agriculture and natural resources department (Brewer, 2008; Moore, Beally, & Tuttle, 2008).

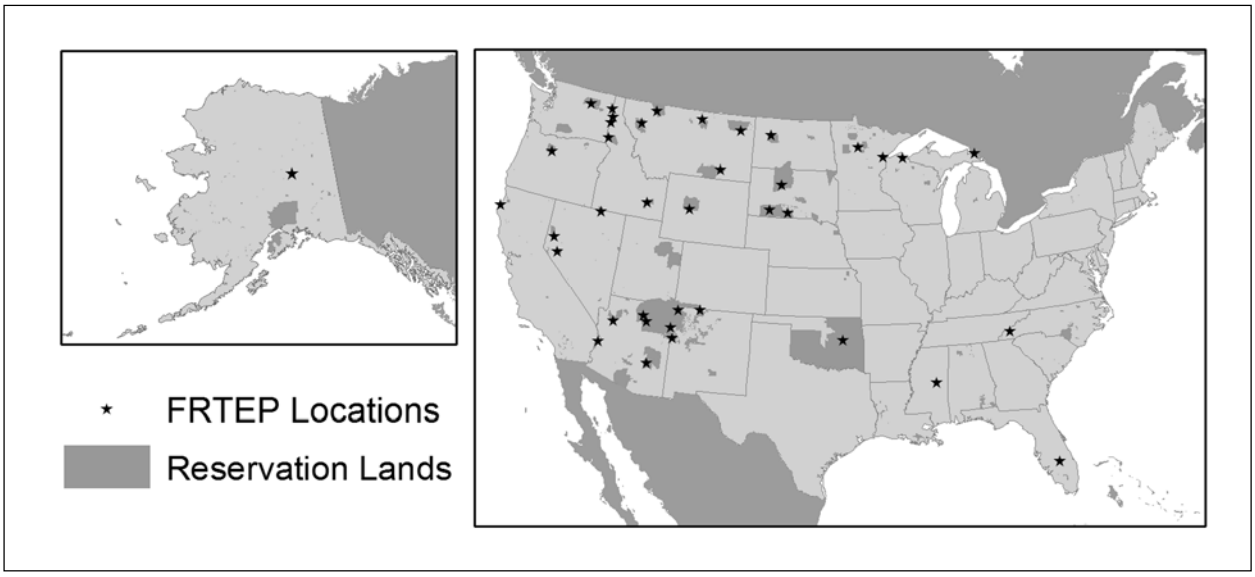
In Reality

As of 2015 there are 36 FRTEP offices located in 19 states (USDA, National Institute of Food and Agriculture [USDA NIFA], 2012) (see Figure 1), which operate under agreements between LGUs and the respective tribe(s). Virtually all funding for these operations is federal and is routed to LGUs via USDA NIFA. The conventional county-based Extension model depends on a blend of county, state, and federal funding. There is virtually no county or state funding available to support FRTEP operations, however. Any supplemental support from tribes is usually provided as in-kind contributions in the form of office space and telephones (USDA NIFA, n.d.).

There are significant political and jurisdictional issues involving funding and access to resources

[8] See http://indiancountryextension.org/

Figure 1. FRTEP Offices in the United States



Information was obtained via the Indian Extension website (Brewer et al., 2016). Map created by Joshua Meisel and modified for this paper.

that continue to be a challenge to Cooperative Extension work in Indian Country. Where a county may have over 100 years of history and experience with traditional Cooperative Extension, most tribes have none (Hiller, 2005). Funding for individual FRTEP offices is grant-driven and nationally competitive, in sharp contrast to the guaranteed-funding rubric for county Extension offices (Hiller, 2005).[9]

Funding fluctuations have a direct effect on the staffing and programming of Extension offices. During 1980 to 2010 the federal budget for Cooperative Extension supported an average of 15,145 full-time-equivalent employees (FTEs) (Wang, 2014). By comparison, in the mid-2000s NIFA agreed to a US$3 million FRTEP budget that supported 36 FTEs (Brewer et al., 2016). Those 36 FTEs deliver programs to 27 reservations, or 8.6 percent of 314 U.S. reservations, with a population of about 1.56 million, out of nearly 5.2 million American Indians (Norris, Vines, & Hoeffel, 2012; Williams, T., 2013).

We shall expand this policy analysis by exploring in more detail the situation in Arizona, as it best illustrates both the potential inherent in FRTEP and also the historical and institutional marginalization embedded in Indian Country–Extension relationships.

FRTEP in Arizona

While FRTEP has a national scope, the forefront of FRTEP is in the arid southwest. Arizona is one of the largest states to encompass a variety of American Indian reservations, delivering FRTEP programs to about 31 percent of tribes in the state. Reservations make up nearly a third of the total land in Arizona (21.6 million of 72.9 million acres, or 8.7 million of 29.5 million ha) (Tiller 2005), with substantial natural resources and farming and ranching within tribe-controlled reservation boundaries.

With seven full-time FRTEP agents on five reservations, Arizona is the largest operation in the U.S. (Montana is the second largest and South

[9] There is a dearth of literature and information on FRTEP and Extension beginnings in Indian Country. Individual agents and specific FRTEP programs write about programming as well as other scholarly concerns, but few sources have gathered information about the history of the program and its current standing. Writing this article was challenging, as contemporary Indian agriculture—what would seem like a large and well documented topic—is in fact not so, and neither are Extension programs for tribal communities.

Dakota third largest) (USDA NIFA, n.d.). Arizona is also the largest tribally occupied land base to acquire this level of federal support; during fiscal year 2013–2014 the total annual budget for Arizona FRTEP was US$541,800 (T. Teegerstrom, director of Arizona FRTEP programs, personal communication, December 28, 2015).[10] By comparison, the Arizona Cooperative Extension program received federal support for 75 FTEs throughout 15 counties for the 2013–2014 fiscal year (Arizona Cooperative Extension, 2014).

Once the national FRTEP budget is roughly determined by NIFA, agents write grant proposals that compete on a national level for the limited funding available. This creates an environment in which FRTEP programs at the state and/or national level, and agents themselves, cannot anticipate their funding from year to year, which limits agents' ability to provide adequate programming for the diverse range of tribes and projects. As a result, Extension agents are severely limited in their activities. Most of the programs they are able to deliver successfully are well-established and proven, such as Future Farmers of America (FFA), rodeo, gardening, and 4-H, programs with a history, community interest, and that work within the resources available.

Tribes steward 55,700,000 acres (22,541,000 ha) of land in the U.S. (Tiller, 2005), of which FRTEP serves only a fraction despite a long history of treaty obligations. There remains a huge potential for sustainable agriculture and natural resources development in Indian Country that a more appropriately funded FRTEP program could help address.

Legal Challenges to Inequity

Beginning in the 1990s, women, African American, Hispanic, and Indian farmers brought suit against the federal government seeking redress for the structural and consistent exclusion from federal agricultural programs and dollars based on sex, race, and ethnicity (Daniel, 2015). What follows is a thematic (rather than chronological) discussion of the key cases related to addressing structural discrimination in allocating federal agricultural resources, concluding with the cases related to Indian agriculture.

Agricultural Discrimination Litigation

Pigford v. Glickman (1999), a class-action lawsuit involving African American farmers and the USDA that was filed in 1998, is the largest civil rights settlement in U.S. history. The suit argued that between 1981 and 1996, African American farmers were denied or not given the opportunity to access loans to support their farming operations. It is estimated that as a consequence there was a substantial decrease in black farmers during this era (Brewer, G. A., 2003; Reynolds, 2003). Representing nearly 25,000 African American farmers, *Pigford* was settled in 1999 for over US$1 billion, to be distributed to individual farmers denied or unfairly treated by USDA loan services. A related suit (*In re Black Farmers Discrimination Litigation,* 2011) expanded the affected population to 60,000 individual farmers (Carpenter, 2012). In what became known as *Pigford II,* this US$1.2 billion dollar settlement not only exposed the discriminatory practices of USDA toward African American farmers, but also set a precedent in civil rights law that further established the significance of and need for policies that assist minority agriculture (Feder & Cowan, 2013).

Similar lawsuits filed by Hispanic farmers in 1997 (*Garcia v. Vilsack*) and women farmers in 2000 (*Love v. Vilsack*) were denied class status. These lawsuits claimed systematic and discriminatory loan practices toward Hispanic and female farmers in the 1980s and 1990s. Despite lacking class status, claimants under both *Garcia* and *Love* could lay claim to a US$1.33 billion fund established in 2010 as part of a USDA settlement intended to remedy claims of structural discrimination.

[10] Inadequate federal accounting of Indian agricultural statistics, despite treaty obligations, and unwillingness by some tribes to share this information make systematic analysis difficult, particularly at smaller scales. It is unknown to what extent the inaccuracy of statistics representing Indian farming and ranching operations has put Indians at a disadvantage, as has been recognized by the courts (*Keepseagle v. Venneman*, 2000).

Indian Legal Challenges

In many ways, Indian challenges began this era of activism for agricultural justice civil rights. In 1996, Elouise Cobell, a member of the Blackfeet Tribe of Montana, filed a complaint against the Secretary of the Interior (*Cobell v. Salazar*,[11] 2009) that would become the largest monetary American Indian trust class-action settlement in history. *Cobell* sought an accurate accounting of the Individual Indian Moneys (IIM) under the Trust Fund Management Reform Act that required the defendant—the U.S. government—to provide accurate accounting of monies held in trust and managed by the federal government. Individual Indian monies funds resulting from leases, rentals, and other incomes from lands held by Indians had been remitted to the Bureau of Indian Affairs and remained in federal trust. The U.S. DOI, the suit alleged, was grossly negligent for not having accurate balances of individual Indian monies (Merjian, 2010). In 2009 the federal government consented to settle the case for US$3.4 billion: US$1.4 billion earmarked for individual Indians and US$2 billion for a Trust Consolidation Fund (Davidson, 2011). The historic quality of *Cobell* serves as a reminder that the legally binding negotiations in treaties and Indian policy still matter.

In what can be considered to some extent a companion suit, *Keepseagle v. Veneman,* was first filed in 2000 as a class-action civil rights lawsuit on behalf of Indian farmers against the USDA, claiming discriminatory loan practices. As in the cases above, to be considered in the suit the claimant must have applied for a farm loan, attempted to farm, filed a discrimination complaint, and attempted to gain access to land with the intention of farming or ranching between January 1, 1981, and November 24, 1999 (*Keepseagle v. Vilsack* Settlement, n.d.). The settlement paid US$680 million to claimants and US$80 million for debt relief. As of this writing, US$380 million has not been issued and remains unclaimed. The final settlement came in 2010 and the claimant filing period expired in December 2011. The early closing date left many Indian farmers and ranchers out of the final settlement. Many of the potential claimants live in remote regions and were therefore difficult to reach. The court is currently assessing ways to use the unclaimed funds. These cases together highlight the relevance of historic treaty relationships, as a number of Indian lands are the result of treaties and obligations particularly as they relate to land tenure, agricultural support, and education.

Toward a New Day

While these legal cases aim to challenge USDA and Cooperative Extension interpretations of who merits federal support for agriculture on a broad scale, FRTEP and the related legal challenges offer real possibilities for Indian farmers, farming, and Extension going forward. For example, the by-products of the *Cobell* litigation, *Keepseagle*'s residual funds, might be useful in helping to develop Indian Country agriculture, depending on upcoming court rulings.

As Cross (2010) states, given the success of Indian ranching operations in the mid-twentieth century, ranching was seen as a possible avenue for bringing Northern Plains Indians into "modern" civilization. But poor policy decisions, such as privileging certain farming and ranching operations and/or practices over others, by "both Indian and non-Indian" led to the downfall of these thriving ranching communities (p. 746). Cross concludes that the reestablishment of ranching (with funding from *Cobell*) may in fact lead to socioeconomic stability for the northern Great Plains tribes, while emphasizing two key points in line with this paper: first, that agriculture in Indian Country can happen, is happening on a small scale, and can create a foundation for a stable economy; and second, given recent settlements, there are opportunities to support farming and ranching programs financially at different scales with an expanded FRTEP while strengthening relationships with nonfederal organizations that are already doing similar work to administer Extension.

Simply put, treaty rights are alive and well, and the federal responsibility to this nation's food

[11] The original suit was filed against the Department of Interior when Bruce Babbitt was secretary; the case was settled while Ken Salazar was secretary.

producers, Indian and non-Indian alike, is alive and well, too. In a time of big litigation, the track record demonstrates that the only way to achieve compliance of federal trust obligations to tribes is through litigation. So, while the federal obligation to provide Cooperative Extension services in Indian Country has never been taken away from tribes, neither has it yet been adequately supported. Realistically, litigating the issue is an option nobody desires.

Although Extension-like services in Indian Country can be viewed as a two-century failed commitment, all the necessary pieces are currently on the table to move in a positive direction for Indian Country agricultural development. In this policy analysis we illustrated the systematic and historic neglect of Extension services first established by treaties, and pointed to the existing, but severely underfunded, framework that FRTEP offers. If properly funded, FRTEP can help shift the federal-tribal relationship into a productive one. FRTEP is uniquely positioned to energize and utilize agriculture as a primary driver to bolster economic stimulation in Indian Country.

In the very near future, there are opportunities to fund FRTEP programs in the manner in which they were originally conceived.[12] As we continue to refine American Indian land tenure policies, keeping an eye on the central mission to move economic development forward is paramount. This policy analysis, in part, informs the way forward by reminding us that the central issue here is the institutional neglect of Indian Country. For those who make decisions that affect American Indian land tenure status, both tribal and non-tribal, history has continually repeated itself. The literature suggests that controls (such as policies and procedures) used to make these decisions have been largely inadequate and are outdated (U.S. DOI, 2013). There are respected nongovernmental organizations that have been carrying out a commitment to American Indian farming and ranching initiatives; it is time to work with and learn from them on a national level. Investing in sustainable land-based agriculture programs such as FRTEP that provide a tangible, day-to-day service to communities will ultimately empower farmers and ranchers in a way that is unprecedented. In light of the recent *Keepseagle* court ruling, to reject the formation of a trust, from unclaimed funds, for farmers and ranchers that would grow to secure longevity only perpetuates the limitations put on Indian Country and its farmers. The day must be realized where Extension in Indian Country supports the control of agriculture-based products by and for American Indians that are bought and sold in a market where they are equals.

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With this article we would like to honor the many contributions tribal Extension educators have made and continue to make to Indian Country. Our thanks also to Joseph Hiller, Trent Teegerstrom, and Ross Racine, all of whom offered great suggestions.

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[12] A cautionary point is to be made, however; there is a difference between supporting FRTEP staff positions with recent litigated funds and supporting FRTEP programs themselves. As shown in this paper, Extension positions are a reflection of the treaty relationship, while programs are not. Therefore, supporting positions would be side-stepping treaty negotiations. As clearly indicated in template treaties, an "agent" was assigned to the reservation and assisted in agriculture (i.e., assisted in "cultivating") and therefore a federal position was assigned to these duties. The litigated funds are a result of a failure to offer federal services to tribes. Treaty rights or reserved rights are much older and separate from litigated issues; nevertheless, supporting programs would enhance FRTEP goals.

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The tipping point: Can Walmart's new animal welfare policy end factory farming?

Carrie A. Scrufari *
Vermont Law School

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Abstract
Undercover investigations revealing abuse and headlines concerning deadly viruses are increasing awareness regarding how we treat farm animals intended for human consumption. Pictures on food products depicting hens and cows peacefully roaming in the grass outside a barn belie the current reality of factory farming and the suffering animals endure under this system. This policy analysis examines how animal welfare has been regulated in this country and exposes the multitude of exemptions that exist for farm animals. The federal Animal Welfare Act, Twenty-Eight Hour Law, Federal Meat Inspection Act, Humane Methods of Slaughtering Act, and the Poultry Products Inspection Act all fail to adequately regulate the treatment, care, and travel of agricultural animals. If states attempt to take matters into their own hands, they run into a host of preemption problems. Even for the regulations that do reach agricultural animals, not a single one embraces the Five Freedoms that are recommended according to the Farm Animal Welfare Council. These recommendations include that animals be free from hunger, thirst, discomfort, pain, and distress, and that they be able to express their normal behavior. In an unprecedented move, Walmart recently announced that its suppliers will adhere to animal welfare standards embracing the Five Freedoms. However, Walmart's policy has several shortcomings, including a voluntary compliance regime and no deadline for implementation. Nevertheless Walmart's animal welfare policy is likely this country's best hope for shifting current practices away from factory farming in favor of more humane and healthy handling of agricultural animals.

Keywords
factory farming, animal welfare, Animal Welfare Act, Twenty-Eight Hour Law, Federal Meat Inspection Act, Humane Methods of Slaughtering Act, Poultry Products Inspection Act, preemption, Five Freedoms, Farm Animal Welfare Council, voluntary compliance, Commerce Clause

* Carrie A. Scrufari, Esq., LL. M. Fellow, Center for Agriculture and Food Systems, Vermont Law School; P.O. Box 499; South Royalton, Vermont 05068 USA; +1-443-610-2308; CarrieScrufari@vermontlaw.edu

"Look at the world around you. It may seem like an immovable, implacable place. It is not. With the slightest push—in just the right place—it can be tipped." (Gladwell, 2002, p. 259)

Introduction

The lives of chickens who lay the eggs we buy at large grocery stores today bear little to no resemblance to that of chickens raised on small family farms decades ago. Today, they are restrained in wire cages with less than a sheet of paper's worth of square footage, often housed with dead and decaying cage mates, and are not provided any opportunity to perch, roost, forage, spread their wings, or experience the outdoors. Baby chicks have their beaks seared off with a guillotine-like machine, without painkillers, so that they do not peck their cage mates to death as a result of their extreme stress and frustration at living in such cramped conditions. The wire caging often mangles the birds' feet, heads, and necks, thereby creating bleeding, open sores (Soloman, 2015). Over 93 percent of the 7.41 billion eggs produced every year in this country are sourced from operations using this battery cage system (Strom, 2015).

Undercover investigations have revealed other abuses to broiler chickens raised for meat. This year, Tyson Foods—a major Walmart supplier headquartered in Mississippi—and workers were charged with 33 counts of criminal cruelty to animals after the nonprofit advocacy organization Mercy For Animals released an undercover investigation showing workers punching and throwing chickens and ripping off their heads (Mercy For Animals, 2015). A similar undercover investigation this year showed workers beating pigs in the face with boards and packing them into dirty, overcrowded pens with other sick and injured pigs (Mercy For Animals, 2015). Similar activities were documented at Seaboard Foods, a Walmart pork supplier in Colorado (Mercy For Animals, 2015).

In response to these undercover investigations and consumer petitions expressing outrage, Walmart announced that its food suppliers should adhere to higher standards for animal welfare, including limiting prophylactic antibiotic use and eliminating the use of gestation crates for pigs and battery cages for egg-laying hens. Gestation crates are narrow, 2-foot wide metal crates that house sows (female pigs) while they are pregnant; the crates do not provide enough space for the sows to turn around (Humane Society of the United States [HSUS], 2014). Similarly, battery cages are small, wire cages that house laying hens for the duration of their lives; they provide each hen with 67–76 square inches (432–490 square cm) of space. The battery cage provides less space than a standard sheet of paper (94 square inches or 603 square cm) and prevents hens from spreading their wings (Friedrich, 2013). Recognizing the cruelty inherent in gestation crate and battery cage operations, Europe has banned their use since 2013. In part because Walmart's animal welfare announcement addressed these two housing practices, it received wide support from animal rights groups, and the HSUS endorsed Walmart's move. Although Walmart's announcement signals a significant turning of the tide with respect to animal welfare and a tipping point in terms of the market power that can be wielded to encourage stronger animal welfare standards, it falls short of what is necessary to implement timely, lasting, and meaningful reforms.

Walmart's plan relies on voluntary compliance from its suppliers and does not contain any hard deadlines or timelines specifying when suppliers should meet these new animal welfare standards. Walmart could receive positive press for its decision to prioritize animal welfare without actually ensuring that its suppliers are complying with the new policy. Notably, Costco made a similar announcement with respect to battery cages seven years ago, but, as a recent HSUS undercover investigation has revealed, Costco is still sourcing from suppliers who raise animals in abhorrent conditions. After weeks of bad press following the undercover investigation, Costco has again committed to source its eggs from battery cage–free operations, claiming that it "expects to sell over one billion cage free eggs" in 2016 (Shanker, 2015). However, it still remains to be seen whether Costco can follow through on any of its cage-free pledges. Animal welfare advocates should be asking the same questions of Walmart's pledge.

This policy analysis argues that although

Walmart's position on animal welfare is laudable, relegating animal welfare to the market under a voluntary compliance regime with no deadline in place is insufficient. Nevertheless, Walmart's announcement likely remains this country's best hope for improving the lives of agricultural animals. In the face of an ineffective federal regulatory regime for animal welfare, Walmart could succeed where Congress has not. State regulatory protection for farmed animals is vulnerable to several challenges, including preemption[1] and dormant Commerce Clause challenges,[2] as will be discussed. Although all states have animal cruelty laws that do not run afoul of preemption and dormant Commerce Clause doctrines, most of these laws either impliedly permit inhumane treatment of animals raised for agricultural use or expressly exempt these animals altogether. Without satisfactory federal or state protections for farmed animals, consumers and advocates have filled the gap by demanding change in the market place. Various retailers have made strides in the realm of animal welfare over the years, but Walmart is uniquely positioned to be the force that ultimately redefines commonly accepted agricultural practices. Walmart's influence on retailer, vendor, and other producer behaviors is unprecedented. However, although it has an unparalleled opportunity to shift the status quo through its policies and initiatives, Walmart will need to require more if it truly intends to promote animal welfare, sustainability, and transparency in our food supply. Animal welfare advocacy groups and consumer pressure pushed Walmart to prioritize animal welfare; now these groups are tasked with ensuring that Walmart remains accountable to its pledge.

The first section of this policy analysis provides a historical overview of how animal welfare has been regulated in the United States and addresses the gaps and loopholes in the animal welfare regulations that exist for agricultural animals. The second section discusses the preemption and Commerce Clause challenges states face when they try to take matters into their own hands to regulate animal welfare. The third section addresses the commonly accepted agricultural practices that are permitted in the agricultural industry and the lack of regulation over these practices that many animal welfare advocates consider inhumane. The final section critiques the market's solution to this lack of regulation: letting market forces drive animal welfare conditions, as evidenced by various retailers' announcements to prioritize animal welfare. This policy analysis concludes that, while flawed in fundamental respects, Walmart's recent announcement—coupled with continuing pressure from consumers and animal welfare advocates—is currently our best hope for achieving stronger animal welfare standards in this country.

A Brief History of Federal Animal Regulation in the United States

The Animal Welfare Act

Congress passed the Animal Welfare Act of 1966 (Pub. L. No. 89-544, 80 Stat. 350, codified as amended at 7 U.S.C. §§ 2131–2159 [2008]) with the intent to provide "humane care and treatment" to animals in interstate commerce (7 U.S.C. § 2131 (1) [2008]), and "to assure the humane treatment of animals during transportation in commerce" (7 U.S.C. § 2131 (2) [2008]). Additionally, Congress stated that it was "essential to regulate the transportation, purchase, sale, housing, care, handling,

[1] The preemption doctrine is used to determine whether state or federal law governs in a particular circumstance. There are three different kinds of preemption. *Express preemption* exists where a federal law expressly states that it controls and the states may not enact contrary legislation (see *Jones v. Rath Packing Co.,* 1977). *Conflict preemption* exists where it would be impossible to comply with both the federal and the state law because the state law is different; in such circumstances, the federal law trumps the state law and controls (see *Jones v. Rath,* 430 U.S. at 525–526, 1977). *Field preemption* exists when Congress is said to have occupied the field of a certain area by leaving "no room for the States to supplement it" (*Rice v. Santa Fe Elevator Corp.,* 1947).

[2] As will be discussed later, the Commerce Clause of the U.S. Constitution grants Congress the authority to regulate commerce among the states (see U.S. Const. Art. I, § 8, Cl. 3). The dormant Commerce Clause doctrine provides that state statutes intended to achieve a legitimate local public interest and that produce only incidental effects on interstate commerce will be upheld so long as any burden on interstate commerce is not excessive in relation to the local benefits the law achieves (see *Pike v. Bruce Church, Inc.,* 1970).

and treatment of animals" (7 U.S.C. § 2131 [2008]). The Animal Welfare Act defines an "animal" as "any live or dead dog, cat, monkey (nonhuman primate mammal), guinea pig, hamster, rabbit, or such other warm-blooded animal" (7 U.S.C. § 2132 (g) [2008]). The Act notably exempts, among other animals, all "farm animals, such as, but not limited to livestock or poultry, used or intended for use as food or fiber, or livestock" (7 U.S.C. § 2132 (g) [2008]). Thus farm animals such as cows, pigs, and poultry raised for human consumption are exempt from all animal welfare regulations contained within the Act.

The Twenty-Eight Hour Law

Congress passed the Twenty-Eight Hour Law of 1873, prohibiting producers from confining "animals in a vehicle or vessel for more than 28 consecutive hours without unloading the animals for feeding, water, and rest" (49 U.S.C. § 80502 (a) (1) [1994]). Historically, the law applied only to "rail carrier[s]" or other "common carrier[s]" that were "transporting animals" (49 U.S.C. § 80502 (a) (1) [1994]). The law specifically exempts animals transported by air or water (49 U.S.C. § 80502 (a) (1) [1994]). Over the last century, as animals have been increasingly transported by truck rather than rail, the law has essentially provided no protection to animals. Indeed, the law has not been enforced in more than 40 years (HSUS, 2005; HSUS, Farm Sanctuary, Compassion Over Killing, & Animals' Angels, 2005). This lack of enforcement led the HSUS and other animal welfare organizations to petition the United States Department of Agriculture (USDA), requesting that it engage in rule-making to promulgate regulations applying the term "common carrier" to trucks (Brandt, 2005). In 2006, the USDA agreed that the plain meaning of the term "common carrier" included transport by truck. Nevertheless, the rule still exempts poultry.

In addition, the USDA claims it is not responsible for enforcing the rule, stating that enforcement is the responsibility of the Department of Justice. Moreover, the Animal and Plant Health Inspection Service (APHIS), which provides the rules and regulations for the Twenty-Eight Hour Law, does not require any sort of reporting or record-keeping on the part of truck drivers or producers to ensure compliance (9 C.F.R. §§ 89.1–89.5). Equally troubling is that the law provides fines for violators in the amount of only US$100 to US$500 per truckload; thus there is a financial incentive to disregard the law and risk a minimal fine rather than comply.[3] No criminal penalties are provided. For all intents and purposes, this rule provides scant protection to farm animals who travel up to—and often in excess of—28 hours without food, water, or rest.

The Federal Meat Inspection Act and the Humane Methods of Slaughtering Act

The Federal Meat Inspection Act (FMIA) of 1906 regulates the production of meat and meat products from cattle, sheep, pigs, goats, and horses (21 USC § 601-695). Courts have interpreted how FMIA appears to govern which animals may be slaughtered, the conditions of the slaughterhouse, and how Food Safety Inspection Service (FSIS) inspectors must staff the slaughterhouses in a variety of scenarios.[4] This Act further regulates how meat products should be labeled, packaged,

[3] See 49 U.S.C. § 80502 (d). The Code of Federal Regulations provides that animals in holding pens shall have access to water and that all animals be given access to food if held longer than 24 hours (9 CFR § 313.2 (e)). When the USDA implemented its Food Safety and Inspection Service (FSIS) directive of August 15, 2011, regarding humane handling and slaughter of livestock, it provided that inspection program personnel (IPP) are required to ask establishment management whether the truck driver stopped to provide the animals with food, water, and rest if the animals appear exhausted or dehydrated (USDA FSIS, 2011). If the establishment or truck driver refuses to provide the queried information and the IPP believe the animals' condition resulted from the deprivation of food, water, or rest, then IPP is required to contact the Animal and Plant Health Inspection Service (APHIS) so that APHIS can conduct an investigation (USDA FSIS, 2011).

[4] Compare *National Meat Ass'n v. Harris*, 132 S.Ct. 965, 973-974 (2012) (holding that California's proposed ban on the treatment, sale, and slaughter of nonambulatory animals was preempted by the FMIA, reasoning that the FMIA's scope includes which "animals that are going to be turned into meat" and which animals within the slaughterhouse "will never suffer that fate," but also reasoning that state bans on the butchering of horses for human consumption were not preempted

and transported. The FMIA was enacted in response to the public uproar Upton Sinclair (1906) created upon publishing *The Jungle,* exposing the unsanitary and unsafe conditions in the United States' meat-packing industry. The Act is not, and was not, intended as an animal welfare statute. Rather, its intent is to protect the public interest by safeguarding "the health and welfare of consumers…by assuring that meat and meat food products distributed to them are wholesome, not adulterated, and properly marked, labeled, and packaged" (Congressional Statement, 21 U.S.C. § 602).

Nevertheless, in 1978, the FMIA incorporated the Humane Methods of Slaughter Act (HMSA), which was originally enacted in 1958 (7 USC §§ 1901–07). In order to comply with the FMIA, slaughterhouses were required to adhere to the HMSA. Citizens concerned with the welfare of livestock animals promoted the HMSA, which was intended to both protect slaughterhouse workers and safeguard the health and safety of the animals intended for slaughter (7 U.S.C. § 1901). To that end, the HMSA provides "it is therefore declared to be the policy of the United States that the slaughtering of livestock and the handling of livestock in connection with slaughter shall be carried out only by humane methods" (7 U.S.C. § 1901).

Two humane methods of slaughter are provided in the Act. The first requires that "cattle, calves, horses, mules, sheep, swine, and other livestock...[be] rendered insensible to pain by a single blow...that is rapid and effective, before being shackled...or cut" (7 U.S.C. § 1902 (a)). The second method involves slaughtering performed in accordance with the Jewish faith or another religious faith where the animal is rendered unconscious "by the simultaneous and instantaneous severance of the carotid arteries with a sharp instrument" (7 U.S.C. § 1902 (b)). Poultry are exempt (7 U.S.C. § 1902 (a)).

The Poultry Products Inspection Act

Similar to the FMIA, the Poultry Products Inspection Act (PPIA) of 1957 was not intended to regulate or promote the humane handling and welfare of poultry. Rather, the purpose of the PPIA is to protect "the health and welfare of consumers...by assuring that poultry products distributed to them are wholesome, not adulterated, and properly marked, labeled, and packaged" (21 U.S.C. § 451). The focus of the Act is on preventing "the burdening of [interstate] commerce by…poultry products which are adulterated or misbranded" (21 U.S.C. § 452). Accordingly, the PPIA regulates the slaughter of chicken, ducks, geese, and turkey in interstate commerce with the above goals in mind. There are no specific provisions dictating the humane raising and slaughtering of these birds. A 2005 Notice to Poultry Processing by the FSIS declared, "there is no specific federal humane handling and slaughter statute for poultry" (Treatment of Live Poultry, 2005). The Notice merely provided that adherence to the PPIA "promotes humane slaughter" (USDA FSIS, 2005). It is difficult to understand FSIS's position when the PPIA itself contains no provisions explaining what constitutes the humane handling and slaughter of poultry.[5] Thus, there is not a single federal

because the latter ban "works at a remove from the sites and activities that the FMIA most directly governs), with *Association des Eleveurs de Canards et D'Oies du Quebec v. Harris,* 79 F. Supp. 3d 1136, 1147 (C.D. Cal. 2015) (relying on the Court's reasoning in *National Meat Ass'n v. Harris* to conclude that California's proposed ban on foie gras was preempted by the Poultry Products Inspection Act).

[5] FSIS issued a proposed rule titled "Modernization of Poultry Slaughter Inspection" on January 27, 2012 (see 77 FR 4408), which would have allowed slaughter facilities to increase their chicken line speeds to 175 birds per minute. Opposition from animal welfare groups such as Animal Welfare Institute (2010) and Farm Sanctuary were successful in preventing this change, due to several comments explaining that increasing the line speeds creates more pressure on workers to shackle the birds faster, thereby increasing the likelihood of rough handling of the birds that could result in bruises and fractures. Decreasing the amount of time birds have to settle after being shackled and allowing less time in the water-bath stunner can result in large numbers of birds not being stunned fully or properly. If birds are not fully or properly stunned, they will miss the throat-cutting machine, which means they enter the scalding tank while still alive (Animal Welfare Institute & Farm Sanctuary, 2012). Due to consumer pressure and advocacy efforts, the final rule states that, with few exceptions, the line speed maximum is 140 birds per minute (USDA FSIS, 2014). Nevertheless, injury and inhuman handling still occurs at line speeds of 140 birds per minute.

law regulating the humane treatment and care of animals raised for food in this country. The law intended to regulate the transport of animals raised for food is largely unenforced, while the laws intended to regulate the humane slaughter of animals are aimed more toward public health than ensuring the safety of billions of animals in the final moments of their lives (USDA, National Agricultural Statistics Service [USDA NASS], 2014).[6]

Challenges to Regulating Animal Welfare at the State Level

Exemption and Preemption Problems

Our federal statutes do a poor job of protecting animal welfare in this country. Many statutes exempt agricultural animals altogether or at least certain types of agricultural animals. The Animal Welfare Act—arguably the broadest and most sweeping of the federal animal welfare statutes—specifically exempts agricultural animals (7 U.S.C. § 2132 (g) [2008]). The Twenty-Eight Hour Law still exempts poultry. Given these shortcomings, it makes sense that states would try to fill in the gaps with legislation of their own.

However, a key problem states face if they try to pass welfare laws for animals raised for human consumption is the preemption clauses contained in federal statutes. For example, the FMIA contains an express preemption clause that prohibits states from enacting laws in addition to or different than the standards contained in the FMIA. Specifically, the FMIA provides that "requirements within the scope of this chapter with respect to premises, facilities and operations of any establishment… which are in addition to, or different than those made under this chapter may not be imposed by any State" (21 USC § 678). The FMIA further preempts states from enacting any laws concerning "marking, labeling, packaging, or ingredient requirements in addition to, or different than" those contained in the FMIA (21 USC § 678).[7]

This preemption clause posed an insurmountable hurdle for California when it passed a law that, among other things, barred slaughterhouses from processing, butchering, or selling meat or products from nonambulatory animals for human consumption (Cal. Penal Code § 599f (a–c) [2010]). The Supreme Court held in *National Meat Association v. Harris* that the FMIA preempted the California law insofar as the FMIA allows for the butchering of nonambulatory animals and the California law does not. While the California law requires the immediate humane euthanasia of a nonambulatory animal, the FMIA allows for an FSIS inspector to inspect the nonambulatory animal and approve it for slaughter in the absence of disease or injury (9 CFR § 309.1). Because the California law imposed different requirements on slaughterhouse premises, facilities, and operations with respect to the handling of nonambulatory livestock, the Court held that the FMIA "therefore precludes California's effort in § 599f (b) and (c) to impose new rules, beyond any the FSIS has chosen to adopt, on what a slaughterhouse must do with a [livestock animal] that becomes nonambulatory during the production process" (*National Meat v. Harris*, 132 S. Ct. 965, 971 [2012]). Thus the FMIA imposes a ceiling, not a floor, concerning the welfare of livestock animals intended for slaughter; individual states may not impose animal welfare standards in excess of those contained in the federal law with regard to the geographical scope of the "premises, facilities

[6] Red meat production in the U.S. totaled 49.3 billion pounds (22.3 billion kg), including beef production of 25.8 billion pounds (11.7 billion kg), hog slaughter of 112.1 million head, and sheep slaughter of 2.32 million head (USDA NASSS, 2014a). In 2013, 8.52 billion broiler hens were slaughtered to produce 50.6 billion pounds (22.9 billion kg) of meat; turkey production totaled 7.28 billion pounds (3.3 billion kg); and egg production totaled 95.2 billion eggs (USDA NASS, 2014b).

[7] When Congress passed the Wholesome Meat Act of 1967, it required that all meat sold across state borders be slaughtered, inspected, and processed in a federal facility (see 21 USCA §§ 601, 602, 624, 641–645, 661, 671–680, 691). The intent was to ensure that all meat in the country was subjected to federal "high standards of inspection" to assure the American public that the meat was wholesome and safe; see Lyndon B. Johnson's 1967 address to Congress, "To Protect the American Consumer" (Peters & Woolley, n.d.). The law favored federal standards of slaughter over state standards and eventually created a hurdle for states that later tried to create their own gold standards of slaughter and treatment of farm animals.

and operations" that FSIS inspects.[8]

Similarly, the PPIA also contains an express preemption clause, stating that "requirements within the scope of this chapter with respect to premises, facilities and operations of any official establishment which are in addition to, or different than those made under this chapter may not be imposed by any State" (21 U.S.C. § 467e). Further, the PPIA provides that "marking, labeling, packaging, or ingredient requirements (or storage or handling requirements found by the Secretary to unduly interfere with the free flow of poultry products in commerce) in addition to, or different than, those made under this chapter may not be imposed by any State" (21 U.S.C. § 467e). Thus, the PPIA is likely to preempt any state's attempts to legislate the conditions and treatment of poultry at slaughterhouses or processing plants in the same way that the FMIA preempted California's attempt to legislate the treatment of nonambulatory animals.

In contrast, the state of California has been successful so far in banning the sale of eggs produced from battery-caged hens. In 2008, California voters approved Proposition 2, a measure that prohibited egg producers within the state from using battery cages in their operations. The state legislature then passed Assembly Bill (AB) 1437, which prohibited the sale of eggs produced through the use of battery cages (Cal. Health & Safety Code § 25996). AB 1437 required out-of-state egg farmers to comply with Prop. 2's requirements if they wished to sell their eggs in California. The legislative purpose of AB 1437 is to "protect California consumers from the deleterious, health, safety, and welfare effects of the sale and consumption of eggs derived from egg-laying hens that are exposed to significant stress that may result in increased exposure to disease pathogens including salmonella" (Treatment of Animals 2010 Cal. Legis. Serv. Ch. 51, 25995 (e) [A.B. 1437]).

Shortly after the California legislature passed AB 1437, six states filed suit as plaintiffs (Missouri, Nebraska, Oklahoma, Alabama, Kentucky, and Iowa), challenging the law as unconstitutional under the Commerce and Supremacy Clauses of the United States Constitution (see *Missouri v. Harris,* 2014). The plaintiffs first alleged that AB 1437 violated the Commerce Clause because it disrupted the free flow of interstate commerce. The plaintiffs next claimed that the Federal Egg Products Inspection Act (EPIA) expressly and impliedly preempted AB 1437. In addition, they alleged that forcing out-of-state egg producers to comply with California's statutory sales ban and accompanying regulations restricting the use of battery cages would result in higher egg costs that would be passed on to consumers.

Defendants in the suit included the attorney general of California and the Association of California Egg Farmers (ACEF) and the Humane Society of the United States (HSUS) as intervenors. The defendants moved to dismiss the plaintiffs' case, alleging that the plaintiffs lacked standing to sue in this instance. The plaintiffs had filed suit under the *parens patriae*[9] standing doctrine, alleging that as states, they each had sovereign interests in protecting their citizens' economic health and constitutional rights.

The standing doctrine, which determines who may file suit in a given case, has developed over time through common law. Standing requires that a plaintiff meet three requirements in order to sue: (1) he or she has suffered an injury, (2) the defendant caused the injury alleged, and (3) the plaintiff can receive redress for the injury suffered through judicial resolution of the matter (see *Lujan v. Defenders of Wildlife,* 1992). In addition, for a state to be able to sue, it must demonstrate that is has a quasi-sovereign interest grounded in the well-being of its populace (see *Alfred Snapp & Sons, Inc. v. Puerto Rico*, 1982). States have quasi-sovereign interests in the physical and economic health and well-being of their residents and in defending the constitutional rights of their residents. *Parens patriae* standing will exist where a state expresses a quasi-sovereign interest and also alleges injury to a sufficiently substantial segment of its population,

[8] See Vesilind (2013).

[9] The *parens patriae* doctrine, translated as "parent of the country," allows states to become plaintiffs in litigation and file lawsuits on behalf of their injured citizens (see *Alfred Snapp & Sons, Inc. v. Puerto Rico*, 1982).

and articulates an interest apart from the interests of particular private parties.

In *Missouri vs Harris,* the defendants moved to dismiss the plaintiffs' suit, alleging that the plaintiffs failed to demonstrate a quasi-sovereign interest. The defendants claimed that the plaintiffs were merely suing on behalf of a small portion of their populace—the egg producers in each individual state. Regarding plaintiffs' claim that dispensing with battery cages would result in rising egg costs, defendants asserted that such a claim was too speculative to meet the injury requirement of standing. The district court agreed with the defendants' position and dismissed the case without leave to amend, holding that the states lacked the necessary *parens patriae* standing to continue suit (see *Missouri v. Harris*, 58 F.Supp.3d at 1075, 1078, 2014).

Because the district court dismissed the case on procedural grounds due to a lack of standing, the court never reached the merits of the parties' arguments regarding the Commerce Clause or preemption under the Supremacy Clause. The plaintiffs appealed the district court's ruling and the appeal is currently pending before the Ninth Circuit. If the Ninth Circuit disagrees with the district court's standing analysis and reverses the ruling, then the case would proceed on its merits, and the district court would have to determine whether AB 1437 violates the Commerce Clause or is preempted by the EPIA. Thus, it is still uncertain whether California will ultimately be successful in banning the sale of eggs produced from battery-caged hens.

Nevertheless, it seems that preemption in this situation is unlikely because California's egg law differs from its attempt to regulate nonambulatory animals in one critical respect. Nothing in the EPIA speaks to how the hens must housed, other than that the premises of each official plant must be kept in sanitary conditions (21 USC § 1035). Thus the situation with battery cages is different that the situation with nonambulatory animals under the FMIA. Here, it is possible to comply with both AB 1437 and the EPIA, thereby alleviating express preemption concerns. Further, because the EPIA contains only a general statement requiring sanitary conditions but no specific requirements regarding how to meet that standard, it does not seem that Congress intended to legislate this area so extensively such that it can be said to occupy the field and impliedly preempt state attempts to regulate here.

Similarly, nine states have been able to ban the use of gestation crates (Arizona, California, Colorado, Florida, Maine, Michigan, Ohio, Oregon, and Rhode Island) without any successful preemption challenges against their legislation. Arizona successfully banned the use of gestation crates by a ballot measure in 2006 with Proposition 204. Interestingly, Arizona's law was codified in the criminal section of its state code, an area of the law traditionally reserved to state power and usually free of preemption concerns (see Ariz. Rev. Stat. Ann. § 13-2910.07). Moreover, state laws banning the use of gestation crates do not raise any preemption concerns under the FMIA because the FMIA is silent on how animals should be raised for slaughter. Rather, "FMIA's preemption clause is more naturally read as being concerned with the methods, standards of quality, and packaging that slaughterhouses use" (see *Empacadora de Carnes de Fresnillo, S.A. de C.V. v. Curry*, 476 F.3d 326, 333 [5th Cir. 2007]). Colorado's gestation ban was codified under the agriculture section of its state code, another area of law traditionally reserved to the states (see Colo. Rev. Stat. Ann. § 35-50.5-101). Where there is not a federal law regulating safety aspects of a food product, such as the FMIA or the Food Safety Modernization Act (FSMA), states should have the authority to regulate animal welfare under their police powers. Thus, anticruelty laws whose purpose is to prevent suffering to animals should not encounter preemption problems.

Commerce Clause Concerns

Dealing with the Affirmative Commerce Clause

Aside from the potential preemption problems states face if they try to regulate animal welfare, they also must take care not to run afoul of the Commerce Clause. The Commerce Clause contains the express delegation of authority from the Constitution to Congress to regulate commerce among the states (see U.S. Const. Art. I, § 8, Cl. 3). Thus,

Congress can regulate all activities except those that are completely interior to a state, that do not in any way affect another state, or that Congress finds unnecessary to regulate (see generally *Gibbons v. Ogden*, 22 U.S. 1 [1824]). The Tenth Amendment to the Constitution provides "the powers not delegated to the United States by the Constitution, nor prohibited to it by the States, are reserved to the States respectively, or to the people" (U.S. Const. Amend. X). Accordingly, the federal government can only regulate those areas of the law that are expressly enumerated in the Constitution; all other powers are left to the states.

Whether a state law violates the Commerce Clause is an inquiry that has plagued legal practitioners and scholars for nearly two centuries. The Supreme Court has acknowledged that when states pass laws "not with a view or design to regulate commerce, but to [legitimately] promote some great object of public interest…such as the public health, agriculture, revenue, or the encouragement of some public improvement…, they are valid as internal regulations, though they may incidentally restrict or regulate foreign trade, or that between the States" (*Gibbons v. Ogden*, 22 U.S. at 72 [1824]). Therefore, a state law such as California's ban on the sale of eggs raised in battery cages seems to promote public health by intending to reduce the rates of salmonella-infected eggs and to raise agricultural animals in a more humane manner. Yet, "the power of Congress is 'to regulate *commerce*.' The correct definition of *commerce* is, the transportation and sale of commodities" (*Gibbons v. Ogden*, 22 U.S. at 76 [1824]). Because eggs are commodities traveling in interstate commerce, the Commerce Clause might reach AB 1437 after all. Later Commerce Clause case law holds that Congress can regulate "the use of the channels of interstate commerce...instrumentalities of interstate commerce [such as people and things, and]… activities having a substantial relation to interstate commerce" (see *United States v. Lopez*, 514 U.S. 549, 558, 1995). This definition might also encompass AB 1437 if the manner in which eggs are produced is construed as an activity substantially relating to interstate commerce.

On the other hand, Commerce Clause violations are usually found where the regulated activity has a direct effect on interstate commerce or where the regulated activity is inherently national and structural impediments could exist if states were left to create patchwork legislation (see *A.L.A. Schechter v. United States*, 1935). If the standing decision in *Missouri v. Harris* is reversed and the Commerce Clause issue is reached on remand, the court will have to employ a balancing test to consider whether the regulated activity (animal welfare) indirectly and remotely affects interstate commerce or whether it has such a close and substantial relation to interstate commerce that Congressional control is essential or appropriate to protect that commerce from burdens and obstructions by the state regulation (see *NLRB v. Jones Laughlin Steel Corp.* 301 U.S. 1 [1937]).

Here, it seems questionable whether changing how laying hens are housed would have a direct or substantial effect on interstate commerce, especially given that several large retailers have committed to sourcing 100% of their eggs from cage-free production facilities in the near future. Whether AB 1437 directly affects interstate commerce may soon be a moot question if the vast majority of egg producers move away from battery-cage operations due to market demands. Additionally, the regulated activity (how egg-laying hens are housed) does not seem inherently national in nature. No federal statute governs how egg-laying hens should be housed or raised. Moreover, Congress has chosen time after time to purposefully exclude the treatment of agricultural animals from any federal animal welfare statutes and has chosen instead to limit federal regulation of animal food products largely to slaughter and inspection. Congress has not shown any interest in enacting a national policy safeguarding the welfare of animals raised for food in this country. The Constitution does not contain any express delegation of authority to the federal government to regulate animal welfare. Thus, under the Tenth Amendment, it would seem that animal welfare is an area that should be reserved to the states.

Dealing with the Negative Commerce Clause

If affirmative Commerce Clause concerns were not enough of an obstacle, state lawmakers must also contend with the evolution of the negative

Commerce Clause doctrine. The negative (also called dormant) Commerce Clause is a legal doctrine arising under the Commerce Clause that deals with the question of whether, in the absence of a federal statute, there are inherent restrictions on state power such that it is appropriate to place limits on states' authority to regulate. Courts will invalidate state and local laws deemed to improperly interfere with interstate commerce. Here, the dormant Commerce Clause is implicated in the absence of a federal animal welfare statute that encompasses the humane treatment of agricultural animals.

Both political and economic theories provide the framework for modern dormant Commerce Clause analysis. Politically, state statutes that are incompatible with the ideal of a unified nation will be struck down. Economically, state protectionist statutes that would create the equivalent of Balkanized trade zones will also be struck down. Here, it seems that AB 1437 would survive a dormant Commerce Clause challenge because the manner in which egg-laying hens are raised would not seem to disrupt a unified nation. By its failure to legislate, Congress has demonstrated that agricultural animal welfare is not a national concern. Similarly, from an economic perspective, the California law is not protectionist in nature. It is facially neutral, applying to in-state and out-of-state producers equally. Yet an argument could be made that outlawing the sale of battery-cage eggs in one state while permitting them in another could contribute to the creation of Balkanized trade zones. However, as noted before, the market as a whole seems to be tipping away from battery cages, so demand (and therefore production) of battery-cage eggs is likely to decrease, alleviating any trade zone concerns.

The dormant Commerce Clause jurisprudence has been murky at best, making it difficult for states to predict whether their laws are likely to be struck down. Justice Scalia readily admitted, "In the 114 years since the doctrine of the negative Commerce Clause was formally adopted as [a] holding of this Court…and in the 50 years prior to that in which it was alluded to in various dicta of the Court…our applications of the doctrine have, not to put too fine a point on the matter, made no sense" (*Tyler Pipe Indus., Inc. v. Wash. State Dep't of Revenue*, 483 U.S. 232, 259–260 [Scalia, J., concurring in part and dissenting in part] [1987]). Thus, any state measure attempting to legislate the welfare of agricultural animals is likely to face a dormant Commerce Clause challenge, the outcome of which is uncertain.

Current Laws Do Not Prohibit Commonly Accepted Agricultural Practices

Another challenge with our current regulatory framework is that federal and state animal cruelty laws do not prohibit commonly accepted agricultural practices (AAPs). Such practices include castration and tail-docking of pigs without anesthetics. Pigs are also kept in gestation crates while pregnant and farrowing crates while nursing, which prevent the mother sows from turning, lying down, or standing up. With respect to cattle, veal production is a necessary by-product of the dairy industry. Cows must be impregnated if they are to produce milk, but that milk cannot be used for human consumption if the baby calf consumes it, as nature intended. Thus, the calves are separated from their mothers, and the female calves are raised for the dairy operation while the male calves are housed in veal stalls. The males are restrained in isolation, prevented from walking and developing their muscles, and fed a deficient diet designed to keep them anemic. Poultry are subject to practices that would likely be considered abuse if they occurred to our companion cats and dogs. Debeaking involves cutting off chicks' beaks without anesthetic so they can be confined and crowded in cages without pecking their cagemates. Male chicks are tossed into chutes that grind them alive, as an unfortunate byproduct of the egg industry. Egg-laying hens are routinely starved so that they produce more eggs in a process called forced molting.[10] Nearly all animals raised for food are housed in crowded, unsanitary conditions without enough room to stand up, stretch, turn around, or engage

[10] This and many other commonly accepted agricultural practices are discussed in *Farmed Animals and the Law,* Animal Legal Defense Fund (n.d.).

in normal behavior for their species, such as nesting and roosting for hens and rooting for pigs. Such overcrowding necessitates the use of antibiotics, which also increases the growth rates of the animals. Unfortunately and ironically, antibiotic use often causes the animals to become sick and develop painful abscesses (Conover, 2013).

Federal law does not prohibit these commonly accepted agricultural practices because they are, by name, "commonly accepted." The rational is that because we have been cruelly treating and torturing these animals in this way for so long, the cruelty and torture has somehow become sanctioned over time. The reality is that we are cruelly treating and torturing billions of animals every year, and "it is not simply more than…billion[s of] animals a year, but it is one, and one, and one, amounting to the large scale mistreatment of individual animals" (Wolfson, 1996, p. 133).

These commonly accepted agricultural practices are the antithesis to the Five Freedoms for animals that are recommended according to the Farm Animal Welfare Council (the Council). Great Britain established the Council in 1979 as an independent advisory group, with the intention to create a strategy to ensure animal welfare for agricultural animals. The Council sought to advance laws and policies intended to promote the Five Freedoms in the lives of animals raised for food in Great Britain. The Five Freedoms include ensuring that all agricultural animals are raised in ways that provide: (1) freedom from hunger and thirst, (2) freedom from discomfort, (3) freedom from pain, injury, or disease, (4) freedom to express normal behavior, and (5) freedom from fear and distress. The Council holds the philosophy that "at a minimum each farm animal should have a life that is worth living to the animal itself, and not just to its human keeper" (Farm Animal Welfare Council, 2009, p. 1).

The Five Freedoms provide a much better measure of animal welfare than our current commonly accepted agricultural practices. If we were to adopt the Five Freedoms as policy in this country, gestation and farrowing crates could no longer be used and veal sheds and battery cages for egg laying hens would be banned, as these practices prohibit animals from expressing normal behavior. The way we transport and slaughter animals would need to drastically change to ensure that they are free from discomfort, pain, fear, and distress.

Last year the American Humane Association conducted a national survey and found that almost 94.9% of Americans were "very concerned" about the welfare of farm animals (American Humane Association, 2014). In a survey Consumer Reports conducted, 80% of respondents stated that they wanted animals raised for food to have good living conditions (Bopp, 2014). Given the overwhelming public support for improving the welfare of agricultural animals, it makes sense that the American public could convince large retailers like Walmart to do what Congress has not: enact an animal welfare policy based on the Five Freedoms, rather than on commonly accepted agricultural practices.

A Solution to Filling in the Gap: Market Forces Are Driving Animal Welfare Conditions

The market is finally responding to consumer demand for humanely raised animal products. Corporate America has been responding slowly, and at first the markets that were the most responsive were not those catering to the mainstream. Small, member-run food co-ops have been sourcing local, humanely raised animal products for some time, but they did not capture the average American consumer. The first significant corporate shift in favor of animal welfare began a decade ago when Whole Foods started selling only cage-free eggs in its stores (Whole Foods Market, Inc., 2008).

Whole Food's shift toward cage-free eggs demonstrated a tidal change toward more humane animal welfare standards. The company began working with the Global Animal Partnership (GAP), a nonprofit organization founded in 2008 with a mission of improving the lives of farm animals (GAP, n.d.). GAP consists of farmers, ranchers, advocacy groups, scientists, and retailers who work together to achieve better outcomes for animals raised for food. This diverse group created the 5-Step Animal Welfare Rating Program in an attempt to bring transparency to the grocery store so consumers could know how the animals were raised (GAP, n.d.).

The 5-Step program creates five levels of

animal welfare, with different standards governing each level. The program is color-coded, allowing consumers an easy way to discern how farmers raised the animals. Step 1 is the lowest level of care provided to animals, which requires at a minimum that there be no cages, crates, or crowding. Step 1 would disqualify every concentrated animal feeding operation (CAFO) in this country. Step 2 refers to those farms that provide their animals with an "enriched environment," designed to provide engaging stimuli to animals that will ultimately reduce anxiety, boredom, and aggression. For example, enrichments for broiler hens include structures that allow birds to engage in natural behaviors such as foraging, scratching, and pecking. To that end, suitable enrichments would include bales of high, scattered grains, edible towers of food (broccoli, lettuce, eucalyptus branches, alfalfa, etc.), and various forage bins, boxes, and/or structures (GAP, 2014). Both Step 1 and 2 bear orange labels.

GAP Step 3 refers to products from farms that have allowed for "enhanced outdoor access," meaning that although animals might live in buildings, they all have access to the outdoors (Whole Foods Market, Inc., 2015a). To qualify for a Step 3 label, farms must allow four-week-old chickens continuous outdoor access during daylight hours, unless inclement weather conditions pose a risk to the birds (GAP, 2014). If chickens are slaughtered before four weeks of age, then they must have continual access to the outdoors for a minimum of two weeks prior to slaughter (GAP, 2014). Step 3 labels are yellow.

Step 4 labels indicate farms that have a "pasture-centered" operation, meaning that when animals live outdoors, they can engage in natural behavior for their species (e.g., rooting for pigs, foraging for chickens, and roaming for cattle) (Whole Foods Market, 2015a). Step 5 labels are used for "animal-centered" farms, which place the well-being of the animal above other concerns such as efficiency and economy (Whole Foods Market, 2015a). The program also defines a Step 5+ label that is reserved for those instances where the animal spends its entire life on one farm and all the other Step 5 conditions are met (Whole Foods Market, 2015a). These last three labels are all color-coded green.

The GAP 5-Step program achieves better living conditions for farm animals than our federal laws do. All steps prohibit the use of commonly accepted agricultural practices, such as debeaking and toe trimming (GAP, 2012). With respect to cows, the steps require that they be allowed outdoor access during the finishing stage (GAP, 2014). Importantly, all steps provide for the welfare of chickens during transport, who are otherwise wholly exempted from the provisions set forth in the Twenty-Eight Hour Law. The 5-Step program even exceeds the requirements for other animals covered under the Twenty-Eight Hour Law by requiring that operators not withhold feed from chickens for more than 12 hours prior to slaughter (GAP, 2012).

The 5-Step program is remarkable in a number of other ways as well. First, all farms seeking a step label are audited every growing season (GAP, 2014). Second, only independent, third-party certifiers can conduct the audits, which promotes transparency and decreases the likelihood that a conflict of interest could affect the auditing process (GAP, 2014). Third, the standards for each step and species are open for public comment (GAP, n.d.). This public comment period allows for farmers, ranchers, scientists, and animal welfare behaviorists to provide feedback on any proposed welfare standards. In this way, GAP is functioning in a regulatory fashion, similar to how the USDA receives public comments for new rules it promulgates. However, USDA has refused to update the rules and regulations governing animal welfare, despite the fact that nearly 95% of Americans are "very concerned about farm animal welfare" and 76% of Americans stated that they are willing to pay higher prices for humanely raised meat, dairy, and egg products (American Humane Association, 2014).

Whole Foods' adoption of the 5-Step Program is laudable for trying to fill the gaps where federal and state animal welfare regulations fall short. However, known to many Americans as "Whole Paycheck," the chain represents a niche market in society, with prices that are often out of reach for the majority of Americans. Although recent surveys have demonstrated that at least three-quarters of Americans are now willing to pay a premium

price in exchange for animal welfare, how much more Americans are willing to pay remains to be seen.

Perhaps it will not be long before other retailers, suppliers, and producers begin adopting the 5-Step program. Slowly, we see other companies embracing animal welfare. Chipotle, a major player intent on revolutionizing the fast-food industry, caters to the mainstream population, unlike Whole Foods. Chipotle refuses to source from pig suppliers who use farrowing or gestation crates and slatted concrete floors without bedding. Remarkably, Chipotle announced to consumers that it might not have pork for carnitas at all of its locations because it suspended one of its major pork suppliers for failing to follow its animal welfare standards (Charles, 2015). Chipotle's decision to remove carnitas from its menus in some locations demonstrates that it is inspecting its suppliers to ensure compliance with its animal welfare policies and is willing to discontinue relationships with suppliers who fail to comply.

Perhaps the largest tipping point of all is Walmart's recent announcement regarding its newly adopted animal welfare policy. Walmart—the largest food retailer in the U.S.—is embracing the Five Freedoms in its new animal welfare policy (Cheeseman, 2015). Walmart (including its subsidiary Sam's Club) is asking its suppliers to:

- Report and take disciplinary and corrective action in cases of animal abuse;
- Find and implement solutions to address animal welfare concerns in housing systems, painful procedures, and euthanasia or slaughter;
- Promote transparency by providing progress reports to Walmart and publicly reporting against their own corporate animal welfare position on an annual basis;
- Adopt and implement the Judicious Use Principles of Antimicrobial Use from the American Veterinary Medical Association (AVMA), including accurate record-keeping, veterinary oversight, and limiting antimicrobial treatment to animals that are ill or at risk;
- Adopt and implement Voluntary Guidance for Industry #209 from the Food and Drug Administration in their own operations and their industry producer programs, including eliminating growth promotion uses of medically important antibiotics; and
- Promote transparency by providing a report on antibiotics management to Walmart and publicly reporting antibiotic use on an annual basis (Walmart Stores, Inc., 2015a).

Walmart's announcement "is the first time the retailer has established an official position on the treatment of animals used in its supply chain. As the largest grocery store in the U.S., the move by Walmart could bring more oversight and awareness of animal welfare throughout the industry" (Hadley, 2015). Every week, over 260 million customers shop at Walmart, and the company reported over US$136 billion in sales for the 2015 fiscal year (Walmart Stores, Inc., 2015b). In contrast, Whole Foods reported US$15 billion in sales for the 2015 fiscal year (Whole Foods Market, Inc., 2015b). If Walmart's suppliers actually adhere to the company's animal welfare policy, Walmart will achieve more for the welfare of agricultural animals in this country than all the federal and state laws combined.

However, it remains to be seen if Walmart will actually achieve the welfare aims listed in its new policy. The company is asking its suppliers to adhere to the welfare goals on a voluntary basis. It seems doubtful that companies will embrace Walmart's new animal welfare policy on a purely voluntary basis if Walmart does not intend to drop suppliers who are unwilling or unable to engage in more humane practices (as Chipotle has done). It has been well-documented that Tyson engages in harmful animal practices, in addition to having numerous labor and environmental violations (Food Chain Workers Alliance, 2015). Walmart's current method of monitoring Tyson and its other suppliers "is failing" (Food Chain Workers Alliance, 2015, p. 68). Given that Tyson is one of Walmart's largest poultry suppliers, it "should be held accountable to a strong labor and environmental code of conduct" (Food Chain Workers Alliance, 2015, p. 68). Yet Walmart has not enacted a plan to monitor or sanction Tyson for

noncompliance with its animal welfare policy—at least not publicly.

There is a danger that Walmart could follow in Costco's footsteps and reap positive press for its stated commitment without engaging in any follow-through. In 2007, Costco announced that it would no longer source eggs from battery-caged hens (Gibson, 2015). However, Costco never created a timeline for when it wanted its suppliers to comply with its battery cage–free policy, nor did it require mandatory compliance from suppliers. Seven years later, the Humane Society of the United States released the results of an undercover investigation, demonstrating that a major Costco supplier (Hillandale Farms) was still caging hens in cramped conditions (Reuters, 2015). The undercover video footage revealed hens caged with deceased and decaying birds while broken eggs and dead chickens covered the floor (HSUS, 2015). Walmart has similarly failed to provide a timeline and require mandatory compliance from its suppliers. If Walmart wants to assure its customers that it values animal welfare, it should create a timeline for implementing its policy and require more than mere voluntary compliance.

Furthermore, if Walmart intends to promote transparency in its food supply chain, then it should enact a third-party certification scheme as Whole Foods has done. Relying on producers to voluntarily self-report risks creating another situation like Costco's. Using independent, third-party certifiers to verify compliance is a crucial component of any animal welfare policy. Better still, Walmart could consider becoming a GAP partner and joining the 5-Step program labeling scheme, which already uses independent, third-party certifiers.

Walmart's adoption of the Five Freedoms presents a unique opportunity to improve conditions for farm animals on a size and scale never before seen in this country. However, unless and until Walmart imposes a deadline, eliminates voluntary compliance, and requires third-party certification, animal welfare advocates and consumers should continue pressuring Walmart to hold the store accountable to its new policy. Animal welfare groups like Mercy For Animals and HSUS should continue investigating Walmart suppliers in the coming months to see if any suppliers are voluntarily complying with Walmart's policy.

Consumers should also be discerning and possess a healthy dose of criticism before purchasing animal products at a Walmart or other corporate chains like a Whole Foods. For customers who have the option of purchasing animal products from a local farm, through a community supported agriculture (CSA) share, or a local food co-op, these options are preferable in terms of assuring transparency and accountability. For example, consumers in Albany, New York, can choose to purchase meat from the local Honest Weight Food Co-Op, which is committed to selling meat from local, pastured, and humanely raised animals (Honest Weight Food Co-Op, 2015). The managers at Honest Weight personally visit the farms they source from and ensure compliance with their animal welfare standards; the co-op's relationship with many of its farmers dates back several decades. Rather than relying on Walmart's voluntary animal welfare scheme, where accountability is still questionable, consumers can purchase from a local food co-op that requires and verifies that suppliers comply with their animal welfare mandates. Similarly, consumers are more likely to observe animal conditions at a local market vendor's farm or a farm offering a CSA than at a Walmart or Whole Foods supplier. For the vast majority of consumers who do not live near local farms or food co-ops, Walmart may offer the best animal welfare option—but only if animal welfare advocates continue working to ensure that the option consumers believe they are getting based on Walmart's press release is truly a humanely raised product.

Walmart's animal welfare policy is significant not just in terms of the impact it will have on animals due to its market share, but also for its ability to influence other food retailers and restaurants to follow suit. Just months after Walmart announced its new policy, McDonald's declared that it was committing to sourcing all of its eggs from cage-free hens within 10 years (McDonald's, 2015). HSUS President and CEO Wayne Pacelle applauded McDonald's decision and noted how it was already having a cascading effect on several

other large companies (Pacelle, 2015; Schroeder, 2016). Compass Group, Sodexo, Aramark, Burger King, Starbucks, Unilever, and now ConAgra have all made similar pledges to begin sourcing their eggs from battery cage–free operations (Pacelle, 2015). McDonald's is in a similar position to Walmart in terms of how it wields an incredible amount of market power. The operations supplying McDonald's in the U.S. and Canada alone provide the chain with over two billion eggs raised from eight million caged chickens every year (Pacelle, 2015). In light of McDonald's recent decision to begin serving breakfast all day, those numbers will likely increase (Strom, 2015).

McDonald's restaurants in Europe have already started sourcing battery cage–free eggs due to the pressure of animal welfare organizations like Compassion in World Farming (Pacelle, 2015). Pacelle notes that making advances for animal welfare are "driven by a combination of ballot measures, courtroom victories, corporate policies, public awareness campaigns, and innovations in agriculture" (Pacelle, 2015, para. 9). Public awareness campaigns must continue, as consumer pressure largely drives corporate policy. Two Mercy For Animals undercover investigations revealing horrific animal abuses at McDonald's egg suppliers in 2011 and 2013, and the subsequent petitions from hundreds of thousands of American and Canadian customers finally culminated in McDonald's announcement to source cage-free eggs (Solomon, 2015).

Although McDonald's has committed to a deadline of 2025, it has not explained how it will verify that its suppliers adhere to the new battery cage–free requirements. Moreover, there is the risk that egg suppliers will simply convert crowded battery caged conditions to crowded tunnels that still do not allow for adequate access to light, the outdoors, perches, and stimulation. Nevertheless, eliminating battery cages is an important first, incremental step in improving the lives and well-being of millions of farm animals—so long as suppliers actually comply.

Conclusion

Mainstream consumers are growing concerned about the food they are placing on the dinner table. Parents worry about the antibiotics and hormones in the food they feed to their children. The public is outraged when undercover videos of CAFOs reveal the horrific abuses inherent in the meals we consume three times a day. Despite this shift in public opinion, federal legislation has thus far been unresponsive and wholly ineffective at safeguarding the care, transport, and slaughter of animals raised for food in this country. At worst, attempts at state regulation have largely fallen short; at best, these attempts often face uncertain and expensive legal challenges. In the face of a Congress that lacks the political will necessary to effectuate meaningful change, consumers and animal advocates have placed increasing pressure on industry. In response to a myriad of consumer concerns, some restaurants and retailers are trying to encourage more humane methods of raising animals for food. Now, in response to consumer pressure, the company with arguably the most capital and market power in America has officially embraced animal welfare and the Five Freedoms.

Malcolm Gladwell explains that "the name given to that one dramatic moment in an epidemic when everything can change all at once is the Tipping Point" (Gladwell, 2002, p. 9). We are now standing at the precipice of another tipping point. The retail and restaurant industries, at their customers' urging, are steering us toward a tipping point where we may finally start to see some chinks in the armor that has always surrounded the factory farming method. Walmart could lead the charge.

However, there are serious flaws in Walmart's animal welfare policy. The lack of a deadline, the nature of voluntary compliance, and the absence of third-party certifiers could all ruin what would otherwise be an important step forward in the animal welfare realm. Now is no time for complacency. More than ever, consumers and animal welfare activists must maintain their advocacy efforts to hold Walmart accountable and ensure that its suppliers, like Seaboard Foods and Tyson, adhere to the principles set forth in the Five Freedoms.

Other companies, such as McDonald's, are starting to follow Walmart's lead. These companies also need deadlines for mandatory compliance, as well as third-party certifiers to verify that compliance. Walmart's animal welfare proclamation is a

laudable first step forward, but consumer pressure and momentum must continue building to ensure follow-through. Consumer demands, animal welfare advocacy, and shifting corporate policies are creating a synergistic recipe for change. If our food system is to tip in favor of animal welfare and sway away from factory farming, now is the time. 

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Locational advantage and the impact of scale: Comparing local and conventional fruit and vegetable transportation efficiencies

Chuck Grigsby [a] * and Chad Hellwinckel [b]
University of Tennessee

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Abstract

Some have suggested that in order for local foods to reach broader consumer segments and become price-competitive with foods sold in mainstream market channels, local farmers need to scale up their production and distribution operations to match the efficiencies of the conventional food system. In this study, we take a first step in evaluating how scaling up production and distribution could make locally produced foods more competitive with the conventional food system. We compare the transportation efficiencies of the conventional and local fruit and vegetable transportation networks in Knoxville, Tennessee, and determine the Knoxville-area food system's competitive transportation zones, defined as the region in which local farmers' shorter travel distances to market give them a locational advantage in transportation over their long distance, conventional food supply chain competitors. We analyze the extent to which local farmers' scales of production and distribution affect their transportation efficiencies, and we investigate factors that could improve their competitiveness with conventional distribution networks. We find that farms located within 25 miles (40 km) of the downtown market tended to deliver their produce to market at least as efficiently as conventionally distributed foods from California. More distant farms needed to scale up their production and distribution operations to remain within the competitive transportation zones. Investigating travel distance thresholds could provide policy-makers with useful information in planning land use and infrastructure investment projects for local food systems and in

[a] * *Corresponding author:* Chuck Grigsby, Department of Agricultural & Resource Economics, 310 Morgan Hall, 2621 Morgan Circle; University of Tennessee; Knoxville, Tennessee 37996-4519 USA; +1-865-368-3519; cgrigsby@vols.utk.edu

[b] Chad Hellwinckel, Department of Agricultural & Resource Economics, 310 Morgan Hall, 2621 Morgan Circle; University of Tennessee; Knoxville, Tennessee 37996-4519; +1-865-974-5006; chellwin@utk.edu

designating sustainable geographic boundaries for foodsheds and local food economies.

Keywords
food distribution, food miles, local and regional food systems, location theory, sustainable agriculture, transportation efficiency

Introduction and Literature Review

Analysts of local food supply chains often suggest scaling up the local food system's transportation network to more effectively compete with the scale efficiencies of the conventional food transportation system, and in turn propel local foods beyond higher-priced niche markets (Bittner, Day-Farnsworth, Miller, Kozub, & Gollnik, 2011; Day-Farnsworth, McCown, Miller, & Pfeiffer, 2009; Day-Farnsworth & Miller, 2014; King et al., 2010). The objective of this research is to improve the understanding of how local farmer transportation efficiency compares with conventionally transported foods in a midsized, southeastern U.S. city: Knoxville, Tennessee. Using Hotelling's location theory framework (1929), our goal is to determine local farmers' locational advantage in transportation: the geographical boundary, or threshold, within which local producers can deliver their fresh produce to market at least as efficiently as the conventional fruit and vegetable transportation system. In our analysis, we investigate the impact of changes in production and transportation scales on local food distribution efficiency, and develop a model to demonstrate how increasing key production and transportation scale factors affect local farmers' travel distance thresholds against conventionally shipped foods. Analyzing the competitive transportation zones in other communities could help policy-makers and planners develop more sustainable and resilient local food economies.

Production of fruits and vegetables in the U.S. has become increasingly limited to the states of California, Texas, and Florida due to their natural competitive advantage. The geographical and climatological characteristics of these states are optimal for large-scale, year-round production of most fruits and vegetables (Lucier, Pollack, Ali, & Perez, 2006; Paggi, Noel, Yamazaki, Hurley, & McCullough, 2012; U.S. Department of Agriculture, National Agricultural Statistics Service [USDA NASS], 2014). These three states rank in the top 10 in freight transportation of fruits and vegetables by volume in the United States (USDA Agricultural Marketing Service [USDA AMS], 2014a). California alone accounts for 65 and 48 percent of the nation's fruit and nut, and vegetable production, respectively, and is the nation's leading producer of nearly 80 crop and livestock commodities (USDA NASS, 2013).

This concentration of production promotes the establishment of other industry-specific infrastructure, services, and technical skills that in turn benefit members in the regional industry cluster (Isard & Peck, 1954; Marshall, 1920; McCann, 2013; Ohlin, 1934). California, Texas, and Florida, for example, also rank among the top 10 states in food and beverage manufacturing (U.S. Census Bureau, 2010). Specialization throughout the entire supply chain spurs the development of cost-reducing technologies that engender economies of scale, and thus the competitive gap widens (Chandler & Hikino, 2009).

Transportation is a component of the fruit and vegetable supply chain that has experienced significant technological advances through the development of more efficient refrigerated trucking devices that employ remote monitoring and global positioning systems (GPS) to help maintain produce quality during transit (Coyle, Hall, & Ballenger, 2001; Kaufman, Handy, McLaughlin, Park, & Green, 2000; Paggi et al., 2012). Technological improvements have permitted growers in more productive agricultural areas, despite their geographical separation from final consumer markets, to effectively exploit food supply chains that rely on long distance transportation (Coyle et al., 2001; Wang, Coyle, Gehlhar, & Vollrath, 2000). Much of California's early economic development focused on reducing the shipping costs of the state's staple agricultural crops via technological advances in long distance transportation (North, 1955). Long distance freight transportation of fresh fruits and vegetables by truck has intensified more rapidly than the modes used to ship other agricultural commodities (Coyle et al., 2001). In the United States, most perishable produce is hauled from 500

to 3,000 miles (805 to 4,828 km) before reaching consumers, using special packaging and controlled-atmosphere shipping technology (Ashby, 1995; Huang, 2004).

Some food analysts are concerned with the energy, environmental, social, and economic implications of the increasing distance food travels (Heller & Keoleian, 2003; Mundler & Rumpus, 2012; Paxton, 1994). Researchers use life-cycle analysis to estimate the energy consumed for long distance food transportation, and the data are often compared with the energy consumed in local food transportation networks (Coley, Howard, & Winter, 2009; Jones, 2002; Sim, Barry, Clift, & Cowell, 2007; Wallgren, 2006). Sourcing produce from distant origins and relying on long distance truck shipments has been a successful strategy during periods of low energy prices (Hendrickson, 1994). However, under a scenario with high fuel costs, the current supply network could become a high-cost structure for U.S. food distribution (Casavant et al., 2010).

Despite longer travel distances and the transportation sector's vulnerability to fuel price volatility, some researchers suggest that economies of scale make the conventional (long distance) production and transportation system of fruits and vegetables more energy-efficient per unit of produce shipped compared to local food distribution networks (Avetisyan, Hertel, & Sampson, 2014; Coley et al., 2009; Mariola, 2008; Saunders, Barber, & Sorenson, 2009; Schlich & Fleissner, 2005). Conventional shipping hauls thousands of pounds of fruits and vegetables in a single semi-truck load, and thus the fuel use per unit of produce shipped is often minimal (Mariola, 2008). Similarly, Avetisyan et al. (2014) and Saunders, Barber, and Taylor (2006) emphasize the importance of considering more than the fuel used during food transportation because the comparative advantage in production in distant locations may outweigh the benefits of lower fuel consumption in a local food distribution system.

Transportation of locally grown food, in contrast, may be less efficient than the conventional system in terms of energy use per unit of product shipped, as small- and midsized local vendors bring less produce to market, and therefore have lower fuel use efficiencies despite traveling fewer miles to distribute their produce (Low & Vogel, 2011). Although sourcing food locally results in fewer total food miles, the actual fuel consumed in local transportation is typically higher on a per-unit basis because conventional supply chains transport larger volumes of produce (King et al., 2010). As local food distribution systems are still evolving, and conventional food supply chains have had more time to develop their scale efficiencies (King, Gómez, & DiGiacomo, 2010; Martinez et al., 2010), U.S. food system researchers investigating local food distribution often suggest scaling up the local food system's transportation network to create a local food supply chain that has efficiencies similar to the conventional food transportation system, capitalizing on local farmers' proximity to mainstream consumer markets (Bittner et al., 2011; Day-Farnsworth et al., 2009; Day-Farnsworth & Miller, 2014; Etemadnia, Goetz, Canning, & Tavallali, 2015; King et al., 2010).

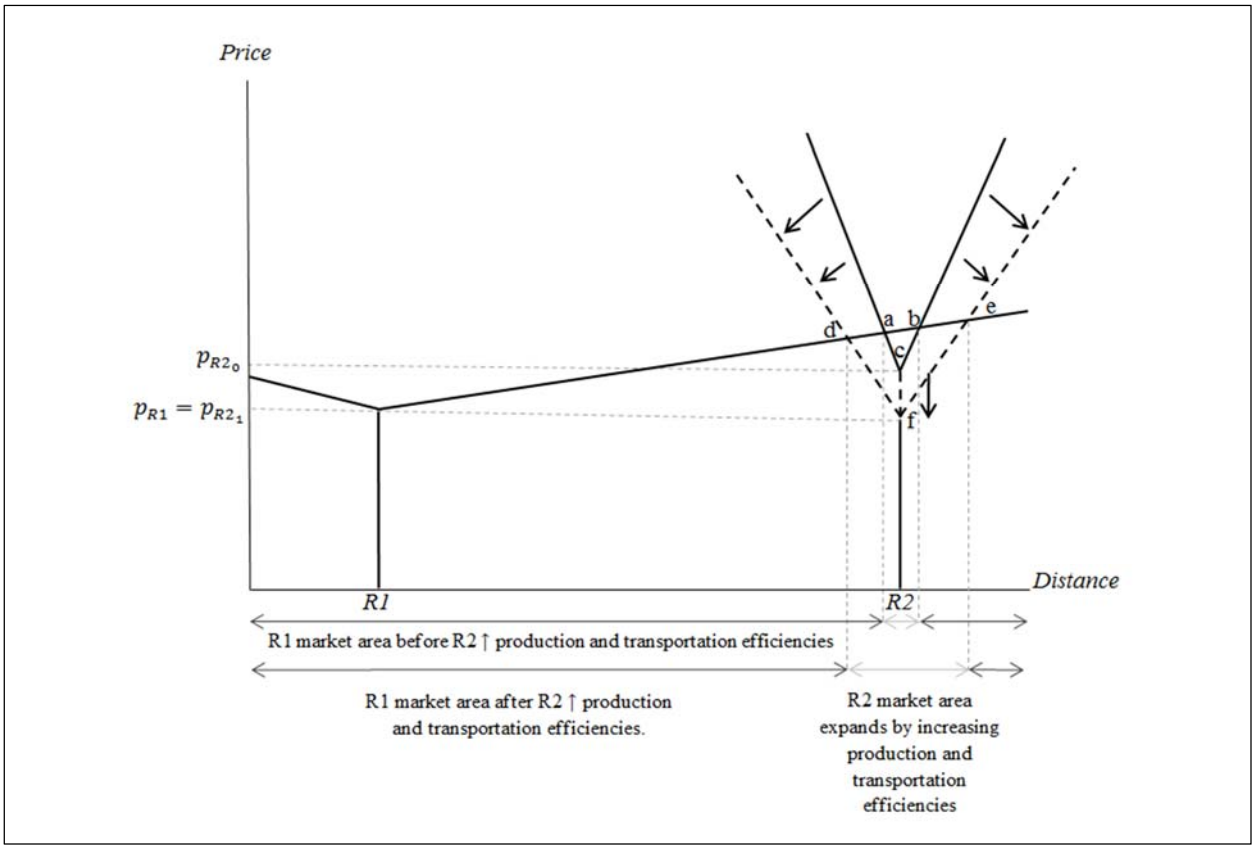
Hotelling's Spatial Competition Model

The spatial competition model (1929), first developed by Launhardt (1885) and later adopted by Hotelling and then Palander (1935) (Fujita, 2010), conceptualizes the idea that scaling up production and transportation operations of small-scale local farmers can improve their food distribution efficiency, which in turn can provide greater marketing opportunities to local producers.

Applying the Hotelling model to the topic at hand, assume the existence of a two-dimensional space in which farmers from two regions sell identical fruit and vegetable baskets (Figure 1) (McCann, 2013). Let the horizontal axis represent distance and the vertical axis indicate product price. Region 1 farmers are located at *R1*, while Region 2 farmers are located at *R2*, and therefore the farmers are separated by distance *R1–R2*. Because Region 1 farmers have a natural productive advantage in growing fruits and vegetables relative to Region 2 and have increasing returns to production, the Region 1 market price for the fresh produce basket at *R1*, p_{R1}, is below the price for the fresh produce basket of the less efficient Region 2, p_{R2_0}.

Consumers are homogenously distributed

Figure 1. Hotelling's Two-Region Spatial Competition Model and the Effect of Increased Production and Transportation Efficiencies



across space and demand exactly one fresh produce basket per period, regardless of price (Eiselt & Laporte, 1989). Because both regions produce the same fresh produce basket, consumers are indifferent between purchasing baskets from farmers in Region 1 or Region 2, and thus purchase from the producer with the lowest delivery price. To deliver fresh produce baskets to consumers, Region 1 and Region 2 farmers incur transportation costs that increase at constant rates per unit of distance, t_{R1} and t_{R2}, respectively. Both t_{R1} and t_{R2} are functions of transportation efficiency and exogenously determined fuel prices. The slope of the transport cost function for producers in Region 1 is flatter than in Region 2, reflecting the Region 1 supply chain's economies of scale in transporting fresh produce baskets.

From Figure 1, it is apparent that producers from Region 1 control most of the fruit and vegetable market, while the market area of Region 2 farmers is limited to markets with shorter travel distances. Their low production costs and high transportation efficiencies allow Region 1 farmers to outcompete Region 2 farmers in sales to consumer markets that are closer in distance to Region 2 farmers. Though Region 2 producers have a potential locational advantage in delivering fruit and vegetable baskets to these nearby markets, their small production and transportation scales constrain their market area. Region 2 farmer profits are limited to area *abc*.

In contrast to Hotelling's spatial competition model, in which firms change location to gain monopoly power (McCann, 2013), given the immobility of farmland, farmers in Region 1 and 2 cannot move their production locations to gain market area over their competition. On the other hand, farmers in Region 1 or Region 2 can expand their market area by improving their production and transportation efficiencies, thereby reducing

production and transportation costs relative to farmers in the other region. Indeed, the conventional food supply chain is characterized by the lowering of production and transportation costs to sell its products globally at lower prices than the same items sourced locally. The small production and distribution scales of many local farmers constrain their competitiveness to nearby markets, forcing them to adopt niche marketing strategies.

The Hotelling framework suggests that, just as Region 1 farmers have lowered production and transportation costs by increasing the size of their operations to generate economies of scale, farmers in Region 2 can recoup part of their market by similarly scaling up production and transportation networks. By doing so, Region 2 farmers can gain a competitive edge in the markets for which they have an improved locational advantage in transporting fresh produce baskets. The dashed production and transportation functions in Figure 1 show that increasing on-farm productivity in Region 2 to the level of Region 1 reduces the price in Region 2 to the Region 1 level, $p_{R1} = p_{R2_1}$, while improving transportation efficiency flattens the Region 2 transportation cost function. Implementing such a strategy would expand the competitive market area of Region 2 farmers and increase profits by the areas *dacf* and *ebcf*. In this study, we use the Hotelling framework to analyze how increasing the scale of local farmers' production and transportation operations improves their transportation efficiencies, and in turn flattens their transportation cost curves to regain market area. An analysis of how scaling up local farmers' production operations affects their production efficiencies and their competitive market area is left for future research.

Methods and Procedures

Local Farmer Survey

We conducted an in-person interview survey of farmers selling fruits and vegetables in direct-to-consumer local markets in Knox County, Tennessee, to accomplish the objectives. The downtown farmers market in Knoxville, Tennessee, was chosen as the primary interview site because it is one of the largest live markets in the east Tennessee region, and therefore attracts a mix of nearby, in-county farms and more distant, out-of-county farms. All 21 of the farmers participating in the downtown farmers market were interviewed. To increase the size of the survey, eight farmers selling produce in two other popular Knox County farmers markets were also interviewed, for a total of 29 surveyed farms. Because it is common for farmers to sell produce in more than one farmers market, in these periphery markets only farmers that were not vendors at the downtown market were solicited to participate in the survey. The survey was conducted during the summer months of June, July, and August 2014. At the end of the survey period all farmers from the three Knox County markets had been interviewed. Farmers were contacted during market hours. The survey was limited to farmers selling fresh produce.

We used research methods from life-cycle analysis, transportation economics, and local food case-study literature in formulating and conducting the survey (Friedlaender & Spady, 1980; Hummels, 2007; King, Hand, & DiGiacomo, 2013; Moneta, 1959; Mundler & Rumpus, 2012; Wang et al., 2000). For life-cycle analysis accounting, the research unit of interest should be clearly defined (Rebitzer et al., 2004). In the case of collecting transportation fuel use efficiency information from local farmers, the primary unit of interest was gallons of fuel consumed per 100 pounds (45 kg) of produce delivered to market (g/cwt). The surveyed farmers were asked to provide all information that would affect the calculation of g/cwt.

Estimation of Fuel Use Efficiency from Survey Data

Following Wallgren (2006), the interviewer collected farm addresses and a detailed description of the route taken to market, including any habitual stops, detours, additional deliveries, or side roads used during transit. The total distance traveled to the market in which the farmer was interviewed was estimated from this information. The farmer's return travel distance was included in the total distance calculation to account for the fuel consumption of partial and empty loads (Kaplin, 2012). The total mileage was verified using Google Maps (2014) and geographical information system (GIS) software (ArcGIS for Desktop Version 10.3). All 29 surveyed farmers indicated that the

Table 1. Description of Local Farmer Survey Data

Variable	Description
Distance	Two-way travel distance to transport produce to market (miles)
Truckload	Truckload weight of fruits and vegetables per trip to the farmers market (lbs.)
MPG	Vehicle fuel economy (miles per gallon)
Boxtruck	Equals 1 if produce delivered using a box truck; 0 otherwise*
Gallons	Gallons of fuel per trip to market
g/cwt	Gallons of fuel per 100 pounds of produce shipped to market
Acres	Number of acres planted in fruits and vegetables for local food market sales*
Organic	Equals 1 if produce was certified organic or naturally grown; 0 otherwise*
AcresOrg	Interaction term between Acres and Organic*
Mktchannels	Number of marketing channels used per week; participating in multiple farmers markets (≥2), selling community supported agriculture (CSA) shares, roadside farm stand, delivery to restaurants and wholesalers, or operating a pick-your-own enterprise, are respectively counted as a marketing channel*

* Used for regression analysis

sole purpose of their trip to market was to sell their produce.

Information on farmer vehicle model, year, drivetrain, and fuel type was collected, along with the truckload weight (lbs.) of produce shipped to the farmers market. The interviews were administered during the peak growing months in which the heaviest fresh produce (e.g., tomatoes, squash, melons, and root crops) was marketed by local farmers. Therefore, calculations of g/cwt likely reflect greater fuel efficiency estimates because of heavier-than-average truckload weights per trip. If the farmer could not provide a reliable estimate of truckload weight, the truckload weight per trip was estimated by weighing the farm stand's different produce boxes (Wallgren, 2006).

Table 2. Descriptive Statistics for Local Farmer Survey Data

Variable	Mean	Median	Min.	Max.
Distance (miles)	75.40	56.40	9.4	198.5
Truckload (lbs.)	768.98	760.30	100	4050
MPG	14.61	14	9.21	23
Boxtruck	0.31	0	0	1
Gallons	5.56	4	0.47	19.85
g/cwt	0.96	0.59	0.06	3.78
Acres	3.81	2	0.25	25
Organic	0.31	0	0	1
Mktchannels	1.86	2	0	4

Each farmer's vehicle fuel economy, measured in miles per gallon (MPG; 1 gallon=3.8 liters), was estimated using the U.S. Department of Energy's (2014) vehicle fuel efficiency calculator. Farmer $i's$ fuel consumption per trip to market (G_i) was calculated as the two-way distance from farm to market divided by the MPG of the farmer's vehicle. To estimate g/cwt, G_i was divided by the farmer's estimated truckload weight and multiplied by 100 pounds (45 kg). The term g/cwt measures local farmer transportation fuel use efficiency and provides a baseline image of local food distribution efficiency. This estimate provides an understanding of how travel distance to market, MPG, and truckload weight affect transportation energy use efficiencies. Descriptions of the data collected from the survey and descriptive statistics associated with those data are presented in Tables 1 and 2, respectively. These data were used throughout the analysis.

Comparing Local Farmer and Conventional Fuel Use Efficiencies

The g/cwt estimates for the local surveyed farmers were compared with the transportation fuel use efficiencies (i.e., g/cwt estimates) of the conventional, long distance distribution systems for produce shipped from Florida, Texas, and California. Conventional g/cwt estimates were developed from data provided by the USDA AMS weekly truck rate reports for fresh produce (*Agricultural Refrigerated Truck Quarterly*) (USDA AMS, 2014b), and other food distribution studies (Casavant et al., 2010; King et al., 2010). The AMS reports that conventional semi-trucks transporting fruits and vegetables haul 39,000 pounds (17,690 kg) of fresh produce, on average. The U.S. Department of Transportation (DOT) (2014) estimates that semi-truck fuel efficiency is approximately 5.7 MPG, while other studies assume that conventional semi-truck fuel economy ranges between 5.3 MPG and 6.1 MPG (King et al., 2010; Paggi et al., 2012; Pirog, Van Pelt, Enshayan, & Cook, 2001). The DOT's estimate is the fuel economy used in this study. The travel distances for the conventional transportation systems assumed shipping points from Palm Beach County, Florida; Hidalgo County, Texas; and San Joaquin Valley, California. The terminal market for all three shipping points was the downtown Knoxville farmers market. Google Maps (2014) was used to approximate the total distance traveled from each shipping point to the terminal market. Distances for the Florida, Texas, and California shipping points are 818 miles (1,316 km), 1,333 miles (2,145 km), and 2,338 miles (3,763 km), respectively.[1]

The g/cwt for the local farmers were compared in two ways with the g/cwt of produce shipped from Florida, Texas, and California. First, they were compared by listing the g/cwt of all 29 interviewed local farmers and the g/cwt of the three distant shipping points on the same graph. The percentages of local farmers with lower g/cwt estimates were calculated relative to the fuel use efficiency of transporting produce from each of the distant shipping points. Second, the local farmers were divided into two-way distance increments of 0–50 miles (0–80 km), 51–100 (82–161 km), and more than 100 miles (161 km) from the local markets. The distributions of local farmers with lower g/cwt estimates than from the Florida, Texas, and California shipping points were compared across increments.

Effects of Key Factors on Fuel Use Efficiency

Surveyed farmers were asked to provide additional information about farm size, farming practices, and weekly marketing activities, as these factors were hypothesized to have a relationship with local farmer transportation g/cwt. Local farmer g/cwt varies according to the farmer's travel distance to market, vehicle MPG, and truckload weight. Although travel distance to a farmers market is exogenously determined for a given farmer, vehicle MPG and truckload weight are transportation efficiency factors under the farmer's control. In the case of truckload weight, variables related to scale, such as farm and vehicle sizes, are expected to affect the amount of produce a farmer delivers to the farmers market. Using the survey data on local farmers' transportation methods in delivering their produce to Knox County farmers markets, an ordinary least squares (OLS) regression model tested hypotheses about how farm and vehicle sizes affect truckload weight. All else equal, farmers hauling heavier truckloads have improved transportation fuel use efficiencies.[2] The OLS

[1] Two-way travel distances are included in the local farmer g/cwt estimates, whereas one-way travel distances are assumed for the three conventional supply chains (Kaplin, 2012). Conventional semi-trucks transporting fruits and vegetables over long distances typically return with full truckloads of other products to maximize efficiency. The interviewed local farmers, on the other hand, did not report any backhaul activity.

[2] Case studies related to scaling up local food distribution are most often oriented toward farm produce aggregation and establishing contractual relationships with local hotels, restaurants, and institutions, such as hospitals and schools, so that deliveries can be made on a consistent basis using larger vehicles (Day-Farnsworth et al., 2009; Diamond & Barham, 2012; Gunter, Thilmany, & Sullins, 2012; Northeast Organic Farming Association of Vermont [NOFA-VT] & Wilson, 2012). However, not all farmers are interested in collective product aggregation. In such cases, local producers may need to increase their own production and distribution scales to

regression was:

$$truckload_i=\beta_0+\beta_1 acres_i+\beta_2 organic_i+\beta_3 acresorg_i+\beta_4 boxtruck_i+\beta_5 mktchannels_i+e_i,$$

where subscript *i* represents the i^{th} local farmer ($i = 1…29$), *truckload* is truckload weight per trip to market of mixed fruits and vegetables (lbs.), *acres* is acres planted in fruits and vegetables for sale at the local farmers market, *organic* equals 1 if the farmer used certified organic or naturally grown farming methods and 0 otherwise, *acresorg* is the interaction between *acres* and *organic* (*acres*×*organic*), *boxtruck* equals 1 if the farmer used a box truck[3] to transport produce to market and 0 otherwise, *mktchannels* is the number of marketing activities the farmer participated in per week (i.e., multiple farmers markets (≥ 2), CSA shares, farm stands, restaurants, wholesale, and pick-your-own), β_j (j = 0…5) are the parameters to be estimated, and e_i is the error term assumed to be independently and identically distributed (i.i.d.) with a mean of zero and constant variance. Descriptive statistics of the variables included in the regression are provided in Table 2.

The farm size variable, *acres,* is a scale variable describing production size and is hypothesized to have a positive effect ($\beta_1 > 0$) on the truckload weight of produce delivered to market. The binary variable, *organic*, controls for production practices and indicates whether a farmer used organic or natural farming methods instead of conventional methods, such as synthetic fertilizers and non-organically certified insecticides and pesticides. Organic or natural farming is hypothesized to have a negative effect ($\beta_2<0$) on truckload weight compared to conventional farming because conventional farms tend to be more productive per area of land than organic farms (Seufert, Ramankutty, & Foley, 2012).

The interaction term, *acresorg,* takes into account the difference in the effect that increases in farm size may have on conventional and organic farmers' truckload weights. The sign of the coefficient of this variable is expected to be negative ($\beta_3 < 0$). An additional acre of produce planted by local organic producers is expected to increase truckload weight by a smaller amount than for local producers using conventional farming practices, as synthetic herbicides, pesticides, and fungicides allow conventional farmers to increase their farm size more effectively relative to organic farms that rely on more labor-intensive farming techniques. The binary variable, *boxtruck*, measures the effect on farmers' truckload weights when the farmer uses a box truck to transport fruits and vegetables to market. This variable models how scaling up vehicle size affects truckload weight. The variable *boxtruck* is expected to positively ($\beta_4 > 0$) affect truckload weight per trip because the farmer's vehicle carrying capacity increases with a larger vehicle.

The final variable, *mktchannels,* accounts for the number of marketing channels used per week. Farmers with local food sales tend to use more than one marketing channel for fresh produce (Lawless, Stevenson, Hendrickson, & Cropp, 1999; LeRoux, Schmit, Roth, & Streeter, 2010; Uva, 2002). These farmers may have larger farms, and thus have greater quantities of produce for sale at the farmers market. If a given farm has several marketing channels, it may use farmers markets as a way to promote its other marketing activities, such as pick-your-own produce or wholesale to restaurants, and therefore brings an ample quantity of produce as a display of on-farm productivity and variety. On the other hand, holding farm size constant, more marketing channels implies less produce per marketing channel, and hence lower truckload weights per trip. In these cases, the farmer may bring less produce to the farmers market. Thus, the effect of *mktchannels* on truckload weight could be positive, zero, or negative ($\beta_5 >=< 0$).

improve transportation fuel use efficiency. Furthermore, for local foods to become more than a niche marketing strategy, local food distribution systems may need to be efficient across all types of market channels: farmers markets, CSA shares, wholesale to hotels, restaurants, and institutions, etc.

[3] Relative to pickup trucks, box trucks have a closed, square-shaped cargo space similar in design to a downsized semi-truck shipping container and provide local producers with added hauling capacity.

Table 3. Truckload and MPG by Farm Size and Vehicle Type Assumed in the Sensitivity Analysis

Scenario	Number of Acres (acres/ha)	Farming Method	Vehicle Type	Drivetrain* and Fuel	Truckload (lbs./kg)	Average (MPG/L per 100 km)
1	2.25 / 0.91	Conventional	Pickup	2-WD, Gas	443 / 201	18.6 / 12.6
2	6 / 2.4	Conventional	Box Truck	2-WD, Gas	1,501 / 681	10.7 / 22.0

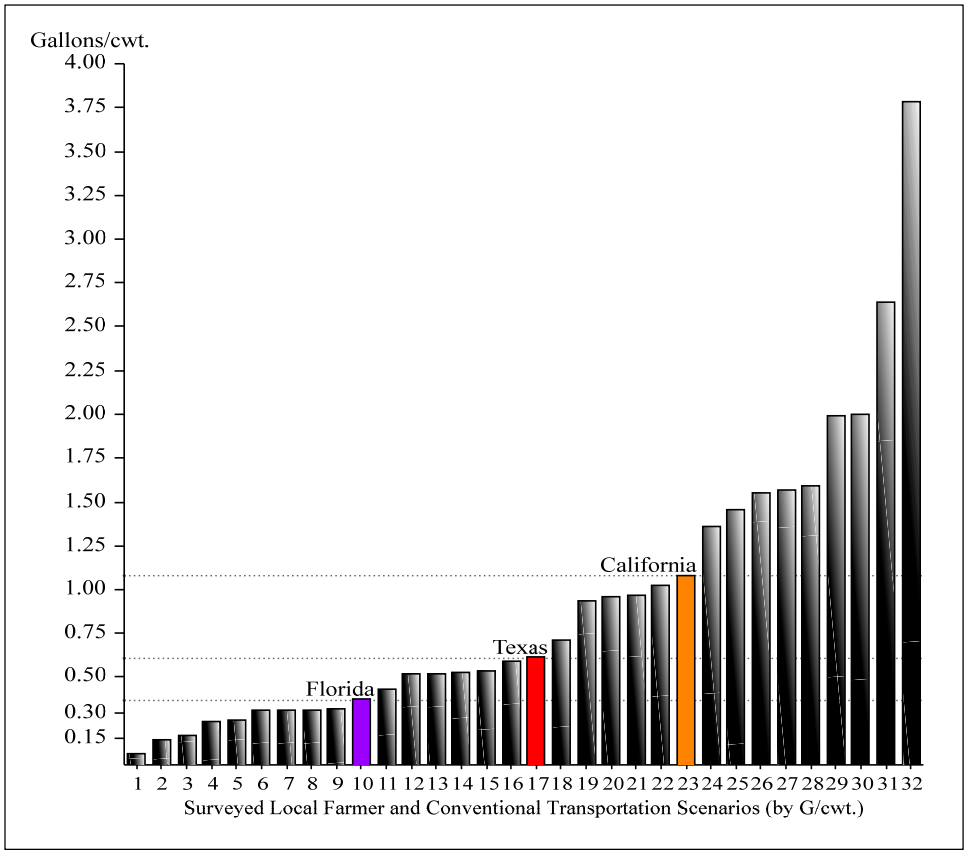
* 2-WD=Two-wheel drive

Locational Advantage Sensitivity Analysis

Using the truckload regression coefficients and average MPG estimates of the surveyed farmers' vehicles, we conducted sensitivity analysis scenarios to observe how variations in key transportation efficiency factors affect local farmers' locational advantage in the delivery of fruits and vegetables to market. The sensitivity analyses varied farm size and vehicle type (production and distribution scale variables, respectively) to show how travel distance thresholds change when the scales of these variables change in the truckload weight regression.

The assumptions of the sensitivity scenarios are reported in Table 3. Because nearly 70% of the surveyed farmers used conventional farming methods in production, both scenarios assumed conventional farming practices. Additionally, to simplify the scenario analyses, *mktchannels* was set at the average of two marketing channels. Two-wheel drive (2-WD) vehicles using gas were assumed in all scenarios, because these were the drivetrain and fuel type observed most frequently in both vehicle type categories (pickup and box truck). Farm size (acreage) was determined in each scenario by using average estimates of *acres* relative to farmers' farming method (organic or conventional) and vehicle type (pickup or box truck). Scenario 1 models the average surveyed farmer using conventional farming practices and a pickup truck with an average fuel efficiency of 18.6 MPG (12.6 liters/100 km). The scenario 1 farmer plants 2.25 acres (0.91 hectares) of fruits and vegetables, which corresponds to the average acreage planted in fruits and vegetables for farmers using conventional farming practices and a pickup truck for transportation. Scenario 2 models the average surveyed local farmer using

Figure 2. Local vs. Conventional Transportation Fuel-Use Efficiency



conventional farming methods and delivering produce to market in a box truck with an average fuel efficiency of 10.7 MPG (22.0 L/100 km). Scenario 2 increases the production scale to 6 acres (2.4 ha), corresponding to the average acreage planted in fruits and vegetables by farmers using conventional farming methods and delivering produce to market in a box truck. The maximum travel distance thresholds to the downtown farmers market were geographically graphed for each sensitivity scenario.

Results

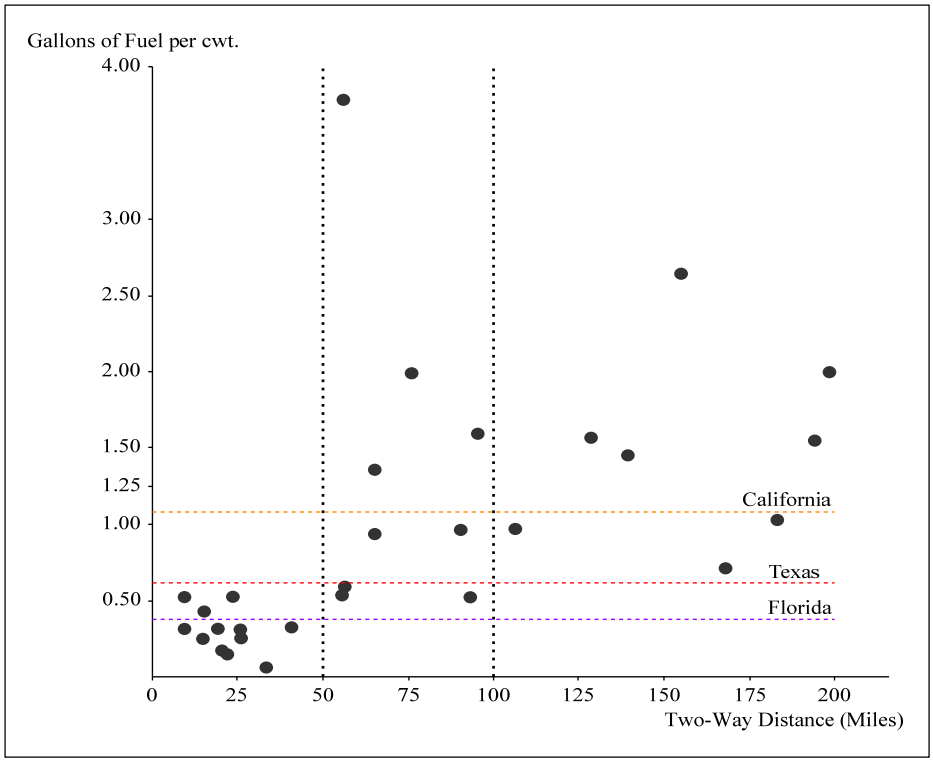
Comparing Local and Conventional Transportation Fuel Use Efficiencies

Figure 2 shows the estimated g/cwt for each farmer compared with the conventional transportation supply chains from Florida, Texas, and California. Approximately 31% of the interviewed farmers (9 farmers) have g/cwt below all three conventional transportation shipping points (more efficient than Florida), 52% of the surveyed farmers (15 farmers) have g/cwt less than the Texas and California thresholds (more efficient than Texas), and 69% have g/cwt below the California fuel use threshold (more efficient than California). Nine local farmers have g/cwt above the California threshold (less efficient than California), indicating that they are less fuel efficient in transporting local produce to market than produce delivered from all three long distance shipping points. Conversely, if local farmer transportation efficiencies are only compared with fruits and vegetables sourced from Florida, 69% (100%−31%=69%) of local farmers (29–9=20 farmers) are above the fuel-use threshold for produce shipped from that state (less efficient than Florida).

Figure 3 shows that all 12 farmers with travel distances below 50 two-way miles (80 km) have lower g/cwt estimates than the conventional transportation systems from Texas and California, while nine of the 12 farmers transport produce to market at least as efficiently as produce shipped from Florida. These farmers' transportation efficiencies are primarily attributed to minimal travel distances to market and less to heavier truckloads. The median truckload for farmers traveling less than 50 two-way miles (80 km) to market is 588 lbs. (267 kg), approximately 23% below the average truckload weight of all surveyed farmers.

Local farmer competitiveness with the three conventional supply chains is mixed for farmers traveling between 50 and 100 two-way miles (82 and 161 km) and over 100 two-way miles (161 km) to market, respectively. Surveyed farmer g/cwt estimates in these travel distance ranges are all above the Florida threshold. Five of the nine

Figure 3. Comparing Local and Conventional Transportation Efficiencies by Travel Distance to Market



farmers with two-way travel distances between 50 and 100 miles have g/cwt estimates below the California threshold, while only three of the eight farmers traveling more than 100 two-way miles have g/cwt estimates below the California threshold. These three farmers compensate their longer travel distances with heavier truckload weights.

These findings support King et al. (2010), as the surveyed farmers with the shortest travel distances tend to have lower g/cwt than the conventional transportation supply chains. The transportation efficiencies of farmers farther from the farmers market are often not competitive with the three conventional transportation systems because their truckload weights are insufficient to offset the added travel distance to market. Local farmers can improve their transportation efficiencies by increasing truckload weights or employing more fuel-efficient (higher MPG) vehicles. However, improving vehicle MPG usually requires using a smaller vehicle, which in turn may constrain vehicle carrying capacity.

The Impact of Scale: Modeling Truckload Deliveries to Market

The estimated truckload weight regression is reported in Table 4. The R^2 of 0.90 indicates that the explanatory variables in the model explain 90% of the variation in truckload weight among the 29 surveyed farmers. The Breusch-Pagan test fails to reject the null hypothesis of no heteroskedasticity (Breusch & Pagan, 1979). Multicollinearity diagnostics showed no statistical significance of strong linear relationships among the explanatory variables, as all variance inflation factors were below 1.8. Therefore, the regression coefficients in Table 4 are best linear unbiased estimators (Wooldridge, 2012).

Table 4. Results for Truckload Weight (lbs.) Regression

Variable	Coefficient	*P*-value
intercept	215.56 (112.54)	0.07
acres	128.67 (12.11)	0.00
organic	209.65 (139.48)	0.15
acresorg	–119.65 (24.37)	0.00
boxtruck	574.81 (117.49)	0.00
mktchannels	-30.95 (55.96)	0.59
n	29	
R^2	0.90	
F-statistic (5,23 *df*)	37.01	0.00
Breusch-Pagan statistic (5 *df*)	1.48	0.91

Although the coefficient for *organic* is significant only at the 15% level, a joint test of the null hypothesis that *organic* and *acresorg* are jointly zero was rejected (F=13.8; 2, 23 *df*; Critical F=5.66 [α=0.01]) (Wooldridge, 2012). Thus, truckload weights are different for organic and conventional farms of the same size. Furthermore, analysis of the production scale variable, *acres*, and the interaction term, *acresorg,* suggests a nontrivial difference in the effect of an additional acre on truckload weights between conventional and organic fruit and vegetable farmers. Controlling for vehicle type and marketing channels, an additional acre for a conventional farmer (*organic*=0) yields 129 lbs. (59 kg) more produce shipped to market per truckload, on average. Although organic farmers (*organic*=1) ship on average 210 lbs. (95 kg) more produce per truckload to local markets than conventional farmers, the effect of an additional acre on truckload weight is only 9 lbs. (128.67 lbs.−119.65 lbs.=9.02 lbs.), 120 lbs. less than the effect on truckload weight of an additional acre for conventional farmers.

Because the coefficient of *acresorg* is negative, the difference between the average truckload weights of the two farming methods diminishes as the number of acres planted in fruits and vegetables increases. The regression results show that organic farmers producing less than 1.75 acres (0.71 ha) (209.65 lbs.–119.65 lbs.×1.75 acres≈0 lbs.) of fruits and vegetables deliver larger truckloads to the farmers market than conventional farmers with the same farm size. However, as acreage increases beyond 1.75 acres, conventional farmers ship heavier truckloads than organic farmers, for the same farm size. This result suggests diminishing returns to farm scale for

Table 5. Sensitivity Analysis Results for One-Way and Two-Way Break-Even Travel Distance Thresholds

	Conventional Shipping Points Break-Even Mileage/Kilometer Marker					
	Florida (g/cwt=0.38)		Texas (g/cwt=0.62)		California (g/cwt=1.08)	
Scenario	One-Way	Two-Way	One-Way	Two-Way	One-Way	Two-Way
1	15.5 / 24.9	31 / 50	25.5 / 41	51 / 82	44 / 71	88 / 142
2	30 / 48	60 / 97	49.5 / 79.7	99 / 159	86 / 138	172 / 277

Note: Scenario assumptions are reported in Table 3.

organic farmers relative to conventional farmers. A *t*-test was used to test the null hypothesis that $\beta_2/\beta_3=0$. The point estimate of 1.75 (209.65/ 119.65) derived from the coefficients of *acres* and *acresorg* is significantly different from zero at the 10% level ($t=1.77$; 23 *df*; *P*-value=.09) (Gregory & Veall, 1985; Wooldridge, 2010). The result suggests that local conventional farmers of fruits and vegetables may have increasing production advantages over organic growers as farm size increases.

The binary indicator variable, *boxtruck*, is significant at the 1% level, indicating that vehicle type is an important factor in determining truckload weight. Controlling for all other variables, a farmer using a box truck carries, on average, 575 lbs. (261 kg) more produce to market than a farmer using a pickup truck for transportation. Thus, to improve the Knoxville area's local food transportation efficiencies, scaling up vehicle sizes to allow for heavier truckload shipments per trip may have a considerable impact. To illustrate using the regression coefficients, a local farmer who produces 4 acres (1.6 hectares) in fruits and vegetables, employs conventional agricultural techniques, uses two alternative marketing channels, and transports produce to the farmers market in a pickup truck is estimated to ship 668 lbs. (303 kg) of produce per trip to market. If this same farmer were to use a box truck, truckload weight would nearly double to 1,243 lbs. (564 kg), which leads to greater transportation fuel use efficiency per trip to market.

However, using a box truck alone does not necessarily enable a farm to transport larger loads to market. The production scale must also be adequately large to take advantage of the added carrying capacity. The average number of acres of fruit and vegetable production for the 9 farmers using a box truck was 6.25 acres (2.53 ha), whereas the remaining 20 local producers with pickup trucks planted an average of 2.75 acres (1.11 ha).

The regression model provides a quantifiable example of the potential impact on local farmer transportation efficiencies by scaling up local food production. While some authors (Day-Farnsworth et al., 2009; Diamond & Barham, 2012) refer to the significance of scaling up the local food supply chain via farmer cooperatives and food hubs, in this study the impact of increasing production and distribution scale is analyzed on the microsetting for a single farm. The two scale variables, *acres* and *boxtruck,* which account for the influence of production and distribution scales on farmer truckload weights, are both significant and their coefficients are nontrivial in magnitude.

Sensitivity Analysis Results

The one-way and two-way travel distance thresholds are presented in Table 5. Delivering fresh produce from Florida, Texas, and California to Knoxville requires 0.38 g/cwt, 0.62 g/cwt, and 1.08 g/cwt, respectively. The two-way travel distance thresholds are determined where the local farmer travel distance functions intersect the g/cwt from the conventional shipping points and depend on the farmer's production and vehicle characteristics in Table 3. Results from the sensitivity analysis show that by scaling up production and transportation operations, local farmer transportation fuel use efficiency is improved, and in turn the competitive travel distance thresholds are extended. However, the sensitivity analysis does not account for changes in farmer welfare or alterations in the final price paid by consumers for locally grown fruits and vegetables as local farmers

increase their transportation efficiencies.

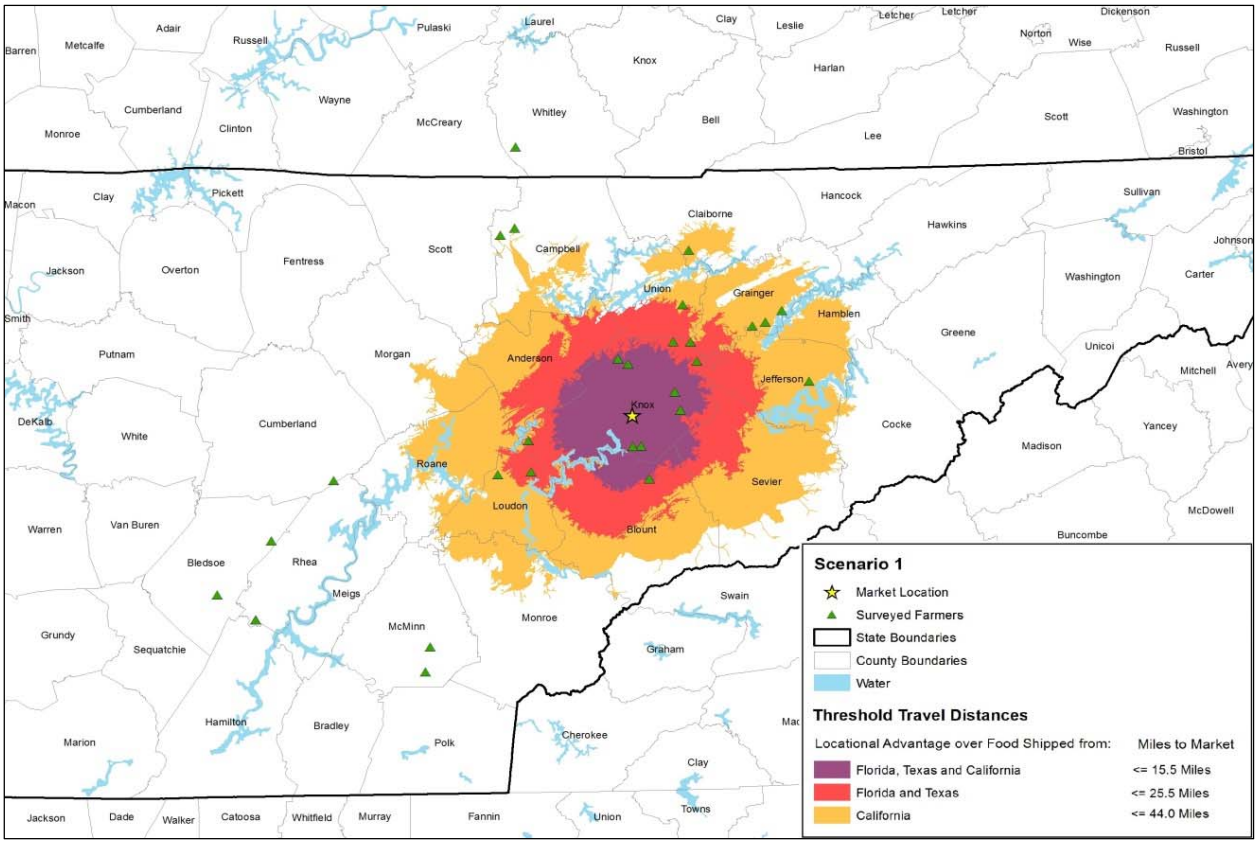
Figures 4 and 5 provide a geographical mapping of the one-way travel distance thresholds of the sensitivity scenarios. The three colored areas represent competitive transportation zones within which local farmers can ship their produce to market and have a locational advantage in transportation over at least one of the three long distance conventional supply chains. The sizes of the competitive transportation zones are based on the farmers' transportation efficiencies, which are determined by the truckload weights and vehicle MPG estimates presented in Table 3. The maps illustrate that if local farmers' production and distribution scales are not sufficiently large, the geographical scope of their locational advantage in transportation is significantly reduced.

Figure 4 shows that the small-scale, pickup truck farming operation modeled in scenario 1 must be located roughly one county away from the downtown market to compete with the transportation efficiency of produce shipped from California. The scenario 1 farmer's transportation fuel use efficiency can compete with Florida produce only if the farm is located in Knox County, within 15.5 miles (24.9 km) of the downtown market. Small, pickup truck farms, therefore, need highly localized marketing strategies to achieve comparable transportation efficiencies with conventional food distribution networks.

Production and distribution scales increase in scenario 2, and in turn the local farmer delivers larger truckloads of fresh produce to market. Larger production and distribution scales allow the modeled farmer to significantly expand the geographical range across which fresh produce can be delivered to the downtown market without exceeding the conventional travel distance

Figure 4. Scenario 1 Competitive Transportation Zones

Scenario 1 models the average local farmer with 2.25 acres (0.91 ha) planted in fruits and vegetables and a pickup truck for transportation (see Table 3 for scenario assumptions).



thresholds (Figure 5). Farms hauling more weight (i.e., 1,000–1,500 lbs. or 454–680 kg) can deliver produce to the downtown market from within two or three counties and maintain their locational advantage over conventional food supply chains in terms of transportation fuel use per unit of produce shipped. Farmers who are scaled up in production and distribution have the opportunity to market fruits and vegetables in a more "regional" sense by traveling up to 86 one-way miles (138 km) to market before surpassing the travel distance threshold for California produce.

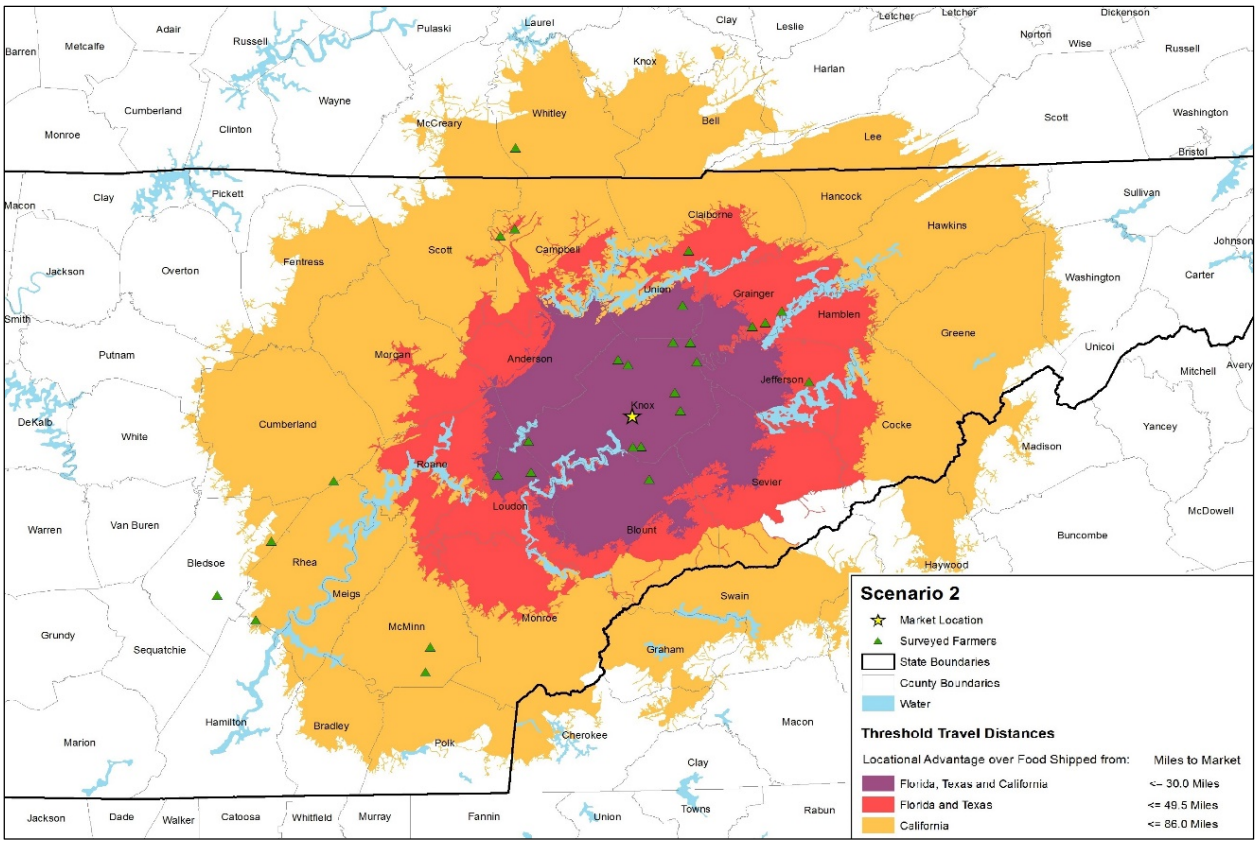
Policy Implications and Conclusions

U.S. fruit and vegetable production has become increasingly concentrated in states such as California, Texas, and Florida due to their geographical and climatological comparative advantages in production (Lucier et al., 2006; Paggi et al., 2012; USDA NASS, 2014). Large-scale, specialized production is conveniently wedded with an efficient transportation network characterized by economies of scale. While large-scale fruit and vegetable production and transportation largely contribute to the low-cost conventional food supply chain, our study shows that factors of location and scale also play key roles in determining Knoxville-area local farmers' transportation efficiencies. Although the higher prices received for their differentiated products may enable local farmers to be profitable regardless of how their transportation fuel use efficiencies compare with the conventional food supply chain, if local foods are to become more than a niche market, improving transportation efficiency by scaling up local farmer production and distribution may be a desirable goal for local farmers, consumers, and food policy-makers.

In the case of Knoxville, our study showed

Figure 5. Scenario 2 Competitive Transportation Zones

Scenario 2 models the average, scaled-up local farmer who plants 6 acres (2.4 ha) in fruits and vegetables and employs a box truck for transportation (see Table 3 for scenario assumptions).



that despite their relatively small truckloads, all 12 farms operating within 25 miles of the downtown market (50 two-way travel miles, or 80 km) delivered their produce to market at least as efficiently as conventionally distributed foods from California. Local farmers traveling further than 25 one-way miles (40 km) were less competitive with the three conventional transportation scenarios unless these more distant farms had adequately scaled up their production and distribution of fresh produce. Because the farms within the 25-mile competitive transportation zone cannot satisfy Knoxville's local food supply needs with their small-scale operations, policies designed to meet the city's objectives by conserving farmland beyond the 25-mile threshold need to ensure that the production and transportation scales of more distant farming operations are sufficiently large so that their transportation fuel use efficiencies are competitive with conventional food distribution systems.

The OLS regression results suggest that farm size (acreage) and vehicle type (pickup or box truck) have a significant effect on the amount of fresh produce delivered to market per trip. Using the scale coefficients from the OLS regression (*acres* and *boxtruck*), the transportation sensitivity analysis illustrates that as the surveyed local farmers increased their distribution scales, they delivered produce to market more efficiently, and in turn extended their competitive transportation zones outward to compete more favorably with conventionally transported foods, as predicted by Hotelling's spatial competition model (1929).[4] Our model showed that small-scale, pickup truck farmers could be located up to 44 miles (71 km) from the downtown market before losing their locational advantage in transportation to produce shipped from California. A larger-scale farm employing a box truck for transportation could travel nearly double the distance (86 miles or 138 km) before it surpassed the California threshold. As travel distance to market increases, balancing out the added travel miles with larger truckloads becomes essential if local farmers are to compete with the transportation fuel use efficiency of conventional supply chains.

These findings corroborate the results of other local food transportation studies (King et al., 2010; Mundler & Rumpus, 2012; Pirog et al., 2001; Wallgren, 2006). While most research has documented the effects of scaling up local food production and distribution with qualitative analyses (Bittner et al., 2011; Day-Farnsworth & Miller, 2014; Day-Farnsworth et al., 2009), these regression and sensitivity results offer local food analysts a quantitative baseline for the impacts of scaling up local food networks. However, because the sample is not random, the regression results cannot be used to make inferences about the broader population of farmers transporting food to local markets. The model only pertains to the 29 surveyed Knoxville-area farmers.

Determining the competitive transportation zones in other cities could be useful information to help policy-makers and urban planners develop more efficient farm conservation and infrastructure programs in support of local food systems. The transportation fuel use efficiency thresholds will be unique to every community, as they are contingent on the shipping points of their conventional food suppliers and local farmers' locations, and production and distribution scales. The local food economy in Knoxville is characterized primarily by numerous small- and midsized farms that individually market their fresh produce at farmers markets and through CSA shares. The city has not developed a local food aggregation network through food hubs or farmer cooperatives. Thus, comparing local farmers' respective transportation fuel use efficiencies with the conventional food supply chain, and developing competitive transportation zones for these local producers, were appropriate for the Knoxville-area food system. However, our methods could also be applied in

[4] Hotelling's spatial competition model (1929) suggests that increasing local farmers' production and distribution efficiencies will expand their competitive market area by lowering locally produced food prices relative to conventionally produced foods. This study, however, only analyzes the transportation efficiency component of local farmers' operations. Investigating the extent to which local food prices change as a result of local farmers increasing their production and distribution scales could be addressed with future research.

food systems where local food aggregation operations are delivering fresh produce to larger wholesale buyers, such as hotels, restaurants, and institutions.

Glaeser & Kohlhase (2004) identify falling transportation costs related to technological innovation as a factor that has transformed the structure of the modern economy. Without the relatively low transportation costs and technological advances that facilitate long distance food distribution, concentrating the production of perishable food items in regions remote from most consumer markets may become less viable. If transportation costs were to increase significantly, local farmers with a locational advantage in transportation could have greater marketing opportunities, as wholesalers and retailers facing higher distribution costs may alter their procurement strategies by adopting regional sourcing strategies (Acharya, Kagan, & Manfredo 2009; Gosier, Simchi-Levi, Wright, & Bentz, 2008). In determining the competitive transportation zones in other local food systems, some communities may find that most of their local farmers transport their produce to market less efficiently than food shipped conventionally, and thus are outside of the competitive travel distance thresholds. Indeed, some local food economies may be more vulnerable to fuel price increases than their long distance conventional competition. Conversely, our study indicates that food systems in which a large proportion of the local farmers are located near the urban core are more sustainable and resilient to fuel price shocks, as their shorter travel distances may give the closest farming operations a distinct locational advantage in transportation over the long distance conventional transportation system.

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Examining barriers to implementation of electronic benefit transfer (EBT) in farmers markets: Perspectives from market managers

Anne M. Roubal,[a] * Alfonso Morales,[b] Karen Timberlake,[c] Ana Martinez-Donate [d]
University of Wisconsin-Madison

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Abstract

Farmers markets are generally considered one of the healthiest places to purchase food. However, less than 1% of food assistance dollars are redeemed at farmers markets. Because farmers markets have operated historically as cash operations, they are still experimenting and struggling to find ways to redeem electronic food share benefits. Much work on electronic benefit transfer (EBT) has focused on barriers from users' perspectives. Farmers markets have often been overlooked during the transition from food stamps to EBT. This paper takes an in-depth look at barriers and facilitators to successful implementation of EBT at farmers markets from the market manager's perspective. The researchers interviewed a semi-random geographic sample of farmers market managers across Wisconsin (*N*=13) to determine if and how the electronic Supplemental Nutrition Assistance Program benefits are redeemed at their market and identify factors that impede or aid EBT redemption. Data were analyzed using grounded theory analysis. Several positive and negative themes emerged from the interviews as factors

[a] * *Corresponding author:* Anne M. Roubal, PhD, University of Wisconsin-Madison, Department of Population Health Sciences.

Dr. Roubal is now at the University of Arizona, Center for Population Science and Discovery, Building 200A; Arizona Health Sciences; 1501 North Campbell; Tucson, Arizona 85724 USA; +1-520-626-8747; roubal@email.arizona.edu

[b] Alfonso Morales, University of Wisconsin-Madison, Department of Urban and Regional Planning; 104 Music Hall, 925 Bascom Mall; Madison, Wisconsin 53706 USA; +1-608-263-4848; morales1@wisc.edu

[c] Karen Timberlake, JD, University of Wisconsin Population Health Institute; 610 Walnut Street WARF 575-D; Madison, Wisconsin 53726 USA; +1-608-265-4603; ktimberlake@wisc.edu

[d] Ana Martinez-Donate, PhD, University of Wisconsin-Madison, Department of Population Health Sciences.

Dr. Martinez-Donate is now at Drexel University School of Public Health; 3215 Market Street; Nesbitt Hall 458; Philadelphia, Pennsylvania 19104 USA; apm78@drexel.edu

associated with successful EBT programs, including community support, perceived match of EBT with market mission, stable financing, perceived benefit to vendors, and vendor acceptance of EBT. Farmers markets have the potential to reduce food insecurity through EBT redemption. Understanding the main barriers as well as effective strategies for successful implementation of EBT in farmers markets is imperative to realize the full potential of this program. Understanding difficulties from market managers' perspectives is important to inform future policy initiatives to streamline reimbursement at farmers markets.

Keywords
electronic benefit transfer, EBT, farmers market, farmers market managers, Supplemental Nutrition Assistance Program, SNAP

Background

Farmers Markets and Health

Over the past 30 years, growth in the number of farmers markets has occurred rapidly in the United States (Brown, 2001). In the last decade alone farmers markets have grown by 150% (Brown & Miller, 2008). In 2014, 280 new farmers markets began operating in the U.S., adding to the existing 7,864 (U.S. Department of Agriculture, Agriculture Marketing Service [USDA AMS], 2014). The volume of transactions at farmers markets continues to increase as well (Holben, 2010), partly because many items cost the same or less at farmers markets and are of better quality (Wolf, Spittler, & Ahern, 2005; Pirog & McCann, 2009). This growth in the number of farmers markets has garnered the attention of many researchers interested in understanding the social, economic, and health impacts of farmers markets, including their role in obesity prevention efforts.

What foods individuals eat are largely the product of what foods they have access to in their environment. The Social Ecological Model (SEM) asserts that health behaviors are the product of multiple factors at the individual, household, organizational, community, and policy levels (Simons-Morton, McLeroy, & Wendel, 2012). Factors at these multiple levels are nested within and interact with each other (Simons-Morton et al., 2012). Understanding the role of each level as well as the interactions between them is important for determining how to improve dietary patterns. The SEM has often been utilized by researchers attempting to describe how dietary patterns are affected by the multiple SEM levels (Centers for Disease Control and Prevention, 2013; FitzGerald et al., 2013). Farmers markets affect dietary patterns at the policy, community, and economic spheres of influence.

Farmers markets have many variations, but they can be defined as a "food or local product market where individual producers, primarily farmers, ranchers and local producers, bring their food wares and local goods for direct sale to the public" (University of Wisconsin–Madison & Journal of Agriculture, Food Systems, and Community Development, n.d., para. 1). Farmers markets have several well-established relationships to health. They provide access to fresh fruits and vegetables and have been shown to improve fruit and vegetable purchasing and consumption. In a 2002 survey of customers at 21 New Jersey farmers markets, self-reported vegetable consumption had increased over that of five years previous for 78% of the survey respondents (Govindasmy, Italia, & Adelaja, 2002).

Location of Farmers Markets

Although little work in public health has been done to understand the factors driving the location of farmers markets, there are practical, political, and economic reasons for their location. Markets are generally located in high-traffic areas with available parking and enough space for the market and its vendors. Thus, markets are often located in city parks, parking lots, or at the intersection of streets in a downtown neighborhood. Partnerships between businesses (such as hospitals or banks) and local government buildings may allow markets to take place during nonworking hours (George, Kraschnewski, & Rovniak, 2011). Structural elements, such as the existence of parking, electrical outlets, and public transportation nearby, may play a larger role than the economic makeup of neighborhoods when deciding where to locate farmers markets. Economic factors such as the

presence of a grocery store or income of a community could also factor into where to locate a market. Additionally, community coalitions or organized citizens may start a market and thus its location is based on their interests.

Farmers markets are often located in higher-income, predominately white neighborhoods, where food insecurity is not a prevalent issue (Treuhaft & Karpyn, n.d.). In order to combat food insecurity, in other neighborhoods a farmers market may form through a successful community intervention. A few successful case studies where food insecurity or the price of food was reduced through the establishment of a farmers market have been published in the scholarly literature (e.g., Larsen & Gilliland, 2009; Neumakr-Sztainer, Story, Resnick, & Blum, 1996). Despite attempts to use farmers markets to reduce food deserts, their customers tend to be upper-middle income, non-Hispanic whites who live within 10 miles (16 km) of the market (Ammerman, Lindquist, Lohr, & Hersey, 2002). These factors indicate that farmers markets currently serve as a food amenity rather than a tool to reduce food deserts.

Nutrition Assistance Programs and Electronic Benefit Transfer at Farmers Markets

Farmers markets have been viewed as locations that promote access to fruits and vegetables and, more recently, as a strategy to reduce food insecurity (Bollen, Vernez-Moedon, Kinney, & Drewnowski, 2010; Brown 2001; Larsen & Gilliland, 2009). Farmers markets have been most successful in improving fruit and vegetable consumption among individuals who receive Supplemental Nutrition Assistance Program (SNAP) benefits by using coupons and vouchers (Evans et al., 2012; Gustafson, Lewis, Perkins, Wilson, Bucker, & Vail, 2013; McCormack, Laska, Larson, & Story, 2010; Rose & Richards, 2004). Despite recognition of the potential for farmers markets to increase access to healthy foods, more research is needed to understand how to maximize the impact of these outlets (Hendrickson, Smith, & Eikenberry, 2006; McCormack et al., 2010). One of the main strategies used to improve access to healthy foods at farmers markets is to expand the number of markets where federal food dollars can be redeemed. This expansion of SNAP access has been slow because of the many challenges faced when transitioning the program from paper food stamps to electronic benefit transfer (EBT).

In 2002, SNAP changed from "food stamps" to an electronic benefit transfer (EBT) system, significantly changing the way food dollars were redeemed (USDA, Food and Nutrition Service [USDA FNS], 2014a). EBT systems accept federal nutrition assistance dollars via a magnetically encoded payment card. This was a dramatic change from the previous food stamp method, where coupons were given to farmers market vendors in exchange for a specific product. Under the new system, redemption of SNAP dollars at a farmers market requires a point of sale (POS) terminal to accept SNAP benefits, an active Internet connection, and the implementation of many other market processes that may exceed the limited resources of many farmers markets (Parsons & Morales, 2013). In order to redeem EBT payments at a farmers market, the market must first finance an EBT machine. Only 18% of farmers markets nationally receive government funds to operate an EBT program; the others finance EBT machines through donations or vendor fees (Payne, 2000). EBT start-up costs run between US$390 and US$1,000 (Illinois Department of Agriculture, 2009; Hasin, Smith, & Stieren, 2014). Even 12 years after its introduction, EBT remains a costly and time-consuming process and a burden to implement and operate at farmers markets (Buttenheim, Havassy, Fang, Glyn & Karpyn, 2012; Flamm, 2011).

Since EBT was implemented, the value of SNAP dollars redeemed at farmers markets has declined drastically. The value of SNAP benefits redeemed at farmers markets dropped by 71% between 1994 (pre-EBT) and 2008 (post-EBT transition) (Briggs, Fisher, Lott, Miller, & Tessman, 2010). Further emphasizing the struggle of farmers markets to successfully transition to EBT redemption of SNAP was the decline in percentage of redemption of all SNAP funds at farmers markets between 1992 and 2005 (Roper, 2012). Although there has been steady growth since 2007, the percentage of SNAP redemptions at farmers markets is still well under one-half that of 1992

redemptions (Roper, 2012). These continuing low EBT redemption rates have prompted policy advocates and market managers to search for an efficient redemption method (Food Trust for Transform Wisconsin, 2014; USDA FNS, 2014b).

Farmers markets with EBT for SNAP can greatly improve the quality and quantity of food to which low-income individuals and families have access (Jones & Bhatia, 2011). However, the extent to which farmers markets participate in EBT and the mechanisms for accepting SNAP dollars electronically at farmers markets is poorly understood. Reasons for accepting EBT at farmers markets are often economically motivated, and not due to the health benefits (Ward, Slawson, Wu, & Jilcott Pitts, 2015). Yet offering SNAP redemption at farmers markets has been shown to increase fruit and vegetable intake among SNAP beneficiaries (Jones & Bhatia, 2011; Krokowski, 2014; Ruelas, Iverson, Kiekel, & Peters, 2012). Adoption of EBT in farmers market continues to be limited in nature. In Wisconsin, 15% of the state's population receives SNAP funding, but only 14% of farmers markets accept EBT (Food Trust for Transform Wisconsin, 2014; USDA AMS, n.d.). Furthermore, only 0.015% of the federal food benefit dollars issued in Wisconsin is redeemed at farmers markets (Roper & Miller, 2013). This is slightly lower than the general U.S. estimate that American consumers spend almost 0.2% of their food dollars at farmers markets (Briggs et al., 2010).

Many farmers markets have expanded their electronic money transfer services to include credit and debit cards in addition to SNAP funds. This can be expanded to the vendor level with devices such as the Square or other chip readers (Buttenheim et al., 2012). These devices increase the purchasing power of individuals who do not need to rely on cash or check to buy produce.

Other nutrition assistance programs at farmers markets have been analyzed in studies. However, these studies have been limited in scope to either one or a few farmers markets and have not evaluated the EBT reimbursement process, since both the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and the Senior Farmers' Market Nutrition Program (SFMNP) programs still operate using paper exchange processes. A study of the SFMNP in South Carolina indicated that farmers benefited from the program through increased produce sales and that program participants intended to eat more produce because of the program (Kunkel, Luccia, & Moore, 2003). An evaluation of a similar program in Massachusetts indicated that SFMNP vouchers were successful in attracting new customers to the farmers market (Balsam, Webber, & Oehlke, 1994). In a Connecticut study, researchers found that use of WIC vouchers increased visits to the farmers market but not consumption of fruits and vegetables (Anliker, Winne, & Drake, 1992). Studies in California and Michigan, however, found modest increases in fruit and vegetable consumption through WIC supplements for farmers markets (Anderson et al., 2001; Herman, Harrison, Afifi, & Jenks, 2008; Joy, Bunch, Davis, & Fujii, 2001). Furthermore, it has been suggested that simply by having access to the WIC supplement, farmers market received increased visits, and hopefully their consumers had additional fruit and vegetable consumption over the long term (National Association of Farmers' Market Nutrition Programs, 2001). Consumers who received the FMNP supplement in addition to WIC had higher perceived benefits and quality of foods as well as increased vegetable intake (Kropf, Holben, Holcomb, & Anderson, 2007). A study on 2011 SNAP redemption at farmers markets indicated that fruit and vegetable consumption increased among SNAP participants (Young et al., 2013). Furthermore, SNAP sales doubled at farmers in low-income areas in the first two years of the program (Young et al., 2013).

Much work has focused on individual barriers to using EBT at farmers markets from the vendor or customer perspective. Barriers to EBT redemption at the customer level include limited hours, limited locations, lack of child care, price, selection of foods, and difficulty of using the EBT card (Grace, Grace, Becker, & Lyden, 2007; Leone et al., 2012; Suarez-Balcazar, Martinez, Cox, & Jayraj, 2006; USDA, 2014b). In one study that looked at vendors' perspective, 51% of vendors judged the program to be unsuccessful (Krokowski, 2014). Perceived challenges to the program included marketing challenges and having to send customers

to the EBT station from their stalls for redemption (Krokowski, 2014). On the other hand, 80% of farmers market managers believed that the EBT program was a success at their markets, although they recognized that the largest challenges were related to time and operational logics (Krokowski, 2014). To date, very few solutions have been offered to assist managers in overcoming those barriers.

This paper investigates the processes, facilitators, and barriers encountered by farmers market managers when initiating a EBT program, using the grounded theory to approach the issue. We focus on the state of Wisconsin, which has 365 farmers market and a rich history of farmers markets and direct producer sales. This study was conducted in the context of a multipronged statewide obesity prevention initiative, spearheaded by the University of Wisconsin Obesity Prevention Network and with support from the Wisconsin Partnership Initiative and the USDA-supported Ridge Center for Targeted Studies. The results from this paper will supply information on ways to overcome major barriers encountered by farmers markets around the nation that are interested in beginning a farmers market EBT program.

Applied Research Methods

To understand the different redemption practices for FoodShare dollars in farmers markets in the state of Wisconsin, in-depth interviews regarding the use of EBT were performed with 13 market managers. (FoodShare is the name given to the SNAP program in the state of Wisconsin.) The markets themselves were purposefully chosen to represent different geographic regions of the state, sizes, and years of operation. Markets were eligible if they report to the USDA Farmers Market Directory, reflecting approximately 84% of all farmers markets in Wisconsin (Roubal, 2015).

We contacted farmers market managers initially through email and then telephoned the following week to schedule an interview. We asked the managers to participate in a semistructured, qualitative interview regarding SNAP redemption at their market and to complete a structured questionnaire that collected basic sociodemographic and market characteristics. Interviews lasted approximately 1 hour and included multiple choice as well as open-ended questions. Participants could choose between completing the interview face-to-face or by telephone. They received a small incentive of a US$50 gift card. The initial recruitment goal for the study was 10 markets redeeming SNAP using EBT and 5 markets not offering EBT, in order to obtain different perspectives. In total, 10 markets with EBT redemption programs in place and three without were interviewed. Lack of response from managers at markets without EBT was the main reason for the limited representation of this market type.

The lead investigator performed audiorecorded interviews. The recordings were transcribed by a third-party transcription service (using Caption Sync from Automatic Sync Technologies in Seattle, Washington). The interviewer also took field notes during each interview, which were included for analysis. Participants were asked questions about market demographics, history, employees, EBT, WIC redemption, environment, and other topics using a semistructured interview guide developed with the assistance of researchers in the departments of Population Health Sciences, Urban and Regional Planning, and Human Ecology at the University of Wisconsin–Madison (available upon request).

Qualitative interview data were analyzed using grounded theory analysis of the interview data (Grounded Theory Institute, 2014) to develop a general theory or theories for the topic, "Why is EBT accepted at some farmers markets but not at others?" No a priori theories as to why this occurred were utilized; instead, the interviewer privileged the perspective of the participants and sought to understand how they understood their circumstances. Grounded theory is an inductive methodology that is used to derive a theory from an evaluation of the available data. It allows for the development of conceptual categories and not one overall answer. As we suspected that the relationship of interest was complex, this method was used to analyze our interview data (Grounded Theory Institute, 2014). Grounded theory allows for the *development* of a theory, as opposed to the *testing* of a specific theory (Stern, 1980). It was the best fit as there is no generally accepted theory about why

EBT is accepted at certain farmers markets but not others.

The analysis consisted of the three main steps for grounded theory analysis: coding and theorizing; memos and theorizing; and integrating, refining, and writing up theories. Selective coding was performed by coding portions of the interviews related to the core question. Coding was performed manually by the primary investigator due to the low count of interviews (13). We analyzed the transcriptions for recurring themes to identify reasons for EBT acceptance at farmers markets. We created and grouped memos into categories in order to develop theories as to why EBT redemption was successful at specific farmers markets in Wisconsin (Table 1). The research group reviewed general themes in discussions regarding the transcripts.

Table 1. Summary of Main Themes Emerging from Participant Narratives

Facilitators		Barriers
Interest	⇑	Financing
Training		Paperwork
Advertisement	Successful EBT Program	Reimbursement process
Community support		Vendor compliance
Motivated manager	⇓	Part-time manager

Preliminary results were presented at the annual Wisconsin Fruit and Vegetable Growers conference to a room (30 to 40 people) of farmers market managers across the state to perform member checking. Member checking is a useful way to validate findings in a range of research approaches; it consists of testing "data, analytic categories, interpretations and conclusions with members of those groups from whom the data were originally obtained" (Robert Wood Johnson Foundation, n.d., "Definition," para. 1). This study was considered exempt from institutional review board protocols by the University of Wisconsin–Madison.

Results

Participant Characteristics

Farmers markets participating in the study represented the geographic diversity of the state in terms of location and urbanicity. Two markets were located in southeastern, 5 in southcentral, 1 in southwestern, 2 in northwestern, 2 in west central, and 1 in central Wisconsin (Appendix). Populations of the cities in which the participating farmers markets were located ranged from 8,391 to 599,164 (median=47,134) (U.S. Census Bureau, 2013). Markets ranged in size from 10 to 160 vendors (median=50). EBT initiation at the 10 markets that had already implemented it occurred between 2008 and 2014 (Appendix).

Factors Associated with EBT at Farmers Markets

Interest

EBT redemption required that farmers markets had certain conditions in place. First, an interest in allowing SNAP funds to be redeemed at the market was necessary. This interest may have been generated by the community, the market mangers and/or vendors, or an outside source. Markets with or without EBT redemption acknowledged that food security was formally or informally a part of their markets' mission. Most farmers markets' mission statements included terms regarding "local produce," "healthy," and "access." For example, the Milwaukee County Winter Farmers' Market mission statement includes "equitable access to whole foods" (Milwaukee County Winter Farmers' Market, n.d., "About MCWFM," para. 1). One market mentioned redefining its mission statement to include food access issues; adding this statement made it easier to talk with public health departments, businesses, and other agencies to build partnerships. Several market managers mentioned having an interest in redeeming the funds and researching EBT after having been approached by a local city or health department that offered to provide funds for obtaining the machine. As one market manager noted,

> The market had been interested in doing [EBT] for a little while…I started the application process to become a SNAP retailer…It felt like we were waiting to see if anything was going to come about and we basically said…"we're just going to commit to funding our own anyway." We felt like that was in line with our mission…and then very fortuitously, we got approached by the state of Wisconsin Department of Health and Human Services to participate in this grant, and we got some funding to help purchase the equipment.

Market managers are busy with multiple activities, so adding an EBT machine or changing redemption procedures is a process that can unfold over months or years. Leadership is important in this regard: some leaders perceive and act on an EBT redemption system as a mission of their market, while other managers perceive a different mission and deploy their scarce resources in different ways, or act on different priorities.

Financing

Financing the EBT machine was a barrier common across markets. Three markets received funding from either the city in which the market is located or the organization that operates the market (Appendix). The machine usually costs around US$1,000 (Illinois Department of Agriculture, 2009). Additionally, the market must have a plan in place to pay the wireless and transaction fees. According to market managers, the monthly wireless fee dominated these costs at around US$45 per month; the fee per EBT transaction was about US$0.15. One market manager indicated, "The monthly wireless cost dominates the cost to run the machine. The transaction fees are minute, but if I have to turn on the machine for one person per month then it gets difficult to justify the service." To get past this financial challenge most markets received assistance for EBT costs through grants, local nonprofit organizations, city governments, or health departments. The Dane County Farmers Market (DCFM) received financing from the city of Madison for its EBT program. The bookkeeping functions were performed by a local nonprofit organization, the Community Action Coalition. The markets in Beloit and Green Bay received funding for their EBT programs from the organizations that support the markets, Downtown Beloit Association and Downtown Green Bay, respectively. Both organizations acknowledged that the cost of the program is high, but that they do not anticipate support for the program to disappear.

Three of the markets received external funding for their EBT programs from an agency not associated with the market itself. The Westside Market in Madison, Wisconsin, was awarded a "Transformation Grant" from the Department of Health Services that had money earmarked for food access issues. The market manager noted that the market had already begun discussions regarding how to implement EBT in the market, "and then very fortuitously, we got approached by the State of Wisconsin Department of Health and Human Services to participate in this grant, and we got some funding to help purchase the equipment." Positive aspects of the grant funding were that EBT could accepted with no cost to the market or community, and it was a fairly fast way to obtain the machines and tokens necessary to begin the EBT program. A limitation of the grant funding was that the sustainability of the EBT program was questionable unless another funding source could be identified. The market also needed to have someone on staff capable of grant-writing or forming relationships with government agency staff who could assist with this task.

The Cameron Park Market in LaCrosse tried an innovative method to defer EBT costs. They were the only market in the sample, at the time of the study, to allow EBT transfers using debit cards. Although measures of cost-effectiveness were not yet available, the market manager remarked on positive responses from vendors and customers. The market charged a small fee to cover the transaction, which in turn helped cover the cost of the SNAP transactions done using the same terminal.

Paperwork

There were two types of paperwork to initiate the program once interest was generated and markets made the decision to adopt EBT. First, the proper

paperwork needed to be completed to be granted a USDA FNS identification number for tax purposes. In most cases the markets themselves applied to be an EBT vendor, but in one case vendors within the market applied to have their own EBT identification numbers. Most markets apply instead of vendors because it reduces the amount of paperwork required.

Second, market management had to incorporate administrative tasks into their routine. Often this involved some paperwork; for instance, the DCFM had to establish an agreement with the local organization Community Action Council (CAC) to do bookkeeping for SNAP transactions on a weekly basis. Following that negotiation, the market and CAC signed an agreement regarding the actual transfer of information, records to be kept by CAC, and payment to vendors for the money earned in SNAP/EBT sales. For some markets these partnerships were already in place, relationships were strong, and partners were willing to bear the administrative burden, which made the process easier for market management. In other situations the administrative burden and/or the absence of willing partners inhibited participation in EBT transactions.

Training

Once an EBT machine was functional and financed, the market needed to decide how to perform the redemption on market day. Markets trained volunteers or employees on how to operate the EBT machine. Occasionally partners participated in the training. In smaller markets the farmers market manager typically assumed this role. However, in larger markets the EBT machine was operated by volunteers. This included swiping the EBT cards and providing the tokens or vouchers for redemption at the vendor stalls. At the end of the market day, a volunteer or often the market manager went around to all market vendors and recorded the number of tokens redeemed at each vendor, the most common mechanism for collecting EBT payments by customers. In one case this process also included payment to the vendors.

Our data indicate that, like interest in EBT, training in its use develops over time in processes that incorporate new experiences, and markets occasionally find support in partner organizations. For instance, in the La Crosse market the manager noted that, "we do a training at the beginning of the season… It consists of me going around and speaking with them [vendors]." However, the manager notes difficulties in training non-English speakers, "Honestly, the one place where we have a gap, I think, is, our Hmong vendors because there's a little bit of a language barrier. But a lot of times there will be somebody else working with them that has better English, like a second generation [vendor] or something, that we can speak to really easily, but because their family operations, there's lot of times people working." This manager identified a need for training, but also went on to show how partners can help supply training, saying, "Last year, for the first time though we had someone from the Health Department speak, so she even helped us do the training. And I think next year I kind of want to do that again just because we do have a couple new vendors and it's always good to make sure they understand exactly." These data illustrate how market managers are responsive to opportunity and sensitive to the needs of their vendors. Appreciating the multiple processes in place is an important element of understanding adoption and practice of EBT in markets.

Reimbursement Processes

Reimbursement of market vendors, another aspect of financing, was also cited as a barrier. Tracking and reimbursing payments requires substantial bookkeeping. Most markets reimbursed vendors biweekly or monthly to eliminate the number of checks written. As the Cameron Park manager noted, "This year we're doing every other week redemption…But it is hard [for vendors to wait]." This market previously reimbursed every week, but was spending a large sum to purchase checks. Some markets additionally required a minimum number of tokens for a check to be written (e.g., US$10.00) so that the cost of ordering blank checks did not outweigh the benefits of the program. In contrast, the Oshkosh Saturday Farmers Market, a year round, large market located in northeastern Wisconsin, currently has volunteers who reimburse vendors daily. Vendors generally

prefer to be reimbursed on market day for the product they sold. While the time intensity for reimbursement and the cost of blank checks makes this difficult, after a few cycles of redemption market managers noted more positive feelings and vendor trust toward the redemption process and greater support for the program overall.

Market managers also mentioned difficulties with token swapping, where tokens "purchased" at market "A" were redeemed at market "B." This happened when several markets with EBT redemption were located close together. This exchangeability of EBT tokens occurs because the EBT stamp is on one side of the token, but during the transaction the vendor may not look at the other side, which indicates at which market the EBT reimbursement occurred. Market managers suspected that this is an informal market system occurring from vendor to vendor rather than customer to vendor, but still creates an issue for the market because they are not able to reimburse the vendor if they do not turn in the tokens unique to the market at which they are vending. This problem is exacerbated because tokens purchased on one day can be redeemed during later weeks, and market managers often noted that the EBT amount swiped rarely equals the amount redeemed that day. This makes it difficult to balance the books during weekly farmers market hours.

Market managers, however, have mixed impressions about the difficulties presented by this situation. At the Dane County Farmers Market, the cost CAC imposes to handle transactions is of more concern to management then the burden on vendors from having to wait for that portion of their sales. According to the market manager, "the Community Action Coalition handles all of the bookwork. They send out checks once a month. You know, which was a bit of an adjustment for the members [who asked] 'What, you mean we're not going to get cash right away?'" The proportion of income earned from EBT was relatively small, and vendors grew accustomed to waiting. From the manager's point of view, negotiating with and paying CAC was the chief problem: "you know, funding is an issue. Funding the operation is probably the biggest challenge."

This returns us to the questions of relationships with the market's community and its community partners. Managers reported that another challenge farmers markets face when implementing EBT is the distinction between debit cards and EBT cards. Some markets use tokens for both EBT and debit card transactions, and these must be separated due to the rules on products that can be purchased with EBT funds. This must all be tracked for an accountant to reconcile later in the week. This is often the farmers market managers' duty in small markets, but for large markets the accounting function is contracted out to volunteers or local businesses. For instance, DCFM, the large market that contracted with CAC, said, "we have given some money to Community Action Coalition to kind of keep things going and keep things afloat. We had kind of a tough situation earlier this summer because they—they wanted money. And we were like okay, that's fine but we need to see documentation to see where it's going. It got a little dicey. We said we're not going to give you money until you show us documentation. They're like, 'we're working on it.' And then the city and the county came along with a grant." Again, this quotation reveals how ongoing relationships are both sources of concern and support to market managers.

Obtaining Compliance from Vendors

Every market, with one exception, mentioned the challenge of obtaining compliance from all eligible vendors. Market managers provided examples of political opposition or language barriers when describing why this opposition to the EBT program occurred. For example, in the case of Hmong or Hispanic vendors, "there's a little bit of a language barrier. But a lot of times there will be somebody else working with them that has better English, you know, like a second-generation [vendor] or something, that we can speak to really easily." This quotation from training was important for interaction with customers using EBT tokens as well. Farmers market managers reported that some vendors equate the EBT program with "government handouts" and thus refuse to accept transactions from these customers. Additionally, many Wisconsin farmers market vendors are Hmong or Hispanic, meaning that their primary

spoken language is not English. This makes it difficult to understand the entire EBT process or ask questions when the process is unclear. A few markets have added board members who are fluent in both languages to reduce these barriers. The bilingual board members often translate important documents as well as translate during meetings for vendors in order to assure understanding of and compliance with market rules and EBT redemption procedures. They are also available to assist customers when necessary on market day.

Advertisement

A challenge mentioned by all market mangers, some when prompted, was the need to advertise the fact that EBT is accepted in order to obtain a larger customer base and maximize profits for the vendors and leverage the cost of the wireless fee. The farmers market managers had tried several marketing tactics. Most made note of EBT acceptance on all their press releases, Facebook pages, websites, newsletters, and flyers. However, others obtained support from the local health department, community centers, and even local grocery stores to target advertising to individuals already redeeming their SNAP benefits, but who are not doing so at the farmers market. One market manager expressed how the market had targeted areas of the community to publicize EBT, "So this year we sent out a letter to all of the churches in the area, not just [our area] but kind of the county and surrounding communities. We delivered posters to some of our lower-income facilities. We're trying to get the word out as much as possible." Successful marketing campaigns bolstered the number of customers and volume of transactions each week.

Community Support

Markets with EBT programs maintained strong community ties that provided help in the way of advertising, funding, staffing, marketing, and grant writing. The Milwaukee County Winter Farmers' Market has partnered with the Hunger Task Force and Indian Health Center to help promote its market, the acceptance of EBT funds at the market, and its additional US$20 voucher program. Other markets have partnered with local health departments, grocery stores, and state agencies to promote the fact that their market accepts EBT. Managers at three of the 10 markets operating EBT reported partnering with local nonprofit organizations that assisted in everything from financing the EBT machine to facilitating redemption. The market in Plymouth, Wisconsin, partnered with United Way to cover the costs associated with the machine. As the market manager stated, "Well, we decided that we wanted to do it…Then we approached United Way and they went, 'Of course.' They got the money for us to put the machine in and now they support us in the market every year to pay for any of the fees." We are not surprised that market managers have developed partnerships with government and business in order to foster vendor success.

Likewise, the Stevens Point Farmers Market was able to implement the EBT program with the support of the Central Rivers Farmshed, which received a Centers for Disease Control grant to operate EBT at two local markets. The Milwaukee County Winter Farmers' Market has supported EBT for many years and was the only market in the city until the 2014 season to do so. A staple of its winter program was a match of US$20 in EBT funds, which increased marketing through EBT participants' word of mouth and thus increased vendor sales. The funds for this program and the EBT machine came from the Farmers Market Promotion Program, a USDA program to increase direct producer-to-consumer market opportunities (USDA AMS, n.d.). Another noteworthy example of a market receiving assistance with EBT redemption is the MadMarket Double Dollars program in which the city of Madison partnered with CAC and local businesses to provide more tokens for individuals redeeming their EBT funds at four farmers markets in Madison. Customers who used EBT at the markets received double the amount they were allowed to spend, up to US$25.00. Partnerships with cities or organizations were very helpful in garnering support for EBT programs. Benefits of these partnerships were that there are numerous connections involved, such as local businesses, that can also be approached for support.

The Oshkosh Saturday Farmers Market partnered with two local Rotary International organizations to operate its EBT redemption

program. Volunteers from Rotary International assist in staffing the EBT redemption booth and reimbursing vendors on market day. The Central Rivers Farmshed provided the staffing and financial support for EBT redemption at the Stevens Point Farmers Market. Successful cooperation and mutually beneficial relationships between market managers, the market vendors, advisory leadership teams, and the organization led to successful EBT redemption in all of these markets.

Barriers to EBT Adoption Among Markets Without Acceptance Programs

Among the three market managers interviewed whose markets did not accept EBT, three themes emerged. First, the *small market size* led to concern over the volume of EBT transactions the market could produce. All the markets in our study that did not have an EBT program had fewer than 30 vendors. The cost of obtaining the EBT machine and the anticipated operational costs were not perceived to be worthwhile to the markets at the current time because their customer demand was low. Second was *the amount of work* required. At smaller markets the manager often works only part-time. When a manager is only paid to spend 10 hours per week or less on market work, it is difficult to find time to perform other duties. The market day itself often required six or more hours, leaving little time for other duties. Third, most of the market vendors *already accepted WIC.* Although SNAP was not accepted through EBT at these markets, another form of federal nutrition assistance, WIC, was accepted at the market and the market managers felt that they were partially meeting the demand. As one market stated, "The vendors accept WIC, we know it is not the same, but at least it's something."

Perhaps most promising, all the managers whose markets did not have EBT yet expressed a *desire to accept EBT* in the future. They agreed with the premise of the program and the potential it has to improve food security. However, they expressed that, at the time of the interview, the costs did not justify the benefits. A market manager summarized all these issues as shown in this quotation: "And it's just the two of us, and I'm part-time. So we can't make it work, but I wish we could."

Member Checking

Data and results from the study were presented in an hour-long presentation to the Wisconsin Farmers Market Association at the Wisconsin Fresh Fruit and Vegetable Growers Conference on January 26, 2015. This activity provided an opportunity to summarize the preliminary study findings and receive feedback from a larger set of farmers market vendors and managers. The results of the member checking generally supported the interpretation of the interview data and the themes identified as related to EBT implementation or lack thereof. Member checking validated the importance of the subcategories. Agreement was very strong with the relevance of having a motivated market manager, with many unsolicited comments regarding individuals who took time when they were "off the clock" to work to obtain an EBT machine for their market. Additionally, the importance of community partnerships was supported and new examples were provided, such as a hospital that is working to partner with farmers markets to provide "gift certificates" for fresh fruit and vegetable baskets for patients at or below the federal poverty line. EBT operational issues were also agreed upon by the audience, especially in regards to how to reimburse vendors. Markets that perform direct deposit described their methods to reimburse vendors weekly and avoid the nuisance and costliness of ordering checks.

Discussion

To understand some of the barriers to offering EBT at a farmers market, we investigated factors associated with implementation of EBT redemption systems at farmers markets using grounded theory analysis. From the farmers market manager interviews, the major themes of interest, training, advertising, community support, and having a motivated market manager were identified as important facilitators for both initiating and sustaining a successful EBT program. Overcoming financial barriers, paperwork, reimbursement methods, and enforcing vendor compliance were identified as barriers to implementing and sustaining an EBT program. We believe our findings can be summarized as providing a deeper understanding of the processes market managers interweave

and navigate in the course of establishing an EBT program.

The acceptance of nutrition assistance benefits through EBT at farmers markets is an emerging research area. It has the potential to positively affect consumers, vendors, markets, and communities. Although the program was established nationally in 2002, EBT is still not offered at all farmers markets. Market managers, vendors, and community organizations are now realizing the potential benefits of accepting SNAP through EBT. Vendors and market managers often see EBT as a new revenue stream. They may also see EBT as a way to improve community food security and a way to get fresh, healthy fruits and vegetables to low-income individuals.

Our study suggests that although markets often have their own unique nuances to EBT redemption, the themes of the challenges and facilitators are consistent across the markets sampled. Characteristics of the challenges to and facilitators for EBT redemption at markets were explored through grounded theory analysis. Having community support, finding strategies to successfully deal with operational issues, having motivated market mangers, and having a mission statement inclusive of food security were identified as factors that had contributed to successful EBT implementation. These themes encompass those identified with positive feelings about EBT from a recent study performed in Michigan (Montri, Behe, & Chung, 2013). This study indicated that ease of reimbursement and a low administrative burden for vendors, along with the belief that accepting food assistance increased their customer base, were associated with positive feelings toward EBT. These themes fit under operational issues in our study. These results indicate that the themes identified in the study may be generalizable to other areas of the U.S. Difficulties with and strategies to obtain funding, marketing, and positive support were expressed repeatedly as barriers by study participants; this agrees with findings reported by previous literature (Cole, 2013; Farmers Market Coalition, 2016; Krokowski, 2014; Payne, Wethington, Olsho, Jernigan, Farris, & Walker, 2013). Funding has remained a challenge for EBT redemption because of the high up-front costs associated with this program. Marketing remains a problem in that many individuals who receive SNAP funds are not aware they can use them at the market. Our finding of the role of the mission statement and its positive influence on the move to adopt EBT is a novel contribution of our study. An interest in improving food security was noted in a study performed in San Francisco markets (Jones & Bhatia, 2011), but there was no direct mention of a mission statement. However, Wholesome Wave recommends examining a market's mission statement as one of the first steps to determining if a market is ready to implement EBT (Owens & Verel, 2010). Future research should investigate the role of this factor and consider it as a potential strategy to increase interest in EBT adoption at farmers markets.

No two markets were alike in their approach to EBT funding, yet several markets developed successful mechanisms for EBT redemption. Markets continue to change their EBT redemption practices to streamline the process and increase the dollar amount redeemed. Identifying and understanding the similar, yet unique, challenges that farmers markets face when implementing an EBT program can help new markets or markets considering changing their practices to improve their redemption process. Farmers markets should assess each method to determine which method or combination of methods will work best based on their own unique needs.

In light of all the different methods undertaken by farmers markets to redeem FoodShare benefits in this small sample in Wisconsin, it is clear that no one-size-fits-all prescription for EBT redemption at farmers markets exists. Each market must do what fits the organization itself with regards to financing and operation. Farmers markets have successfully implemented EBT programs through both grant funding and community support. They have also been successful with reimbursing vendors daily, monthly, or on some schedule in between. This process is completely dependent on the needs of the market, its managers, and its vendors.

The ability for markets to design unique reimbursement programs in order to overcome barriers to the redemption of federal SNAP dollars

is not unique to Wisconsin. Farmers markets across the U.S. are designing their own programs to maximize the SNAP funds redeemed. In Arizona, simply providing EBT machines to farmers markets resulted in an increase in SNAP redemption and overall market spending in 80% at the markets (Bertmann, Ohri-Vachaspsati, Buman, & Wharton, 2012). The Philly Bucks Program in Philadelphia, an intervention that provided US$2.00 incentives which could be redeemed for fruits or vegetables at a farmers market, showed an increase in SNAP redemption up to 5 times higher than before the intervention (Young et al., 2013). A program in Nashville, Tennessee, brought a farmers market into a low-income neighborhood and awarded students and adults "Super Shopper" status for completing surveys, which translated into vouchers for the market (Freedman, Bell, & Collins, 2011). The market gained new customers and had a high retention rate of those new customers. A study in North Carolina identified the most important reasons for EBT use at farmers markets as being able to use nutritional assistance dollars, having transportation, and knowledge of market's operational hours (Leone et al., 2012). While these studies are mostly from the users' perspectives, they highlight two important points with regards to users. First, not accepting SNAP is a major reason for individuals not visiting farmers markets, and second, individuals with SNAP benefits are often unaware they can be used at farmers markets that accept EBT. These results are promising in encouraging continued implementation of EBT at farmers markets around the country. In early 2015, the Farmers Market Coalition announced that through a partnership with USDA FNS, EBT equipment will be provided to farmers markets for up to 3 years. This lifts some of the burden off the markets themselves to initiate the program and make it economically viable in the first few years (Farmers Market Coalition, 2015).

All market managers noted that EBT was a major undertaking. Most agreed that it required half a market season to work out all the nuances associated with the machine and reimbursement. However, once the program was underway, all the market managers noted that it worked well and they would continue doing it. Expending the time and energy needed to implement an EBT program and then sustain it are truly commendable when considering all the issues that must be overcome in order to operate a successful EBT program.

This paper highlighted some of the mechanisms used to successfully overcome barriers to EBT implementation and some of the positive and negative aspects associated with the overall process. This is one of the first studies to attempt to identify issues that the farmers market has in implementing an EBT redemption program, and the first to do in-depth interviews with specific markets with open ended questions. A grounded theory approach was used in order to synthesize the data available from all interviews performed. Grounded theory allows for studying participants' meanings, intentions, actions, and situations. In addition it allows for the study of diverse processes and relationships between individuals and the process (Charmaz, 2003), in this case market managers and SNAP/EBT redemption. Instead of generating a list of over 20 strategies for how farmers markets can operate SNAP/EBT effectively, it allows for synthesizing the data using memos, thus strengthening the results by providing examples of the major themes and concepts identified (Charmaz, 2003). Grounded theory also allows for researchers to check the concepts and theories that were developed with new sets of data or others interested in the topic through member checking. For these reasons grounded theory was used over other qualitative methods, such as narrative research, phenomenological research, ethnography research, or case study research. Narrative research, ethnography, and case study research all focus on the unit of analysis of a single individual (Creswell, 2013). Phenomenological research is used to understand how individuals perceive a process (Lester, 1999). Phenomenological research would have been used if the research team interviewed farmers market customers, EBT operators, market manager, and farmers market board members, for example, to synthesize the perceptions of this diverse group of individuals who interact with the EBT process. Although the research team was interested in the stories told by the market manager (narrative), the cultural context of the market (ethnography), and

the experience of the market manager (phenomenological), grounded theory allowed the research team to combine all these elements to answer the essential question.

Much of the work related to EBT redemption has been on barriers to use by those receiving SNAP benefits (Berzins, 2004; Colasanti, Conner, & Smalley, 2010; Dixit-Joshi, Burke, Das, & Williams, 2014; Flamm, 2011; Grace et al., 2007; Kaye, Lee, & Chen, 2013; Payne et al., 2013; Wetherill & Gray, 2015). Social stigma, unnecessary burden, higher perceived cost of produce, and lack of knowledge about EBT acceptance at farmers markets were identified barriers to using SNAP at farmers markets from the beneficiaries' point of view (Colasanti et al., 2010; Dixit-Joshi et al., 2014; Kaye et al., 2013; Wetherill & Gray, 2015). In order to implement SNAP/EBT successfully, interventions must be designed with the involvement of market managers, vendors, and consumers. Studies on facilitators to successful EBT from a farmer/vendor perspective include promotion of program, increased sales, and satisfaction with program design (Krokowski, 2014; Oberholzer, Dimitri, & Schumacher, 2012). Yet little work has been performed on understanding barriers from the farmers market's perspective. This paper fills this void and should serve as a starting point for more research. From a public health perspective, this paper serves to identify several of the barriers to EBT redemption that exist across most farmers markets.

Strengths and Limitations

This study has several strengths. This was the first study, to our knowledge, to provide a deeper investigation into reasons for successful EBT redemption methods in farmers markets. The qualitative nature of the interviews allowed for each farmers market manager to tell a narrative for his or her market, allowing for the identification of themes not previously researched. Finally, these interviews included farmers markets from all across the state and markets of many different sizes, as well as markets without EBT redemption methods, allowing for a wide range of issues with EBT to be explored.

There are also limitations of this analysis. This study was limited to farmers markets in Wisconsin. The sample size was small (13) due to the in-depth and time-intensive nature of the on-site interviews. This number and the overall participation rate of 57% (13 of 23 markets) was similar to other qualitative studies in which interviews were conducted, rather than limiting the study to online surveys (Hasin et al., 2014; Krokowski, 2014; Ward et al., 2015). In performing member checking it became apparent that many other EBT redemption methods, outside the 13 markets interviewed, occur in the state and were not included in this study (e.g., weekly direct deposit to vendors for EBT tokens). Additionally, this study focused on barriers to EBT redemption by the farmers markets themselves. It did not include information on consumer-focused issues which might enhance or detract from participation with farmers markets or EBT. This dynamic relationship between consumers, vendors, markets, and SNAP should be further explored. Furthermore, we were only moderately successful in recruiting managers from markets that have not implemented EBT for our study. Further research should find strategies to include the voice of these markets, as they can provide additional insights regarding barriers to EBT adoption.

Recommendations

From the managers' narratives, some lessons regarding effective strategies to implement EBT can be drawn. Additional resources provided by markets currently operating an EBT machine would be useful for markets that have not been able to implement EBT transactions. Tool-kits such as the one provided by the Virginia Farmers Market Association[1] (n.d.) as well as some "lessons learned" of successes and failures from other markets would be useful for market managers either initiating or struggling to maintain an EBT redemption program. The most important strategy uncovered is connecting the farmers market to other community sectors, such as business, government, nonprofit, clinical care, and public health. Through partnerships with these organizations, markets can receive assistance with

[1] http://www.vfmma.org/instructional/snapebt-tool-kit

promoting and marketing the farmers market and EBT that will help attract new customers, finance the cost of EBT, operate the machine, and increase staffing to run EBT operations smoothly. Covering the cost of EBT could include a broad range of financial help, from providing incentive programs for EBT users, helping apply for grants to cover the cost of the machine, or providing funds to cover the cost of the machine or internet fees. Additionally, individuals from these sectors might help operate the machines and perform the paperwork for the farmers market. Building these community partnerships assists with operational issues of EBT.

The largest barrier to EBT redemption according to this research is financing the machine. This barrier was noted in all interviews. Through community and business partnerships the machine can be financed and operated successfully, as exemplified by many markets in this study. Having programs that funding the machine and pay for the monthly wireless fee is especially important for markets new to EBT. The removal of costs might persuade them to try EBT at their farmers market if they do not have to accrue any immediate implementation costs. These recommendations can be applied to other nutrition assistance programs such as WIC and SFMNP. Although those programs still operate using paper vouchers, they will imminently be transitioning to EBT type redemptions.

There are many recommendations for future research and policy as well. Researchers should investigate how to best market the EBT redemption program at farmers markets to increase the volume of EBT transactions. This work might focus on where the advertising should be located, who should be responsible for the advertising, what methods are most successful, and how new customers are obtained, as well as how likely customers are to return. Simply adding an EBT machine at a market will not immediately remove the barriers to accessing healthy food. However, it is one step in the process. Research must be conducted to identify characteristics of SNAP beneficiaries who currently shop at farmers markets, and then interventions must be designed to attract new customers to the market to improve the number of EBT redemptions. Market research is also needed on the sustainability of EBT at markets. Market size and the cost of the machine versus the volume of transactions may play important roles in a farmers market's decision to implement or continue EBT in the future. Additional research should focus on location of farmers markets and redemption practices. Very preliminary work from our study suggested that in Wisconsin, census tracts with farmers markets were more likely to be categorized as a food desert compared to census tracts without farmers markets. This is contrary to current theories, as farmers markets are believed to be located in wealthy areas where food insecurity is not an issue.

Two additional analyses are proposed. First, a study of EBT redemption at farmers markets and their census tract demographic characteristics (percentage of population receiving SNAP, percentage minority, etc.) across the U.S. should be conducted to determine if EBT is being located where it is of most need. Second, researchers should perform a cost-benefit analysis on a random sample of farmers markets across the U.S. in order to determine how to best maximize the program. Finally, policy implementation must follow the results of this study, the former studies, and the suggested studies. San Francisco mandated that all farmers markets accept SNAP funds through EBT (Jones & Bhatia, 2011). However, this policy has community support and a reliable funding source. Such benefits might not be available to all markets. Thus EBT is promoted at farmers markets, but more research is needed to understand the true cost and social and health impacts of the program.

Conclusion

Farmers markets have the potential to reduce food insecurity and improve access to healthy foods among economically disadvantaged populations. However, to date access remains limited by the small percentage of markets in low-income neighborhoods that accept SNAP benefits through EBT. Understanding the main barriers as well as effective strategies for successful implementation of EBT in farmers markets is imperative to realize the full potential of these outlets. There are many challenges to EBT acceptance for farmers markets, related mostly to cost, operational logistics, and

ensuring sufficient demand. Community partnerships can assist markets with obtaining funding, establishing operating procedures, and marketing. Motivated market managers and a mission statement targeted toward food security also facilitate adoption and maintenance of EBT. Finding ways to streamline redemption and reimbursement procedures is an important challenge. Strategies vary across markets and must match the needs of each market and the community it serves. Policies and programs to remove barriers to EBT implementation and resources to promote sharing of successful stories are warranted. Further research into understanding the various processes associated with establishing EBT is also warranted. We believe that each market has a particular story to tell about these interwoven processes; however, we also believe that similarities can be discerned in different markets, and these need to be understood and described in order to make other, more general policies and recommendations that market managers can follow. 

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Appendix. Sample of Farmers Markets Included in the Study and Their Characteristics

Market Name	Year Market Initiated	Year EBT accepted	Maximum Number of Vendors (2014 Season)	WIC	EBT	EBT Funding Stream	Incentive Program	Interviewee Role	Years in Role	Gender	Type of Interview
Beloit Farmers Market	1965	2013	96	√	√	Grant funded by Beloit Downtown Association		City official	3	F	Phone
Cameron Park Market (LaCrosse)	2003	2013	65	√	√	Transformation Grant from County Health Department	√	Market manager	3	F	In-person
Chippewa Falls Downtown Market	2000		30	√			√	Part-time manger	2	F	In-person
Dane County Farmers Market (Madison)	1972	2008	160	√	√	City of Madison financed		Market manager	2	M	In-person
DeForest Farmers Market	2008		16	√			√	Market Manager	3	F	In-person
Green Bay Saturday Farmers Market	1916	~2010	100	√	√	Downtown Green Bay Association	√	Market manager/city employee	2	F	Phone
Milwaukee County Winter Farmers market	2009	2012	40		√	Grant Funded	√	Market manager	3	F	Phone
Oshkosh Saturday Farmers Market Inc.	1994	2010	160	√	√	Rotary International		Market Managers & EBT manager	8	M	In-person
Plymouth Farmers Market	2007	2009	10	√	√	United Way	√	Market Manager	5	F	In-person
Stevens Point Farmers Market at Mathias Mitchell Public Square	1870	2011	60	√	√	Grant funded through CDC by Central Rivers Farmshed	√	EBT Manager	5	F	E-mail
Sun Prairie Farmers Market	1986		28	√	*		√	Market Manager	2	M	E-mail
Tosa Farmers Market (Wauwatosa)	2009	2014	50	√	√	Grant Funded	√	Market Manager	1	F	In-person
West Side Community Market (Madison)	2005	2013	45	√	√	Wisconsin Department of Health Services	√	Market Manager	2	Male	In-person

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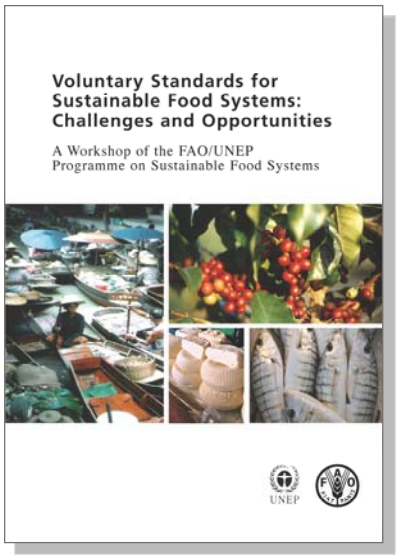
Food system sustainability standards: Room for everyone?

Keith Williams *
College of the North Atlantic, Carbonear Campus



Review of *FAO/UNEP Workshop on Voluntary Standards for Sustainable Food Systems: Challenges and Opportunities,* edited by Alexandre Maybeck & Suzanne Redfern. (2014). Published by the Food and Agriculture Organization of the United Nations; 242 pages; available as free PDF. See more at the FAO website.

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Fair-trade coffee is a familiar item in most Canadian cities and towns, and most grocery stores now stock organic produce. These products are examples of voluntary sustainability standards (VSS) and were introduced into the Western marketplace in the 1980s. VSS "are voluntary schemes conveying information of relevance to sustainability about the process of production of specific products according to a reference standard or measurement" (Maybeck & Gitz, 2014, p. 173, in Maybeck & Redfern, 2014) and are typically implemented by businesses, assessed by third parties, and driven by consumer demand (Maybeck & Redfern, 2014).

The past decade has witnessed a proliferation of VSS, driven by consumer demand for safe, high quality, and ethically and sustainably produced goods (Blackmore & Keeley, 2012). VSS are a promising mechanism by which we might increase worker rights, enhance ecosystem services, and improve the quality of various goods. Even so, VSS schemes have come under criticism on a number of counts, such as excluding smallholder farmers and all farmers in low-income countries due to high certification and compliance costs. VSS (such

* Keith Williams, Campus Director, College of the North Atlantic, Carbonear Campus; 4 Pike's Lane; Carbonear, Newfoundland and Labrador, A1Y 1A7 Canada.

Keith Williams is the campus director at College of the North Atlantic's Carbonear Campus. He is an educator and applied researcher with an interest in promoting food sovereignty for Canada's Atlantic Provinces. Keith can be reached at keith.williams@cna.nl.ca.

as fair-trade) provide no provisions for greater benefits to farm employees above the accepted industry standards. Finally, the premiums charged for VSS products are consumed in support of the cooperatives and other associations necessary to manage the VSS designation (Henderson, 2008) rather than yielding higher returns to the smallholders producing goods for the fair-trade market.

In 2010, the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Environment Program (UNEP) Sustainable Food Systems program formed an Agri-food Task Force composed of representatives from various governments, UN agencies, civil society organizations, and the private sector. The purpose of this task force was to develop a coordinated approach to sustainable consumption and production, share knowledge, build partnerships, and mobilize resources (Maybeck & Redfern, 2010).

The workshop from which these proceedings were prepared was designed to address issues that would help the task force enhance VSS uptake and scaling, including making VSS work for small-scale producers, processors, consumers, and the private sector. The workshop also looked at exploring green trade opportunities and the role of the public sector in facilitating VSS.

I am currently living and working in the province of Newfoundland and Labrador, Canada. Newfoundland and Labrador produces only 10 percent of the food consumed domestically. Its isolation and lack of domestic food production make the province very vulnerable to transportation disruptions (Quinlan, 2012). In my own experience, grocery shelves are bare if the ferry does not make it across the Gulf of St. Lawrence. There is tremendous potential for increasing food production in Newfoundland. Voluntary standards might help to both increase the consumption of locally produced food and build a greater export market. My original desire in reviewing *Voluntary Standards for Sustainable Food Systems* was to learn more about how voluntary standards can help increase food sovereignty in Newfoundland and Labrador.

The workshop proceedings include a mix of academic research, field reports, case studies, and situational analyses. The work is written at a high level, appropriate for the intended audience—that is, members of the task force. However, despite the specific purpose of this document, there is still some value for a range of readers, including members of producer associations, food animators, policy makers, and researchers.

In one paper, Santacoloma (2014) identifies a concern regarding VSS: the exclusion of small-scale producers and food processors due to implementation costs imposed on them in order to achieve certification. This paper reports on a review of over 100 studies on the impact of VSS on smallholder market participation that found that VSS can facilitate smallholder capacity-building, thereby facilitating access to markets. This may be the case, for example, when there is a technical and business support package as a component of the certification process, or if a farm's size and assets are sufficient to support costs associated with certification. However, VSS can act as a barrier to smallholder market participation when smallholders lack the resources necessary for the initial investment in the certification process or if rural agricultural infrastructure is underdeveloped (Loconto & Dankers, 2013, in Santacoloma, 2014).

In another paper, Loconto and Santacoloma (2014) synthesize key lessons after studying VSS schemes in various countries. They found that projects had higher chances of success based on the following factors:

- if a market already exists for a given certified product;
- if cost-benefit analysis is conducted to determine project feasibility;
- if support exists beyond certification and governance systems to ensure continued capacity building and product guarantees; and
- if an evaluative approach is built into project planning to support evidence-based decision making.

Both this paper and the one prepared by Santacoloma (2014) provide suggestions that could be of value to agriculture industry associations or other community food animators interested in implementing a VSS scheme.

In another paper published in the proceedings, Antonelli, Al-Bitar, and Pugliese (2014) describe experiences with quality labeling in the Mediterranean region and highlight some case studies in which VSS have helped to build capacity for smallholder farmers and processors. For example, they report on a federation of women olive-oil producers in the mountainous Rif region of northern Morocco. The group organized to produce higher quality oil and other diverse agricultural and value-added products. A VSS quality designation helped them maintain traditional knowledge, diversify their output, enhance their standard of living, secure support from their regional governments, and upgrade processing equipment to an international standard. The authors of this paper wisely caution that national and regional capacity for quality monitoring must be factored into VSS project design.

Pastore (2014) outlines the role of the FAO in engaging with the private sector, which the FAO defines broadly as including farmer organizations, cooperatives, enterprises, industry and trade associations, research and academic institutions, and more. Areas of engagement are discussed in this article. However, despite the FAO being subject to the 2007 United Nations Declaration on Rights of Indigenous Peoples, there is no discussion of provisions to support market access for Indigenous peoples, who are considered a globally marginalized demographic. This failing does not rest at Pastore's feet exclusively; only three articles in the proceedings mention traditional knowledge (TK) or Indigenous rights.

One of the more interesting articles in the collection presents a study describing how a protected designation of origin (PDO) designation was used to reassure consumers regarding the quality of earthquake-damaged Parmigiano-Reggiano cheese ("Parmigiano-Reggiano damaged by earthquake," or PR-T) in May 2012 (Finardi & Menozzi, 2014). In the article, the authors propose that PDOs can be used as tools for regional resilience in the face of disaster. They described marketing and sales of PR-T, championed by Coldiretti (the primary Italian farmers' union), as "bottom up, self-organizing...and characterized by deep emotional participation by consumers" (Finardi & Menozzi, 2014, p. 152). The authors delivered a questionnaire to 200 consumers to elicit feedback on consumer demographics and behavior (past behavior, behavior post-earthquake, and motivations). They discovered that social networks played a prominent role in consumers' decisions to purchase PR-T and suggest that a 'sense of belonging' influenced consumer behavior as well. They ground these observations in 'embeddedness' theory (Polanyi, Arensberg, & Pearson, 1957, in Finardi & Menozzi, 2014), which suggests that social relationships underpin and shape economic relationships. The implications for disaster-affected regions with large diaspora populations are significant. For example, a coordinated effort to support VSS for some artisanal Syrian food producers could help to create pockets of stability in Syria and other countries in the region affected by the Islamic State. The results presented in this article are also tantalizing when considering Atlantic Canada's food sovereignty. As a Nova Scotian and a resident of Atlantic Canada, I recognize that Atlantic Canadians have a strong sense of place. There are generations of economic migrants from Canada's Atlantic Provinces who have relocated across Canada and beyond for work (Nolan, 2007). This vast diaspora with a strong attachment to their home provinces could play a role in increasing the viability of small-scale food production here, particularly using VSS as a means to identify Atlantic food products.

Contributing authors emphasize the important issue of smallholder participation in VSS. Much of the extant data presented or drawn on in these proceedings suggest that collective action by farmers and value-added producers is critical for smallholder uptake and scheme success. Despite UN and UN-FAO commitments to equity for Indigenous peoples (FAO, 2010; UN General Assembly, 2007), there is little mention and no discussion regarding supporting VSS adoption and market access for Indigenous farmers and value-added food producers. Gender mainstreaming, a strategic objective for the FAO (FAO, 2009), also receives short shrift. Women's participation in VSS is discussed, but almost as a footnote, without analysis regarding inclusionary needs or discussion of best practices, thereby leaving the steps to effective gender mainstreaming a mystery. Overall, the

proceedings effectively highlight current thinking around VSS and make recommendations for successful implementation of VSS in a variety of contexts. The contributors take particular care in discussing smallholder inclusion. Despite the shortcomings of this particular volume, I believe voluntary standards have potential for enhancing small-scale food production in Newfoundland and Labrador, especially if provisions are made to include Indigenous food producers and women. 

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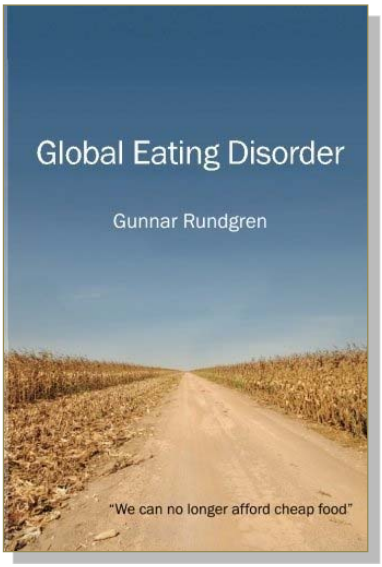
Putting the world on a better diet: A review of *Global Eating Disorder*

Grace Gershuny *
Green Mountain College



Review of *Global Eating Disorder,* by Gunnar Rundgren. (2014). Published by Regeneration, Uppsala, Sweden; 400 pages; available as hardcover, paperback, and Kindle.

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Gunnar Rundgren has written a comprehensive analysis of the current state of the global food system, how it got that way, and what it will take to move toward a more regenerative and equitable one—or, more to the point, toward diverse, locally appropriate systems. *Global Eating Disorder* takes the reader through a metaphorical menu that encompasses the ecological and economic dimensions of each course, and serves up the associated historical, political, and cultural considerations with relish. Prodigiously researched facts support Rundgren's arguments at every step. It all adds up to the conclusion that the way most food in today's globalized and industrial food system is produced, manufactured, transported, and marketed is creating poor health among the humans who consume it as well as the planetary ecosystems that sustain us all.

The author has a deep background as a leading international advocate, consultant, and practitioner of the kinds of solutions he envisions for the dessert course of this meal. Starting as a pioneer organic farmer, Rundgren helped develop Sweden's well-respected organic labeling scheme (KRAV), then later served as president of the International

* Grace Gershuny, Faculty, MS in Sustainable Food Systems, Green Mountain College; 1417 Joe's Brook Road; St. Johnsbury, Vermont 05819 USA; +1-802-633-4152; gracegershuny@gmail.com

Grace Gershuny is an author and consultant, and has written extensively on soil, compost, and food system issues. As a staff member of USDA's National Organic Program in the 1990s she helped develop the organic regulations. Her latest book is *Organic Revolutionary: A Memoir of the Movement for Real Food, Planetary Healing, and Human Liberation.*

Federation of Organic Agriculture Movements (IFOAM) world board from 2000 to 2005. Since that time he has been a consultant and trainer, primarily in developing countries, and has helped draft policy documents for various UN agencies. *Global Eating Disorder* builds on information collected in the course of his work, as well as on ideas elaborated on in his previous book, *Garden Earth: From Hunter and Gatherer to Global Capitalism and Thereafter*, published in 2010.

Rundgren's "Appetizer," a brief essay that serves as the book's prologue, relates his experience as a consultant to the World Bank a few years previously. He was sent to the island of Samoa to assess its potential for commercial organic production as a means of bringing the island's farmers into the market economy, and thus, in theory, improving their standard of living. This brief story elucidates his motivation for writing this book, as well as his ideological framework. In the end, his "growing uneasiness" with the World Bank's basic objectives brings him to make a recommendation that gives him cause to suspect that "the World Bank will no longer want my services, and even less so after reading this book" (p. 8).

The book is nicely organized into bite-sized pieces, consisting of 29 short to medium chapters divided among sections identified as courses of a lavish meal. The opening chapter is more of an introduction, laying out the "Menu" for what is to come. The "Starters" section summarizes much of the historical information on the millennia-long evolution of agricultural systems discussed in *Garden Earth,* contextualizing technological developments within social, cultural, and economic changes. In the chapter entitled "The Making of Food into Commodities," Rundgren identifies land tenure issues as central to the systemic failures of today's food system, and the colonial imposition of the concept of land as private property as the basis for endemic farmer indebtedness. In a paragraph enumerating the obscene land speculation frenzy in the U.S. during the latter part of the 19th century, he notes: "Private ownership is for some reason sacrosanct, even when it is founded on theft" (p. 73).

The second course, entitled "Primi," looks at five case studies of products that together make up a major share of the global food system: grains, grazing animals, sugar, fat, and chicken. Each of those chapters begins with a brief discourse on the language used to denote the respective type of foodstuff, conveying the importance of these products for a wide range of cultures throughout human history. The consequences of industrial-scale methods of food production and processing on these basic forms of sustenance are hardly offset by their increased availability to masses of consumers.

The third section, "Secondi," delves more deeply into the problematic issues that together characterize the *Global Eating Disorder*. Troublesome issues connected to modern food production, such as animal factories, biofuels that replace food for humans, soil and water degradation, energy intensiveness and climate change, and the persistence of food insecurity and hunger, are thoughtfully treated. Rundgren also takes aim at the limitations of the organic industry, saying that "surviving within the market economy requires one to submit to the logic of the market" (p. 298). Regulations, whether through incentives like payments for ecosystem services or through rules that prohibit bad behavior, can only take us so far toward a solution.

Throughout the book, Rundgren provides exhaustive, fully referenced facts and figures to support his arguments. There is even an appendix, "The Digestive," that contains seven tables (inexplicably numbered 6 to 12), along with brief commentary by the author on each. The tables present data on major global food crops, including area planted, amount harvested, estimates of their contribution to protein and calorie intake, and figures on trade and biofuel production.

This depth of research alone makes *Global Eating Disorder* a valuable teaching resource. Rundgren's style is more personal and journalistic than academic, with occasional witty commentary. Notwithstanding its engaging style, the book is marred by serious copy-editing flaws. Originally written in Swedish, the English translation often suffers from clunky sentence construction as well as typos and spelling errors. The lack of an index is another obstacle to the book's usefulness. The table of contents is of little help, inasmuch as the food

metaphors do not always clearly indicate the subject matter. These problems surely can be corrected in a subsequent edition.

Stories about farmers with whom Rundgren has worked also serve to illustrate his points. He repeatedly compares the situation of an Illinois maize (corn) farmer who has 3,200 hectares (7,900 acres) under cultivation with that of a woman farmer in Zambia, who also grows maize but on only half a hectare (1.2 acres). Anecdotes highlighting various cultural peculiarities that surround eating as well as farming balance out his extensive citation of data with warmth and humor. The ambitious scope of this book is at once a positive feature and a drawback. Rundgren's wide-ranging international perspective and sweeping analysis of the failures of the market-based system can leave one overwhelmed, at a loss to imagine a way out.

The final five chapters that make up the "Dessert" course of the book finally portray some of the programs and projects that point to an exit strategy from the *Global Eating Disorder*. Explicitly blaming the capitalist market economy for transforming everything involved in food production into commodities, Rundgren concludes that our entire economic and political system and its underlying values need to be massively restructured to move the food system toward an "ethics of care." Confessing that how this may be accomplished is beyond the scope of this book, he closes by saying, "I believe that food and farming provide an excellent starting point for any attempt to make a more just society and more just relations between humans. If we get food right, the rest will follow" (p. 352). While there may be other very good starting points for creating a more just society, the blatant injustice and ecological damage wrought by the current food system are motivating a new generation to advocate for radical food system change.

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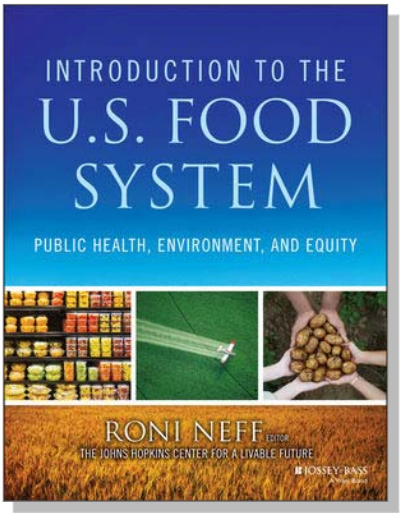
A public health approach to our food system

Gregory Zimmerman *
Lake Superior State University



Review of *Introduction to the U.S. Food System: Public Health, Environment, and Equity,* edited by Roni Neff. (2015). Published by Jossey-Bass, San Francisco. Available as paperback; 542 pages. Publisher's website: http://www.wiley.com/WileyCDA/WileyTitle/productCd-1118063384.html

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Food systems are complex, with many components and many connections. We can view the food system through a variety of lenses: flow of product, flow of money, politics of regulations and policies, food security and social justice, impact on public health, impact on the environment, and more. Descriptions of what constitutes the food system vary across these different approaches. Thus a book titled *Introduction to the U.S. Food System* is sure to be an ambitious volume, and a thick volume. I was daunted by the idea of reading through such a text. Fortunately, it is a good read.

This book is intended to be the text for an introductory course at the upper-division undergraduate or graduate level. I teach upper-division courses in biology, and the level of complexity would be just right for my students. Each of the 18 chapters provides an overview of one aspect of the food system and includes enough depth to anchor the discussion in concrete examples. The chapters are the right length for daily reading assignments for students or for good pacing for readers not taking a class. Each chapter includes a number of "Perspectives," sidebars that bring in additional

* Gregory Zimmerman, Professor of Biology, Lake Superior State University; 650 West Easterday; Sault Sainte Marie, Michigan 49783 USA; gzimmerman@LSSU.edu

Gregory Zimmerman is a professor of Biology at Lake Superior State University, where he teaches in the area of ecology, biostats, and epidemiology. His research includes sustainable local communities, food systems, and environmental conservation. He and his family have a small, diverse farm on which they grow produce for the local farmers market, community supported agriculture (CSA) customers, and local restaurants.

information and viewpoints. The editor did a nice job of making sure each chapter was written at a similar level of detail and in a similar voice. That's an especially impressive task with more than 100 authors, including academic researchers, food justice advocates, health-care workers, and others working across the food system. The tone is informative and challenges the status quo without being vehement. Each chapter includes a list of learning objectives, definitions listed to the side throughout the text, a summary, and discussion questions, all of which should help students as they read and think through the information. The graphical layout is uncluttered and appealing. If (though I hope it's "when," not "if") I were to teach an introductory food systems class, I would use this book. I would also recommend it to anyone who wants to get up to speed on the various aspects of our food system.

After an introductory chapter, the next chapters are organized into sections titled Outcomes, which includes health, environment, and equity; Drivers, which includes economics, policy, culture and society, and marketing; Food Supply Chain, which includes plants, animals, and packaging,; and Food in Communities and on Tables, which includes consumption, nutrition, food environments, and interventions. I found myself nodding in agreement all the way through the book. Rather than summarize each chapter, I note below what to me were new ideas or new ways of viewing specific aspects of our food system, or that were especially well-stated, but sometimes underappreciated, concepts.

I especially appreciated one of the first Perspective sidebars that describes the need for resilience in the food system—not just efficiency or even "just" sustainability. As a complex, adaptive system, the food system needs to be able to absorb shocks, and even catastrophes. The food system needs redundancies, which may involve some inefficiencies. For example, along with the large commodity producers, we need small and medium-sized farms with the diversity of crops and animals they grow and the skill sets they bring. Small enterprises are not always efficient, but can add resiliency. We also need a food system in which all the participants—from farm owners, farm laborers, those in support businesses, those who work throughout the value chain, and the eaters—have a voice in how the system runs so that the benefits do not go to one group of people while the costs and risks go to another.

A later Perspective reminds readers that advocacy around the food system must be done carefully and with cultural sensitivity, so that it does not sound like we are trying to make everyone eat like an "enlightened" one (who is probably young, middle-class, and white). The book does a nice job of providing viewpoints from a wide range of people all across the food system. One set of sidebars is an excellent point and counterpoint on whether we should restrict SNAP purchases to only "healthy" foods. Such discussions throughout the text will help readers without personal experience of food insecurity gain a new outlook.

Of all the topics in my work in food systems, I have the least amount of training in economics. Thus I found that the chapter on economics in the food system provided the most new information to me. It explained economic aspects in an understandable way and showed useful examples, such as quantifying the effects of taxes and subsidies. The authors also introduce behavioral economics with some ideas about effective interventions, while also pointing out that such interventions can be seen as paternalistic.

The chapter on food, culture, and society reminds us of the social significance of food and the importance of understanding how food is viewed differently in different groups. An interesting, but slightly puzzling, sidebar relates the "dystopian imaginings [related to] industrial agriculture" to zombie books and movies. The chapter on marketing includes information on the vast amount of money spent on advertising sugar-sweetened beverages and the resulting high demand for them.

Another message not often covered in discussions of food systems (and not covered in this text) is that we have fewer farm families because there are so many easier ways to make more money. We'll have to come up with an effective way to promote the positive aspects of staying in or getting into farming.

I appreciated the chapter on food packaging, a

topic not always covered in discussions of food systems. Packaging can be used to coax consumers to purchase less-than-healthy foods, but as the chapter reminds us, packaging and food processing should not be viewed entirely negatively. Besides its obvious advantage in enhancing food safety, packaging can also help people choose healthier options. Similarly, the chapter on food distribution is a balanced look at the many steps along the value chain between harvest and table. It's not all just middlemen skimming off their part. Sometimes it is, and sometimes farmers end up being price-takers from the major retailers, but there is also value in the value chain.

The discussion of food environments was written well, too. The look of the neighborhood as well as the displays in the stores and labels on the food packages can help make the healthy choice the more likely choice.

The book concludes with a chapter on interventions for healthy eating, which provides a good overview of health behavior theory (such as theory of planned behavior and social cognitive theory). A sidebar reminds us to use inclusive language in health messaging.

This book represents a view of the food system from the point of view of people working to make it more sustainable, resilient, and just. It's easy to read and carries the story along smoothly. It does not suppose to provide a recipe for fixing the food system, but rather shows the various pieces and connections involved and explains that while the system needs to be fixed, it won't be easy. Whether you're an old hand in food system work and want to see the other pieces with which you may not be as familiar, or are new to food system work and want a good overview, you will do well to read through this text.

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Anticipating a transformative future

Frederick Kirschenmann *
Leopold Center for Sustainable Agriculture

Review of *How To Thrive in the Next Economy: Designing Tomorrow's World Today,* by John Thackara. (2015). Published by Thames & Hudson, New York. Available as hardcover and Kindle; 192 pages. Publisher's website: http://thamesandhudsonusa.com/books/how-to-thrive-in-the-next-economy-designing-tomorrows-world-today-hardcover

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The core principle of this inspiring book is to spell out a compelling alternative to our current industrial economy. As is becoming ever more evident, the mainstream industrial economy not only is destroying many of nature's ecosystem services, but also is depleting many of our precious natural resources. Such destructiveness is part and parcel of the "endless growth" belief system that our industrial culture insists is the only path to progress.

Thackara's global investigation points out that an alternative economy is not only possible but is already emerging throughout the world in the form of "bioregional" economies. These alternative economies rely on the regenerative resources of regional ecologies. The collaborators in such economies are likely to share a common awareness that "our lives are codependent with the plants, animals, air, water, and soils that surround us" (p. 9). Increasingly, participants in these bioregional economies find that they not only can survive but may even thrive. What is perhaps most inspiring is that while such transformations have long seemed

* Frederick Kirschenmann, Distinguished Fellow, Leopold Center for Sustainable Agriculture, Iowa State University; and President of the Board of Stone Barns Center for Food and Agriculture, Pocantico Hills, New York. Contact information: 3703 Woodland Street; Ames, Iowa 50014 USA; leopold1@iastate.edu

unthinkable, they are actually happening now.

As people participate in such bioregional economies, they also learn that many of the promises made by the industrial economy are fallacies. The assumptions that endless growth is possible and a "gospel of consumption" improves everyone's quality of life simply are not true. Alternatively, a bioregional economy—wherein people collaborate for the common good—fosters a flourishing of life and stimulates "the one kind of growth that makes sense—the regeneration of life on earth" (p. 9).

All of this is consistent with Aldo Leopold's observation that the "land community" is "not a commodity belonging to us," but rather "a community to which we belong" (Leopold, 1949, p. viii) and that our role, therefore, is not as "conqueror" of that land community but "plain member and citizen" (Leopold, 1949, p. 204). Similarly, Thackara points out that in these emerging bioregional economies people begin to recognize that "production is determined by the health and carrying capacity of the land through time," and not by the impulse to "drive the land endlessly to yield more food or fiber per acre" (p. 31).

Yet, what is most inspiring about this book is the fact that this new bioregional revolution is already taking place, largely driven by smallholder farmers and regional food citizens in many parts of the world. Furthermore, since "80 per cent of all farms in the world—445 million of them—occupy 2 hectares (5 acres) or less" (p. 59), this bioregional transformation may happen more rapidly than we have imagined. This is the new "commons" that is beginning to transform the lives of an increasing number of people who are increasingly living in such bioregions.

Such bioregionalism is increasingly grounded in a new culture that affirms nature as a living, biotic community of which we are a part. The capacity for renewal of that biotic community can be enhanced in each ecological bioregion. This emerging culture is in sharp contrast to the Enlightenment culture, which operated on the "notion that the universe is a repository of dead resources for us to exploit, as we choose, for the exclusive benefit of our own species" (p. 151).

Of course it may be hard to imagine such a cultural shift taking place in our lifetime, especially since—as Thackara points out—such a shift has "a spiritual as well as a practical dimension" (p. 32). He acknowledges that it might seem impossible to get modern people interested in issues such as soil health, which lies at the heart of these ecological transformations, since most people live in cities where there is no connection with the soil. However, he provides at least one example from Sweden where innovative individuals (including artists) engaged the public in creative ways that contributed to their transformation.

The arts can play a significant role in bringing about these needed spiritual transformations. An example relative to soil is Deborah Koons Garcia's creative documentary, *Symphony of Soil*. This film challenges a public that may still think that soil is just dirt, but after being exposed to this film no one can still have that belief. The arts also can help us to imagine a different future with a more flourishing life than our consumptive lifestyles have provided.

Our current industrial food system is heavily subsidized with public funds. Another strategy not mentioned in Thackara's book might be to use some of these subsidies to encourage transitions to bioregional economies. This support for beginning farmers, many of whom are already intrigued by bioregional economies and food systems, could be well worth exploring.

The vision outlined in this book has the potential to transform our culture, our food and agriculture future, and the quality of life for future generations. I strongly recommend that it be added to everyone's reading list.

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