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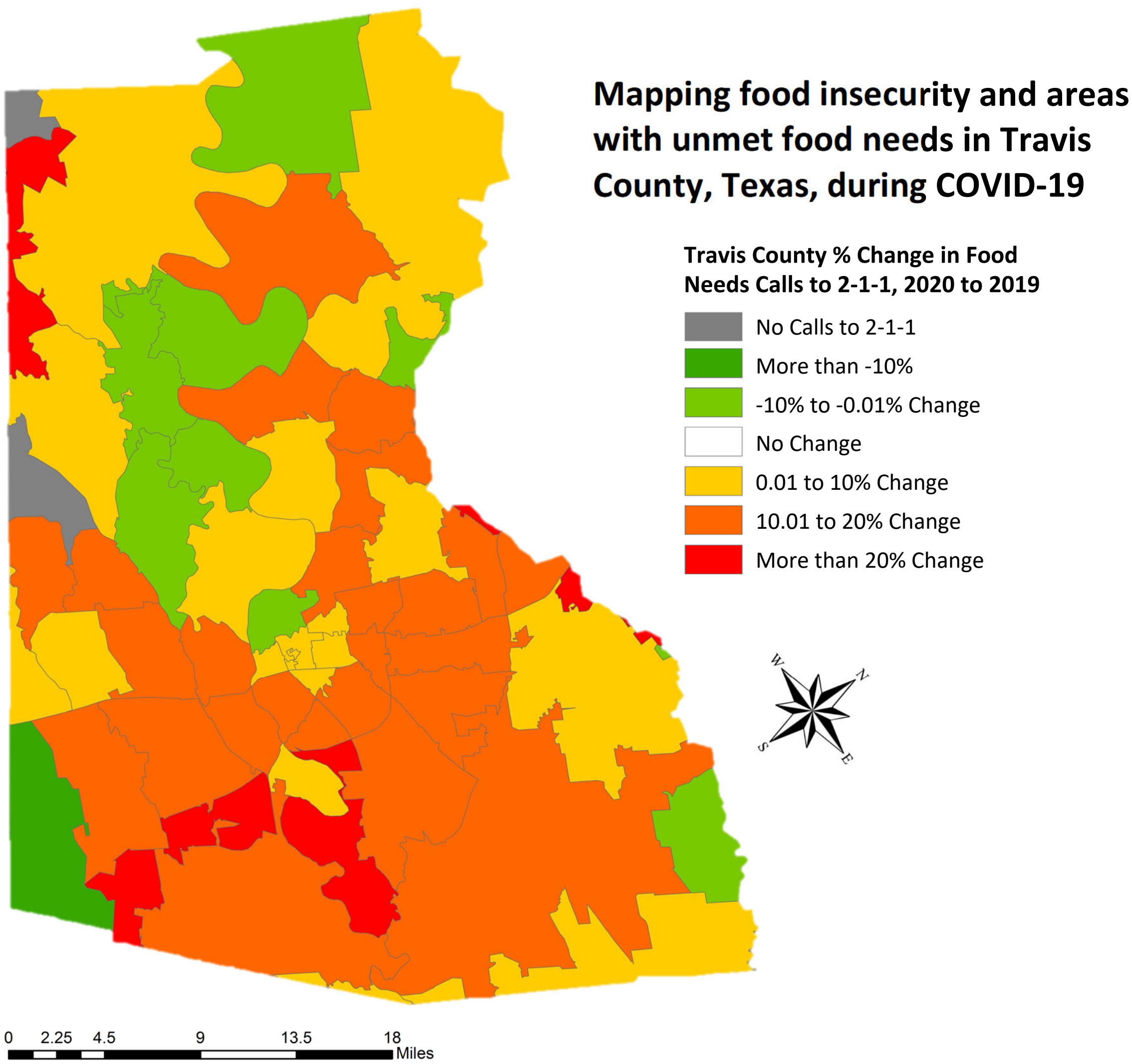
Spring 2021

Open Call Papers, and More Papers and Commentaries on the Impact of COVID-19 on the Food System



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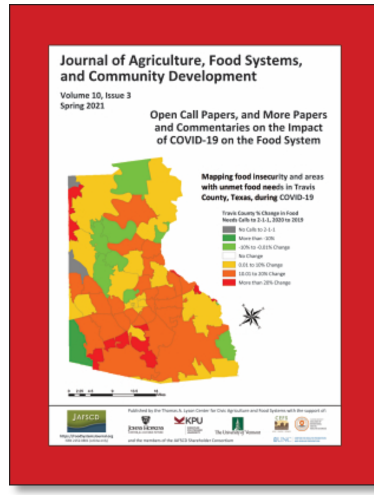

On our cover: Figure 2 from "Examining food insecurity and areas with unmet food needs during COVID-19: A geospatial, community-specific approach," by Janda, Hood, Price, Night, Marty, Rohlich, Hanson, Espinoza, and van den Berg. The map shows changes in the percent of food need call volume by zip code, March–July 2019 to March–July 2020, in Travis County, Texas, USA.

Open Call Papers

Reviews

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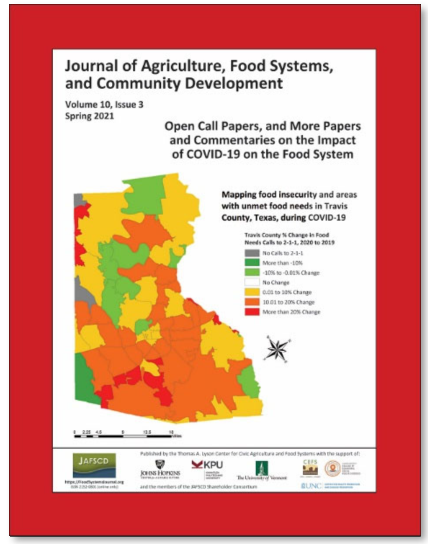
IN THIS ISSUE
DUNCAN HILCHEY



Open call papers, and more papers and commentaries on the impact of COVID-19 on the food system

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Citation: Hilchey, D. (2021). In this issue: Open call papers, and more papers and commentaries on the impact of COVID-19 on the food system [Editorial]. *Journal of Agriculture, Food Systems, and Community Development, 10*(3), 1–3. https://doi.org/10.5304/jafscd.2021.103.021

Have we finally turned the corner on COVID-19? Just maybe.

The world is still reeling from the pandemic, and the delta variant is taking its toll presently, but the winds of change do seem to be shifting in our favor. After publishing more than a year and a half's worth of research-based papers and commentaries on COVID-19 and its impact on the food system, we are taking a kind of odd pleasure in finally publishing content on a broader range of issues. Food systems work is (or should be) a veritable beehive of activity on all fronts, at all levels, at all times: racial equity, family farm resilience, climate change, building out our food security infrastructure, and so on require constant simultaneous attention, each of these key issues being a piece of an interlocking resilience puzzle.

To that end, our open-call issue of JAFSCD begins with **John Ikerd's** Economic Pamphleteer column, *Local foods: Seeds for social change.* John makes the case that individual and sequential actions to deal with systemic problems are not likely to bring intended outcomes, and, in fact, may do more harm than good. We must advance transdisciplinary systems thinking to move the needle.

This is followed by two general commentaries and one COVID-19-related commentary. In his commentary, *"Treat everybody right": Examining foodways to improve food access,* **Alex Hill** interviews Detroit residents about their food shopping experiences. In *Eating inequity: The injustice that brings us our food,* **Manar Arica Alattar** reminds us that even with the complexity of the food system problem, we must go beyond lifestyle changes and engage in civil discourse and political action to make a difference. This article would make a great introduction to those unfamiliar with the issues in food systems related to humankind. In our final commentary, *COVID-19 and consumer demand for local meat products in South Carolina,* **Steven Richards** and

Michael Vassalos share the results of a consumer survey suggesting that local meat demand may take effort and marketing in order to thrive postpandemic.

Continuing our brief, although still important, COVID-19 theme are two research papers: *Disease and disaster: Navigating food insecurity in a community affected by crises during COVID-19,* by **Andrew S. Pyle, Michelle Eichinger, Barry A. Garst, Catherine Mobley, Sarah F. Griffin, Leslie H. Hossfeld, Mike McGirr,** and **Helen R. Saunders,** and *Examining food insecurity and areas with unmet food needs during COVID-19: A geospatial, community-specific approach,* by **Kathryn M. Janda, Raven Hood, Amy Price, Sam Night, William Edwin Marty, Amanda Rohlich, Kacey Hanson, Marianna Espinoza,** and **Alexandra E. van den Berg.** The second paper is the source of our cover for this issue. The GIS map depicts the change in food need calls to the 2-1-1 help line during the early stages of the pandemic, compared with same period the previous year—a clever indicator.

Our open-call papers in this issue cover a wide range of food system–related community development topics in North America and abroad. In *The scope of U.S. state soil health legislation: A mixed-methods policy analysis,* authors **Madison Delmendo, Yona Sipos, David Montgomery, Ryan Cole,** and **Jennifer Otten** use the health policy triangle framework to examine state legislation that formally recognizes the critical role of soil as a living system that supports public health interests.

In *Food forests: Their services and sustainability,* **Stefanie Albrecht** and **Arnim Wiek** take a snapshot of a global sample of active food forests and find that, while they provide important social and ecosystem services, evidence of their economic contributions to families is lacking.

In a complementary (although not related) study, **Sarah Eissler, David Ader, Sovanneary Huot, Stuart Brown, Ricky Bates,** and **Tom Gill** find that, while wild gardening in Cambodia shows potential as a rural livelihood strategy, little is understood about its real contribution to food security, in *Wild gardening as a sustainable intensification strategy in northwest Cambodian smallholder systems.*

In *Indicators of readiness and capacity for implementation of healthy food retail interventions,* **Jennifer Sanchez-Flack, Kakul Joshi, Eunice E. Lee,** and **Darcy A. Freedman** use an expert panel to develop a protocol for evaluating the realistic potential for corner stores to improve local food security.

Next, **Zeenat Kotval-K, Shruti Khandelwal,** and **Kendra Wills** present a nuanced approach to measuring urban food security in *Access to foods using Grand Rapids, Michigan, as a case study: Objective versus subjective issues.*

In *Cost-benefit analysis as a tool for measuring economic impacts of local food systems: Case study of an institutional sourcing change,* **Zoë T. Plakias** uses Monte Carlo simulation to model the cost-benefit of sourcing local food—with surprising results.

Melissa Parks, Gabrielle Roesch-McNally, and **Amy Garrett** then look at the effectiveness of novel engagement and information-sharing strategies in *Bridging scientific and experiential knowledges via participatory climate adaptation research: A case study of dry farmers in Oregon.*

Next, *Exploring differences in communication behaviors between organic and conventional farmers,* by **Fallys Masambuka-Kanchewa, Joy Rumble,** and **Emily B. Buck,** highlights the different foci and language used by farmers in describing their production practices, as well as their use of social media and other tools.

In *Nested risks and responsibilities: Perspectives on fertilizer from human urine in two U.S. regions,* **Tatiana Schreiber, Shaina Opperman, Rebecca Hardin, Julia Cavicchi, Audrey Pallmeyer, Kim Nace,** and **Nancy Love** typologize the responses of residents and progressive farmers in this qualitative study of the potential for utilizing human urine in food production.

Ernest Nkansah-Dwamena next presents a comparative case study in Africa in which land-grabbing has negative impact on farm families, in his paper *Can large-scale land acquisition deals improve livelihoods and lift people out of poverty in Sub-Saharan Africa? Empirical evidence from Tanzania.*

Heather L. Elliott, Monica E. Mulrennan, and **Alain Cuerrier** explore the aftermath of an extraordinary exercise of speaking truth to power by people of color in *Resurgence, refusal, and reconciliation through food movement organizations: A case study of Food Secure Canada's 2018 Assembly.*

In *Visitors and values: A qualitative analysis of agritourism operator motivations across the U.S.,* **Lindsay Quella, David Conner, Travis Reynolds, Weiwei Wang,** and **Doolarie Singh-Knights** use Allport's contact hypothesis to gain a more nuanced understanding of the benefits of agritourism beyond economic ones.

We wrap up the issue with two book reviews. **Alissa Boochever** reviews *Deep Agroecology: Farms, Food, and Our Future,* by Steven McFadden, and **Emily Nink** reviews *The Devil's Fruit: Farmworkers, Health, and Environmental Justice,* by Dvera I. Saxton.

We will continue to publish applied research related to issues of COVID-19 and its aftermath. However, we are very pleased about our forthcoming issue on **Food as Tool for Social Change,** a tribute to the late scholar-activist Dr. Evan Weissman. It is being guest-edited by a team of his colleagues and is sponsored by the Department of Nutrition and Food Studies, Falk College, Syracuse University.

As always, the JAFSCD community is as interested in understanding unsuccessful programs and policies, as well as successful ones. So, please keep in mind, objective post-mortem analysis is highly valued and appreciated.

Keep up your scholar-activism on all fronts!

Duncan Hilchey

Duncan Hilchey
Publisher and editor in chief

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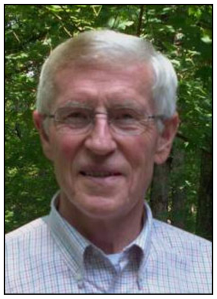

THE ECONOMIC PAMPHLETEER
JOHN IKERD

Local foods: Seeds for social change

Published online May 7, 2021

Citation: Ikerd, J. (2021). The Economic Pamphleteer: Local foods: Seeds for social change. *Journal of Agriculture, Food Systems, and Community Development, 10*(3), 5–8. https://doi.org/10.5304/jafscd.2021.103.002

The local food movement has grown in direct response to the industrialization of the agri-food system—and more recently in response to the industrialization of organic foods. Locavores seem to have an intuitive understanding that the environmental and public health problems associated with industrial food production must be solved within the socioeconomic context of local communities. Similarly, the problems of social justice cannot be solved without addressing the larger environmental and public health problems of society. Systemic problems require systemic change, which is rarely quick and never easy. However, local community-based food systems can provide fertile seedbeds of systemic social change.

From a national or global perspective, ensuring social equity and justice may seem an insurmountable challenge. Within local community-based food systems, however, ensuring social justice is both possible and practically achievable (Ikerd, 2016). Food security requires that everyone have access at all time to a sufficient quantity and quality of food

John Ikerd is professor emeritus of agricultural economics, University of Missouri, Columbia. He was raised on a small farm and received his B.S., M.S., and Ph.D. 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 available at http://johnikerd.com and https://faculty.missouri.edu/ikerdj/

Why an ***Economic Pamphleteer?*** *In his historic pamphlet* Common Sense, *written in 1775–1776, Thomas Paine wrote of the necessity of people to form governments to moderate their individual self-interest. In our government today, the pursuit of economic self-interest reigns supreme. Rural America has been recolonized, economically, by corporate industrial agriculture. I hope my "pamphlets" will help awaken Americans to a new revolution—to create a sustainable agri-food economy, revitalize rural communities, and reclaim our democracy. The collected Economic Pamphleteer columns (2010–2017) are at https://bit.ly/ikerd-collection* to meet their basic nutritional needs for healthy, active lives (International Food Policy Research Council, n.d.). Food security has not been, and will not be, provided by markets or by impersonal food assistance programs (Ikerd, 2016b). Universal access to good food ultimately must be accepted as a basic human right. It is a matter of social justice. As with social justice, ensuring food security may seem to be an impossible task at the national or global level, but it is logically doable within local communities. Furthermore, social justice implanted in local food systems can spread social justice through the rest of communities, from community to community, and eventually bring about systemic social change at national and global levels.

Attempts to address systemic problems individually and sequentially often result in unintended consequences that make bad situations worse.

Changing laws and regulations may seem a more logical means of addressing problems of social justice. Such changes may be necessary during times of crisis. However, systemic social injustice shares common roots with systemic environmental degradation and economic exploitation and can be rooted out only through systemic change. In fact, attempts to address systemic problems individually and sequentially often result in unintended consequences that make bad situations worse, rather than better. Obesity, diabetes, hypertension, heart disease, and the persistence of food insecurity are unintended consequences of trying to solve systemic problems individually. The health and nutritional benefits of food have been degraded in attempts to make food more affordable and convenient for more people. These problems can only be solved by creating food systems that are socially just as well as ecologically and economically sustainable.

Life emerges from the relationships among the various parts within organisms as wholes. Relationships matter.

The roots of today's environmental, social, and economic problems are in the reductionist and mechanistic way of thinking that emerged from the "scientific revolution" prior to "the enlightenment" (Osler, Brush, & Spencer, n.d.). The basic premise is that the world works like big complex machine, and it can be best understood and by taking things apart or reducing them to their component parts. By implication, things can be "fixed" by repairing their faulty parts and reassembling the mechanisms. In reductionist thinking, ecological, social, and economic systems can all be reduced to their separable, fixable or replaceable component parts.

The basic purpose of reductionist science is to reveal how humans can most effectively design, manipulate, and maintain mechanical, chemical, and biological mechanisms in order to extract the maximum usefulness or utility from the natural resources of the earth and human resources of society. This way of thinking laid the conceptual foundation for the industrial revolution and continues to dominate industrial economic development, including industrial agriculture. This worldview also dominated the thinking of advocates of mechanical, chemical, and biological fixes for today's failed industrial agri-food system.

The quest for systemic change in the industrial food system has been driven by the alternative worldview of a world that works like a big complex living organism and must be understood as a coherent whole rather than a collection of components or parts. Organismic systems have emergent properties that are not contained in their component parts but emerge from relationships among the parts within the system as a whole. Life emerges from the relationships among the various parts within organisms as wholes. Relationships matter. This worldview is reflected in the science of ecology. The first principle of ecology is that everything is interconnected. Everything we do affects everything else. Changes in relationships change the essence of systems as wholes.

The fundamental purpose of science in this ecological worldview is to understand how the world works, its functional principles, and the role of humans within the context of the whole of the earth. The functional principles are laws of nature that are inviolable and must be respected because they cannot be changed. The resources of this ecological world are bountiful and capable of nurturing and sustaining those who live in harmony with nature rather than exploit or try to conquer it. The laws of nature include the laws of human nature that are essential for harmonious human relationships and sustainable human communities and societies. One of the most widely acknowledged and accepted laws of human relationships is known as the "Golden Rule." To sustain positive relationships, we must treat others as we would want them to treat us—as if we were them and they were us. Social justice is a core principle of the worldview that supports the local food movement.

These are not esoteric philosophical musings. These are the principles that underly the concept of agroecology, which applies the science of ecology, including social ecology, to agriculture. The life in soils, plants, animals, farmers, families, communities, and society are all inseparable components of the earth's integral ecosystem. Everything affects everything else—some in small ways, others in critical ways. Each field, farm, farmer, community, and society is unique, but all function according to the inviolable principles of nature. The principles of agroecology underlie the full spectrum of approaches to sustainable farming, including organic, biodynamic, ecological, biological, holistic, resilient, and currently most popular, regenerative farming.

Each field, farm, farmer, community, and society is unique, but all function according to the inviolable principles of nature.

These are the principles underlie the global food sovereignty movement: "Food sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems" (Nyéléni, 2007, para. 3). These same ideals are reflected in the "Green New Deal" (116th Congress, 2019) congressional resolution, which was the culmination of decades of discussion and negotiation. These ideals are also reflected in Pope Francis' encyclical on climate change, Laudato si' (Francis I, 2015), which was written after decades of contemplation and consultation with some of the leading thinkers in the world.

Current public interests in social justice, economic inequality, global climate change, and food insecurity have turned local community-based food systems into fertile soil in which to sow the seeds of systemic change. Nature, including human nature, is an awesome force for good that is currently being impeded and threatened by reductionist, mechanistic ways of thinking. But nature is still capable of healing, restoring, and sustaining vibrant and prosperous human communities and societies. Ultimately, communities and societies must function in harmony with the other living and nonliving elements of the earth's natural ecosystem. If the seeds of social justice are planted, nurtured, and tended in the fertile soil of local food systems, they will grow into flourishing and sustainable communities and societies.

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COMMENTARY

"Treat everybody right": Examining foodways to improve food access

Alex B. Hill *
Wayne State University

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Abstract

Detroit is regularly assumed to be a "food desert" despite contradicting evidence. With fruits and vegetables available at each of Detroit's 70 independent, full-line grocery stores, there remains a lack of understanding among media and academics of residents' perception and preferences for food access. A baseline study was initiated during the summer of 2014 to understand residents' own perceptions of food access and to assess the socio-cultural foodways utilized by residents. A total of 207 Detroit residents participated in focus groups and interviews to discuss food provisioning. Residents identified a wide range of food access points, from home gardens and fishing to specialty meat markets and big-box stores. However, 60% of residents reported that their primary grocery store was a chain supermarket outside the city limits. Residents highlighted "customer service" and in-store treatment as key factors in choosing where to shop for food. These new findings present contradictions to assumptions about food access in Detroit and similar cities. The findings point to a significant opportunity to leverage geo-ethnographic methods in order to focus on resident perceptions and preferences to improve food access.

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Author Note

Alex completed this research as part of his master's thesis work in the Anthropology Program at Wayne State University (WSU). He is now a Ph.D. student in the Anthropology Program at WSU and a researcher with the Urban Health Research Group at the Center for Urban Studies, where he also serves as project director of the Detroit Food Map Initiative.

Introduction

> "If we get bad service, we just get mad and don't complain. We must challenge the establishments in our community to step up they game. Treat everybody right!"
>
> – *African-American, Male, 56, Focus Group August 22, 2014*

This resident's emphatic response at a focus group encompasses a common theme across all of the study events conducted during the summer of 2014 in Detroit to better understand residents' own perceived access to food. A wide range of misconceptions about food access in Detroit exist, but, most egregiously, food access research in Detroit nearly never asks people what they think of their own access to food.

Among the food access misconceptions in Detroit are that food is purchased primarily at liquor stores (Hansen, 2008) and corner stores or "fringe" food outlets that are found more frequently in neighborhoods and are geographically closer to residential homes than other types of food outlets (Gallagher, 2007). Both the mass media and academia have engaged in piecemeal discussions around food access in Detroit, which has perpetuated myths and likely slowed improvements to food access in the city (Hill, 2017). Detroit is assumed to be a "food desert" despite contradicting evidence of fresh produce being available at grocery stores (Hill & Naar-King, 2014; LeDoux & Vojnovic, 2013). In addition, there is a strong dislike for the "food desert" term among Detroit's food advocates (Hill, 2017).

In the United States, areas of imbalanced food access are predominantly low-income and African-American, where high rates of obesity, diabetes, and hypertension are confounding (Bodor et al., 2013; Cheadle et al., 1991; Inagami et al., 2006; Izumi et al., 2011; Liu et al., 2007; Zenk et al. 2005). In analyzing food access, most researchers rely on quantitative (price, distance, density) and supply-side valuation metrics. This approach often leads to overly prescriptive understandings of access in food environments and has allowed the "food desert" term to be wantonly applied (Hill, 2017). These limited analyses of food access paint an inaccurate picture in urban centers, specifically Detroit. There is more to food access than delineated "food desert" zones, the number of grocery stores in a city, or how far away they might be from groups of residents.

Background

In the seminal 2009 U.S. Department of Agriculture (USDA) report on "food deserts," a key recommendation was to explore "how people fit grocery and food shopping into their daily activities and travel patterns, how these activities and patterns expose people to food environments outside of their neighborhoods, and how this may affect their shopping and diet" (Ver Ploeg et al., 2009, p. 48). The USDA has published subsequent reports on food access with less focus on "food deserts" and more emphasis on neighborhood characteristics that support healthy food access (Rhone et al., 2019).

A number of food access studies point toward the need for more research on the lived experiences of people in "food deserts" through multidimensional approaches that combine quantitative and qualitative approaches (Alkon et al., 2013; LeDoux & Vojnovic, 2013; Shannon, 2014, 2016; Walker et al., 2010). Only a handful of studies in Detroit have actively asked people about their own preferences in accessing food (Budzynska et al., 2013; Coleman et al., 2011; Rose et al., 2010). Public health and geographic approaches broadly ignore "foodways," or the cultural and social practices that affect food provisioning, how and where people purchase food, and what motivates their food access preferences (Alkon et al., 2013). In other contexts, these have been described as "foodscapes," or the social, relational, and political construction of food provisioning and power structures (Miewald & McCann, 2014).

Food retail environments must be recognized as racialized spaces. Reintroducing ethnographic methods to examine spaces of food access is critical, but any effort would be misplaced without a significant examination of the experience of "shopping while Black" (Pittman, 2017). In cities like Detroit, food retailers most often do not reflect the racial and/or ethnic make-up of the community (Pothukuchi, 2016), and the racial discrimination interwoven into the consumer experience is increasingly well documented (Kamaloni, 2019; Pittman, 2017; Reese, 2019). Pittman (2017) and Reese (2019) have documented the change in consumer preferences and attitudes based on racist and discriminatory treatment of consumers in stores.

This study examined the role of foodways in Detroit residents' perceptions of food access and food provisioning choices. The study sought to re-center Detroit residents' experiences in an analysis of food access by introducing a more anthropological, cultural, or "geo-ethnographic" examination of food access in Detroit (Biffle & Thompson, 2006).

Re-centering Lived Experiences

This study conducted seven focus groups, one for each city council district in Detroit, and 56 individual interviews with residents of those districts. Both types of study activities were conducted using a 16-question guide that included open-ended questions like, "what do you like about food in your community?" as well as specific questions like, "have you had an interaction with a store owner?" The study was supported by the Detroit Economic Growth Corporation (DEGC) and the Detroit Food Justice Task Force (DFJTF), with additional assistance provided by the Detroit Food Policy Council (DFPC) and the Detroit Food Politics Research Group at Wayne State University's Anthropology Department.

The unlikely coalition of supporters from economic development, food justice, academia, and community members allowed for an analysis of the social, political, and economic impacts of food access in Detroit. Members of DEGC and DFJTF sat down in the same room to formulate and agree on a list of questions. DFPC and members of the Wayne State University's Anthropology Department worked together to take notes and record resident feedback. Members from all of the groups gave feedback on the final report. This study was conducted as a baseline for the Detroit Food Policy Council's grocery store engagement work and led to the creation of the Detroit Grocery Coalition's Great Grocer Project.

By engaging residents in focus groups and interviews rather than using only written surveys, this study was able to better understand how Detroit residents utilize the foodways defined by their social networks and social capital when making decisions about how and where to access food. The final study sample included 207 residents. The majority of residents utilized a range of sites and sources each month for their food provisioning. Many residents had (1) extensive knowledge of healthy eating habits, (2) employed multiple strategies for food provisioning that included locations well beyond their neighborhood, and (3) placed high value on in-store treatment and customer service as well as on food prices.

Residents identified a wide range of food access points, from home gardens and fishing to specialty meat markets and distant big-box stores. The foodways identified in this study were articulated by individuals exerting their own choices based on word of mouth in social networks consisting of extended families, neighbors, and church congregations. The prominence of mentions of in-store treatment, discrimination, and customer service remind researchers that grocery shopping is a social activity and not one simply defined by the closest store location, lowest prices, or the presence of the most healthful foods.

> "I was treated very poorly in one of our [Detroit] neighborhood stores and it was the end of the week. Now I'm the pastor, so as you can imagine my weekend sermon included a story of my treatment at that store. Afterwards, members of my congregation came up and shared their own stories of mistreatment at the same store. We can make a movement and really put pressure on these stores." – D5

> "I won't go to the corner [to shop at the neighborhood store]. I rely on my neighbor to drive me to the store [a chain supermarket outside the city]. We get together once a month, talk about the deals and get started." – D7

> "Family all shops together, we don't live together, but we gotta make ends meet so we pool our EBT and split up where everyone goes so we can stretch [our budgets]." – D4

> "He [grocery store owner] spit over the window. There is extreme lack of respect. My niece and her family decided that they will never shop from that place. We told everyone not to." – D6

Some residents had stronger social ties than others, where they could exert greater influence on community foodways. Residents highlighted in-store treatment as an important factor for food provisioning, whether in their neighborhood or visiting a chain supermarket in the suburbs. In-store treatment was most often referred to as "customer service" and focused on negative interactions with store owners and employees, combined with a perception that local grocery stores were not receptive to criticism. Generalizations cannot be made of all stores in any given geographic area, as positive and negative experiences occurred both inside and outside the city. In one very telling instance, an 11-story high-rise apartment building for low-income senior citizens sat directly adjacent to a full-line grocery store, but the residents said they preferred to cross the street to shop for food at the CVS pharmacy and store because they were treated better there than at the grocery store.

> "If we get bad service, we just get mad and don't complain. We must challenge the establishments in our community to step up the game. Treat everybody right!" – D5

> "It's more difficult to get to a grocery store in the suburbs, the location is often less convenient, but the customer service is responsive." – D4

> "There are higher income level people that shop there, and it is supposed to be high-end, but the food is still not as good as in Kroger. But I'm treated better [at Harbortown]." – D5

Occasionally, residents noted that their experience was so bad that they were glad when a nearby grocery store closed, or they persuaded their friends and family not to shop at a particular store any longer.

> "Once my nephew purchased a cereal from a store where I regularly shop. Later when he came home, he found that it was expired . . . He told me about the situation . . . and then we both went back to the store, the manager of that store didn't take it back; he said he doesn't sell expired products. . . . That I was the last time I set foot in that store." – D5

> "The storeowners disrespected us. . . . They used to talk horribly to the women and children. . . . I'm so glad that they left from here. People used to get sick from the food purchased from that store.. . . Most of the items in that store were expired . . . for example you could see that the cheese was molded . . . and chicken which was returned as it was bad, was placed back in the freezer so it could be sold to the next customer." – D6

> "Store owners shouldn't treat all customers bad just because of one bad experience." – D3

This same theme has been covered in the local news media about Detroit, typically focused on store cleanliness and below-average options in specific neighborhoods. As quoted in Smith and Hurst (2007), a resident named Gordon A. said, "Some stores claim to be serving a 'black clientele,' but it's just an excuse for stocking bad quality goods."

The topic of race and privilege has only recently entered the research around food provisioning and grocery stores in the metro Detroit area. One study found that in-store treatment became worse for each mile that a resident traveled outside their neighborhood for a 7% increase in the odds of "unfair" treatment (Zenk et al., 2014). Focus-group participants noted similar themes:

> ". . . Because this is a black neighborhood, everyone gives us the secondary treatment." – D6

However, negative in-store treatment was mentioned to have occurred in neighborhood stores and suburban stores alike. One participant, a local pastor, noted,

> "Most of the time I'm treated very well in local stores, but not in suburban stores [Grosse Pointe]." – D5

Residents were able to identify specific stores in their own neighborhoods as well as the suburbs that they preferred based on the way they felt treated in particular stores. Sometimes these preferences were based on lived experience, and other times the preference was based on anecdotal experience shared by family, friends, or neighbors.

Discussion

These new findings provide direction for future work that needs to act on the feedback and lived experiences of residents accessing food. The findings help to highlight a number of themes that demonstrate the foodways of Detroiters. The fact that neither nutrition knowledge nor geographic location was a barrier for those who participated in study events negates assumptions that Detroiters do not know how to eat healthy or that they only shop at nearby liquor stores.

The multiple strategies for food provisioning broke down along lines of social cohesion. Participants from the same groups would share information on food item sales or upcoming deals. Finally, the common theme of in-store treatment and discrimination was a thread that was carried from participant to participant and community to community. Participants made phone calls and conversed during and after church services to define their own foodways based on how they had recently been treated within particular food stores. These findings mirror the work of Reese (2019) and Pittman (2017), who found that racialized food spaces drove residents to create alternative pathways to food.

Similar to alternative pathways to food, the type of group that hosted a focus group may have influenced participant responses. It is likely that the social capital of a particular community group or congregation that hosted a study event could serve as an indicator for the level of participation by nearby residents or members. Church-based groups that hosted a focus group had the strongest attendance as well as relationships among participants. One long-standing community organization rivaled the church-based groups, but those participants noted they were self-organized from two different church congregations. The church-based groups were also more likely to host healthy cooking programs, diabetes education, and similar programming, which served to build a shared base of knowledge among participants.

Conclusion

Foodways follow a social process rather than one defined by a specific bounded geography. Food access studies regularly examine the food environment but might be better focused on "food ecology" or foodways that include the social, political, and economic relations within the food environment. Similar to Pittman's (2017) work, this study was able to identify social and cultural strategies utilized to mitigate and avoid discrimination in food retail experiences.

The findings highlight the importance of understanding foodways and individual choice among populations living in an assumed "food desert." The creative and socio-cultural strategies used for food provisioning described at all of the study events demonstrate the critical need for food access research to more regularly pair ethnographic methods with quantitative exercises in determining the skills, needs, and desires of communities facing food insecurity. Reversing misperceptions is of the utmost importance if food access efforts hope to break down assumptions and support effective community solutions.

Future research should work to engage residents in geo-ethnographic methods to understand foodways. In addition, food retailers were described as the key drivers of foodway adaptations in Detroit, and there must be a more systematic method used to understand retailer perspectives. Researchers may be a helpful conduit to facilitate connections between food retailers and community groups, but should place the community in the lead. These combined strategies of engaging residents in geo-ethnographic foodway explorations and exploring food retailers' perspectives offer a unique opportunity to advance community food access without simply relying on quantitative measures and overlooking communities' food provisioning preferences.

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COMMENTARY

Eating inequity: The injustice that brings us our food

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Abstract
As we eat, we transform social, natural, and economic systems. Here we briefly explore these transformations.

Keywords
Food System, Food Justice, Food Workers, Farmworkers, Climate Change, Food Waste, Wasted Food, Greenhouse Gas

Introduction

Climate change and global warming have become common phrases in politics, at schools, and at dinner tables. We, largely, understand that human impact on the environment is changing our world in both predictable and unpredictable ways. Species are being lost at an alarming rate (Feldstein, 2017); weather patterns are being disrupted and becoming more extreme (Neff, 2014); pests and invasive species are wreaking havoc (Schapiro, 2018); the Amazon is in flames (McCoy, 2019); and plastics are choking out our aquatic ecosystems (Derraik, 2002). What ties a majority of these global problems together? Con-

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sumption patterns often related to food. Food is a strong cultural, personal, and political driver (Brown, 2012; Mbow et al., 2019). Food is, arguably, the primary resource for which we alter our environment: land, water, and air. In the last 300 years, food production has led to the loss of 20% of grasslands and forests worldwide and 30% of North American forests (U.S. Department of Agriculture [USDA], 2014). Seventy percent of global freshwater is used for producing food (Food and Agriculture Organization of the United Nations [FAO], 2017). A third or more of global human greenhouse gas (GHG) emissions come from food production (Foer, 2019; Intergovernmental Panel on Climate Change [IPCC], 2013). So, let's talk about food.

Think about this for a moment: your food (in the U.S.) travels an average of 15 hundred miles (24,140 km) before it reaches you, and sometimes much more (Henne, 2012). Your food may have even traveled to various other continents and back before you eat it. The food you eat, in a few days or weeks, may have traveled more than you have in your lifetime.

The food that we eat is no longer produced primarily by farmers. Farmers are just a peg in the vast, global, and interconnected web of production, processing, distribution, and sales. Shopping at your local supermarket is actually a global experience. Without even thinking about it, we regularly eat avocados from Mexico, coffee from Ethiopia, bananas from Ecuador, shrimp from Malaysia, and fish raised in the U.S., processed in Asia, and then shipped back to the U.S. for sale. In considering this global food system, we must understand and address some very important questions. Who brings us our food, and are they treated justly? How is our food shaping natural environments as it is produced and transported to us? What can we do about it all?

Considering our "foodprint" in this way is essential because (1) "you are what you eat," and (2) it tells us a chilling story that is more relevant to social and climatic health than whether or not you bicycle to work. So, let's address these questions in turn.

Who brings us our food, and are they treated justly?

As your food travels thousands of miles through a complex national food web with almost 10 million links (Lin et al., 2019), numerous people work to pass it along its journey, from farmers to farmhands, processing-plant workers, truck drivers, barge captains, grocery-store employees, cooks, servers, and more. In the U.S., 21.5 million people (14% of the population) work in the food supply chain (Food Chain Workers Alliance & Solidarity Research Cooperative, 2016). These workers earn a median wage of US$10/hour, which is significantly lower than the median wage across industries (US$16/hour). Additionally, these workers work in some of the most hazardous jobs, report significant levels of sexual harassment (especially farm and restaurant workers), and are nearly twice as likely to use food stamps compared to the general population (Food Chain Workers Alliance & Solidarity Research Cooperative, 2016; Jayaraman, 2016; Yeung, 2018). Foodservice workers report little opportunity for promotion within their fields and consistently have among the highest turnover rates nationwide (Compensation Force, 2017; Food Chain Workers Alliance & Solidarity Research Cooperative, 2016). Farmhands, a majority of whom are Latino, also face harsh working conditions, pesticide exposure, wage theft, and various other injustices, particularly when undocumented (Edelson, Monani, & Platt, 2018; Hernandez & Gabbard, 2018; Marquis, 2017). In fact, service and farmworkers are exempt from pivotal national policy protecting worker rights to unionize and earn a fair wage (Perea, 2010).

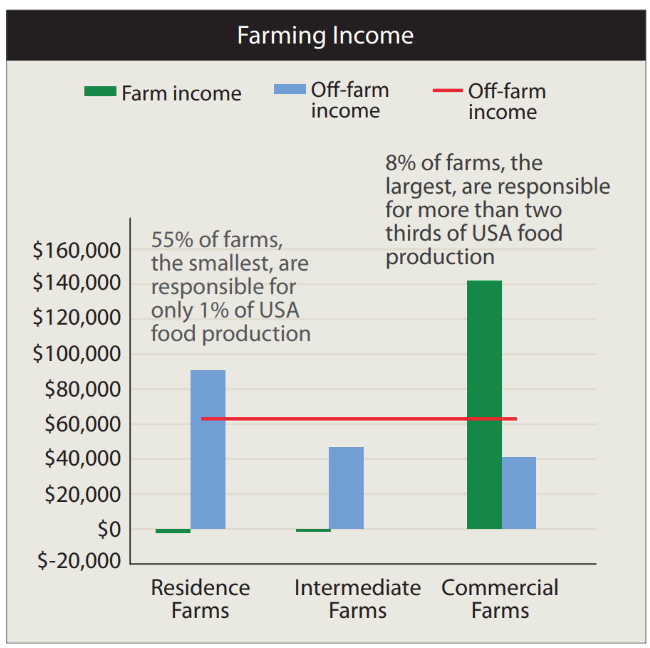
Furthermore, discriminative lending, redlining, and other practices that inhibit landownership have impeded racial minorities, specifically Black Americans, from owning land and farming (Penniman, 2018). Today only 1.3% of American farmers are Black, and they only own 0.52% of American farmland (while the Census reports that 13.4% of Americans identify as Black Americans) (Sewell, 2019). This is a significant decrease from the 1920s, when 14% of American farmers were Black (Newkirk, 2019).

In fact, race and gender disparities are pervasive throughout food work. Racial minorities face significant hiring discrimination (Jayaraman, 2016), and even after they are hired, minorities earn 44 to 80 cents to the dollar of white workers (Food Chain Workers Alliance & Solidarity Research Cooperative, 2016). This is not surprising from a national food system historically based on slave labor and the confiscation of Native lands (Newkirk, 2019; Penniman, 2017, 2018). Even though almost 40% of food workers identify as people of color and almost 35% of food workers are women, 72% of food industry CEOs are white men, and 14% are white women (Food Chain Workers Alliance & Solidarity Research Cooperative, 2016). Women working in the food supply chain earn less than half of their male counterparts and have historically been undercompensated for vast amounts of care work, including that related to food production and preparation (Food Chain Workers Alliance & Solidarity Research Cooperative, 2016; Patel & Moore, 2017). Such trends are reflected across the world as well. Globally, 65% of working poor adults are employed in the food system (Townsend, Benfica, Prasann, & Lee, 2017). Many of these workers produce food for sale abroad and find it difficult to meet the needs of their own households (Patel, 2012).

Farmhands and service workers are not the only victims of the food system. Fewer family farmers can survive corporate food competition and buy-outs, even though the large corporate farms that take their place do scores of damage to environmental and social systems (Carlisle, 2016; Gustafson, 2014). Between 1950 and 2012, the number of farms in the U.S. decreased by 40% and the average size increased by 75% as small and midsized farms were lost (Imhoff & Badaracco, 2019). Today, the largest 8% of farm operations in the U.S. supply 80% of food sales (Neff, 2014). A majority of the remaining small farms rely on additional nonfarming incomes for financial stability, and less than half even make a net profit from farming (Figure 1) (Higgins, 2019). American farmers receive 7.6 cents in each dollar of sales from their raw products, a record low in the last 15 years (USDA, 2017). Corporate interests and sales, on the other hand, receive 85.4 cents of each food dollar (USDA, 2017). Across the nation, farmers are aging; almost a third are over 65 years of age, and only 8 percent are under 35 (Neff, 2014). There is a deficit in both beginning and young farmers to take over farming, as barriers to entry are significant and income instability tends to be high throughout a farming career (Imhoff & Badaracco, 2019; Niewolny & Lillard, 2010). Suicide rates among farmers are among the highest of any occupational group in the U.S. and have spiked with recent historical flooding, the international trade war, and the pandemic (Gowen, 2019; Rosmann, 2017; Weingarten, 2018). The recent

Figure 1. Old McDonald is Struggling

Although family farmers represent the majority of farmers in the U.S., they are increasingly unable to profit from and live off their farms (Klein & Locke, 2014).



Data sources: USDA, Economic Research Service; and National Agricultural Statistics Service, 2018 Agricultural Resource Management Survey. Data as of November 27, 2019, and U.S. Census data 2018.

disruptions in food markets and distribution due to the COVID-19 pandemic have mental health professionals bracing for a continued increase in mental health issues in farming communities and beyond (Pappas, 2020; Singh, 2020).

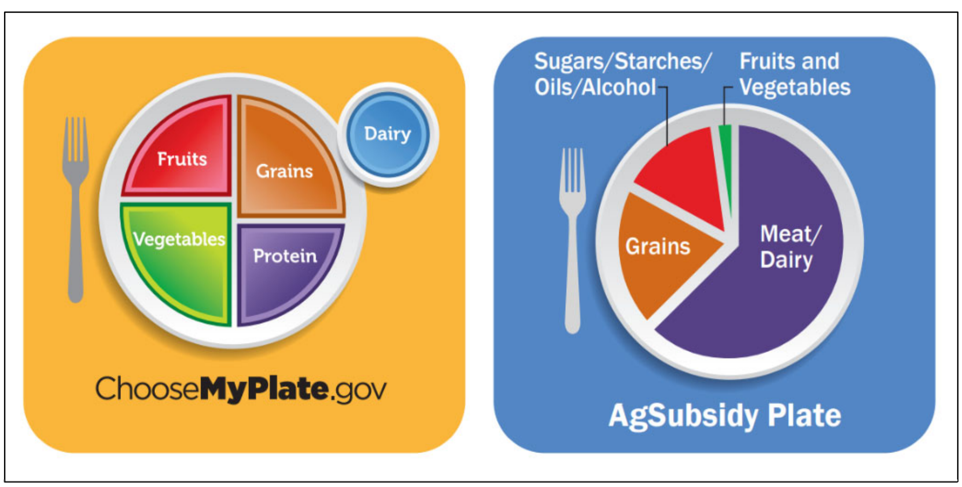
These disparities are perpetuated by national policies that promote massive, monoculture, primarily absentee-owned, commodity crop farms, particularly through the historic "get big or get out" influence of USDA secretary Earl Butz of the 1970s (Gustafson, 2014). Butz focused on improving the quantity and efficiency of commodity crop production. Unfortunately, the resulting policy set the stage for a reliance on large-scale monocrop and concentrated feedlot operations, which cause a great deal of damage to local environments and social structures, as opposed to small and midscale operations producing diverse and nutritious foods (Imhoff & Badaracco, 2019; Raff & Meyer, 2019). Fruits and vegetables, for example, were (and still are) only considered "specialty crops" in the farm bill, the nation's primary food and farm legislation (Imhoff & Badaracco, 2019). Farmers in the early 1900s represented 36% of the national population, whereas today, they represent under 2% (Neff, 2014; Pollan, 2015).

Even more extreme consolidation of power occurs among seed companies; over 200 years, we have gone from thousands of local natural seed companies nationally to having primarily four large *international* chemical and/or pharmaceutical companies dominating the seed industry (MacDonald, 2019; Schapiro, 2018). "Why chemical and pharmaceutical companies?" you may ask. It's because seeds can be engineered to depend on or even produce natural variants of specific chemicals such as pesticides and herbicides (MacDonald, 2019). This improves plant growth in industrial settings but has severely decreased the diversity and resilience of food plants and the availability of local seed varieties (Mbow et al., 2019; Schapiro, 2018). Over time, our food system has evolved such that a smaller and smaller number of larger and larger farms and corporations provide us our food.

Truth be told, you don't have to work with food to eat. Therefore, we are all affected by injustices in the food system. Let's go back to food policy. We, the eaters, have historically received mixed official messages about food. Take, for example, the comparison in Figure 2 between MyPlate nutritional recommendations and actual governmental subsidies of those same food categories (Badaracco, 2019). The historical rise of junk food from excess production of corn and other commodity crops, along with lifestyle changes, are correlated with a massive health epidemic that is spreading worldwide (Gustafson, 2014). For the first time in history, people who are overweight or obese globally outnumber those who are hungry (Capone et al., 2014). Furthermore, "food" that is calorie-dense but of little nutritional value tends to be cheap, meaning that hunger and

Figure 2. Comparison of MyPlate versus AgSubsidy Plate

Are national stakeholders on the same page about what food we should be eating? It seems not. Compare the MyPlate nutritional recommendations to the equivalent plate if it were developed based on agricultural subsidies of those same foods.



Source: The Edible Schoolyard Project, 2019 (42:39 of the video); new image created by the author and Patti Davis and team.

overweightness often run parallel in populations that have historically been excluded from access, autonomy, and opportunity for both economic growth and political influence (Fisher, 2017; Northridge et al., 2003).

In an age where many infectious diseases are controlled (of course, COVID-19 has provided an exception), we are instead overrun with food- and lifestyle-related conditions such as obesity, coronary heart disorder, and type 2 diabetes, even in children and particularly in Indigenous, Black American, and other historically disadvantaged communities (Fisher, 2017; D. M. Nestle et al., 2015). The Centers for Disease Control and Prevention (CDC) reports that 39.8% of Americans are obese, with even higher rates among minorities (CDC, n.d.). The obesity epidemic costs the U.S. an estimated total of US$1.7 trillion annually between health care costs (US$480.7 billion) and lost productivity (US$1.24 trillion) (Milken Institute, 2018; Waters & Graf, 2018). In response to health woes and negative messaging about body image, individuals often become wrapped up in the massively confusing culture (and US$60 billion a year industry) of dieting (M. Nestle, 2013). Instead, eating can be as simple as, "Eat food. Not too much. Mostly plants" (Pollan, 2008, p. 1)—that is, if those foods are accessible to a given population.

Overconsumption worldwide exists simultaneously with malnutrition. Globally, 836 million people (12% of the world's population) live in extreme poverty (less than US$1.25 a day), and approximately one million children a year die from the effects of starvation (Capone et al., 2014; United Nations [UN], 2015). In 2019, 10% of Americans (35 million) were food-insecure (defined as individuals who "experience limitations in access to adequate food to the extent that it causes changes in diet or reduced food intake" [Weinfield et al., 2014, p. 132]) (USDA ERS, 2020). Twenty percent of food-insecure Americans are children, and 10% are elderly (Feeding America, n.d.). Furthermore, food insecurity rates are significantly higher among Black Americans (25%), Native Americans (23–45%), and Hispanic Americans (26%), compared to White Americans (10%) (Neff, 2014). Disruptions in employment, food distribution, and social systems generally due to the COVID-19 pandemic have led food insecurity rates to spike to over 15%, with the greatest impact being on communities of color and other communities that were already experiencing increased food insecurity before the pandemic (Hake et al., 2020).

Similarly, through historical social, economic, and resource disenfranchisement, these populations often find themselves in communities characterized as food deserts (also called areas of food apartheid), with limited access to grocery stores and fresh produce (Penniman, 2018). Only 8% of Black Americans, for example, live in a neighborhood with one or more grocery stores, compared to 31% of White Americans (Penniman, 2017).

Yet, we produce enough food to feed all world citizens twice their daily nutritional needs (about 2,000 calories). In the U.S., almost 4,000 calories of food are available per man, woman, and child (M. Nestle, 2013). Globally, over 5,000 calories of food directly edible by humans are produced per person annually; that figure almost doubles if you include food produced to feed animals (Berners-Lee et al., 2018). Food is available and abundant, but poorly distributed.

It may be becoming clear that food is, in fact, very political (Poska, 2019). Food has historically had implications in power and social activism (Bellemare, 2015). The Arab Spring was preceded by disruptions in food prices (Perez, 2013). Mexican drug cartels are increasingly taking control of forests and farms to benefit from avocado revenues (Linthicum, 2019). Land grabbing, or the acquisition of large swaths of fertile foreign land by governments and corporations without proper compensation to the local stakeholders, has increased dramatically as food and climate change become more pressing (Margulis et al., 2013). The World Bank estimates that 45 million hectares had been acquired through transnational purchases between 2008 and 2012 in all continents, save Antarctica (Rulli et al., 2013).

A plethora of food movements, including those related to social justice, food sovereignty, slow food, organic food, vegetarianism and veganism, and more have utilized food to drive positive social and environmental change (Neff, 2014). Racial justice movements of the 1960s, for example, focused on food sovereignty and food justice for Black Americans in communities, schools, and places of work (Penniman, 2018). Food continues to be essential to social justice movements today (Simley, 2017). The COVID-19 pandemic has also brought food to the forefront of personal and political discourses, with strong advocacy (often met with political resistance) to improve food security (Hake et al., 2020), the working conditions and wages of essential food works (Wozniacka, 2020), food system resilience through localization and decentralization (Lal, 2020; Mejia et al., 2020), and much more.

In order for our food to be just, it has to be produced in a system that values the people who produce it and the people who eat it (Rodman-Alvarez & Colasanti, 2019). This system must value individual and community health over wealth (Gaddis et al., 2020). Just some of the changes that can be made are creating intentional policy to ensure just distribution of and access to healthy food; improving economic opportunity for food chain workers worldwide; instigating legislative reform around worker rights and wages; limiting the power of Big Food, agriculture, pharmaceutical, and chemical companies on markets, food prices, and policy; and restructuring subsidies to support midscale, sustainable, and diverse agriculture.

How is our food shaping natural environments as it is produced and transported to us?

Imagine flying over a landscape. Maybe you've flown in a plane. Some of the most distinct topographical features you'll see are those related to food production: the characteristic square and circular monocultured fields, the irrigation ponds, and the sparsity of forests where they have historically dominated. Land use and other environmental impacts related to food production change natural ecosystems drastically.

Let's start with water. On our water-covered planet, less than 1% is accessible freshwater. We use 70% or more of that water for agricultural and livestock production (FAO, 2017). It takes about 13 liters (3.4 gallons) of water to produce a tomato, 140 liters (37 gal.) for a cup of coffee, and a whopping 2,400 liters (634 gal.) to produce a hamburger patty (Hoekstra, 2008; Water Footprint Calculator, 2020). At the same time, 1 in 3 people globally does not have access to safe drinking water (World Health Organization [WHO], 2019). In addition, agriculture and livestock produce overwhelming amounts of pollution that run into surrounding water bodies. Contamination is widespread and has been documented in 80% of U.S. streams (National Critical Zone Observatory, 2012; Thyberg & Tonjes, 2016). Nutrient and sediment displacement by agriculture also weakens aquatic systems. Specifically, eutrophication, or excess nutrients causing algal blooms and eventual anoxia in aquatic systems, is the leading cause of waterbody degradation, affecting 65% of U.S. waterways (National Oceanic and Atmospheric Administration [NOAA], 2019). Eutrophication in the U.S. alone is estimated to cost US$2.2 billion annually (Chislock et al., 2013).

The significant amount of waste produced from concentrated animal feed operations (CAFO) is of particular concern as well (Imhoff & Badaracco, 2019). In the U.S., more than 335 million tons of dry manure (laden with chemicals and antibiotics) is produced annually from swine, poultry, and cattle operations; much of that waste is stored in lagoons (USDA, 2004). A single CAFO can produce more lagoon wastewater than a human city, with significantly less regulation around pathogen removal and treatment of said water (Neff, 2014; Raff & Meyer, 2019).

Oceans are also suffering. Historic overfishing and pollution have led to fisheries crashing, coral reefs being bleached, and habitats being destroyed (Li et al., 2016; Springmann et al., 2018). Plastic may soon outnumber plankton as 8 million metric tons of plastic waste—not just straws and bags, but food containers, jugs, bottles, packaging, and more—enter the oceans annually (Lauridsen, 2015). The increased use of disposable masks and personal protective equipment (PPE) related to the COVID-19 pandemic has only exacerbated this problem (Cordova et al., 2021; De-la-Torre & Aragaw, 2021).

Deterioration of ocean health also directly affects the 800 million people worldwide who rely on fishing for sustenance (World Wildlife Fund [WWF], 2018).

Agricultural and livestock practices, especially those of large monocultures, also severely deplete soils (Miller, 2013). Soil is the basis for all food production as plants grow in soil and livestock eat plants. But nutrient depletion in soil results from high-density and highly mechanized agriculture and land-use changes. Also at stake is the physical integrity of soil. Poor soil lacking proper amounts of organic materials is more prone to erosion, as became terribly evident in the Dust Bowl of the 1930s (Imhoff & Badaracco, 2019). Such impacts still lead to the loss of more than 1 cm (0.4 inch) of topsoil annually in the U.S. (National Critical Zone Observatory, 2012). Globally, a third of soils are considered somewhat to severely degraded (Neff, 2014). Ironically, another threat to farmland is that of urbanization. In the U.S., 40% of agriculture production occurs at the "urban-edge," making it vulnerable to urban expansion (80% of Americans and 50% of the world's population live in cities, and such urban areas are expanding) (Neff, 2014; U.S. Census Bureau, 2016).

As with water, fertilizers are a significant factor in land degradation. Phosphorous, an important component of fertilizers, is extracted from mines worldwide. Scientists warn of the limited nature of phosphorus and the significant amount of radioactive byproduct (5 tons of this waste for each ton of phosphorous extracted) resulting from phosphorus extraction (Cordell et al., 2009). Food justice becomes relevant again here as, paradoxically, Africa is one of the top producers of the essential phosphorus with which we grow food *and* is the most food-insecure continent (Syers et al., 2011).

Also at stake is the air we breathe. The processing of food produces air pollution and significant amounts of the GHG emissions that lead to climate change (Poore & Nemecek, 2018). In fact, a third or more of anthropogenic GHG emissions, much of which comes from meat production, originate from the global food cycle (Foer, 2019; IPCC, 2013; Venkat, 2011). Minority communities and people of color are frontline communities in climate change, as they are disproportionally exposed to the resulting degraded air, water, land, and social systems (Chiapella et al., 2019). Forests, one of the planet's main mechanisms for sequestering GHGs, are being lost at a rate of about 13.5 million hectares (33.4 million acres) worldwide per year, mostly due to agriculture and illegal logging. This rate of loss is, unfortunately, faster than forests can regrow (Silver et al., 2000; WWF, n.d.) (see Figure 3, below). Even considering forests planted to offset said deforestation, net deforestation has increased significantly since the 1990s (Lindquist et al., 2012). Deforestation and forest slash and burn are attributed to 12% or more of global anthropogenic GHG emissions (World Bank, 2019). Tropical rainforests sequester 228 to 247 gigatons of carbon annually; the fact that we are losing that capacity at such a critical time should immediately cause one to pause and consider the vastness of the impact (WWF, n.d.).

Now, let's talk about one more thing.

Humans exploit natural, social, and economic systems to produce (cheap) food, and *then we waste it*. In fact, we waste a whole lot of edible food and all the resources that go into it. Nationally 40%, and globally 30%, of food produced is wasted annually (Lipinski et al., 2013; Thyberg & Tonjes, 2016). To put that into perspective, 32.4 million hectares (80 million acres) of farmland in the U.S. are used to produce food that we never eat (ReFED, 2016). More than 10 million pounds of produce never leave farms due to cosmetic imperfections (ReFED, 2016). Thirty-five percent of the freshwater, 31% of the cropland, and 30% of the fertilizer in the U.S. are used to produce food that never gets eaten (Johns Hopkins Bloomberg School of Public Health, 2015). An estimated 40% of seafood caught is considered "bycatch" or unintended fish catch that is thrown back, usually dead—wasted before it even reaches a dock (Feldstein, 2017).

On top of all that, the COVID-19 pandemic led to a spike in wasted food, both preconsumer (due

Figure 3. Example of a Food Chain Cycle

Photos courtesy Pexels and Pixabay. Image created by the author and Patti Davis and her team.

to disruptions in distribution and markets) and postconsumer (as people eat and cook more at home) (Aldaco et al., 2020; Yaffe-Bellany & Corkery, 2020), although there is hopeful evidence suggesting that improved home skills will eventually decrease household food waste overall (Roe et al., 2020; Seeley, 2020).

The average American wastes more than half a pound of food a day (Thyberg & Tonjes, 2016). The average American family spends between US$1,350 and US$2,275 per year on food they purchase but never eat (Waters & McNamara, 2015). Food waste costs the nation an estimated US$218 billion and the world US$2.6 trillion annually (Feldstein, 2017). Twenty percent of landfill-bound waste in the U.S. is wasted food (Schwab, 2012). Once in the landfill, wasted food releases carbon dioxide (CO_2) along with the even more potent GHGs methane and nitrous oxide (Gunders, 2012). Food waste alone produces an estimated 8% of anthropogenic GHGs globally (FAO, 2013). The global food system impacts our world in overwhelming ways, yet we waste that impact on the food that is not eaten. As we waste food and resources at an alarming rate, hunger is prevalent, both nationally and internationally (Capone et al., 2014; Weinfield et al., 2014). For this reason, food waste has been deemed "the world's dumbest problem" (Ahmed, 2019).

And it's not just the food that is being wasted. Once again, let's take a bird's eye view, this time over a grocery store. Do you see food? No, besides the produce section, we see only plastic and paper packaging—trash. The U.S. Environmental Protection Agency (EPA) estimates that 29.9% (80.1 million tons) of landfill-bound waste in the U.S. is packaging (U.S. EPA, n.d.).

So, what do I do?

Ok, so we're eating injustice and drowning in trash; how can we redesign the food system? When dealing with a global system, the solution is never simple. But a global system does allow everyone, from policy-makers to home gardeners, to help make a difference in their own way. We can start by understanding the complexity of the food system, the impacts it has on social and environmental justice, and the entry points for change. We have only just scratched the surface in this article.

Additionally, the COVID-19 pandemic has made clear what has always been true: our food workers are the core of our livelihoods. They are essential. Our response, though, has been mixed. While local growers, fishers, and communities work to decentralize, find new markets, and distribute much-needed resources, our administration works to deregulate the industry and marginalize many food workers, further entrenching an already-unjust food system (Grillo, 2020; Held, 2020; Jordan, 2020; Mejia et al., 2020; Sethi, 2020; Wozniacka, 2020). In a moment of crisis, there may be a moment for food system change.

Small steps for change include voting with your fork (eating intentionally to reflect your values), planning meals to avoid waste, composting at home, planting a garden, and many other lifestyle changes (Gunders, 2015; Gustafson, 2014). *But settling for small lifestyle changes won't make broader change.* We also need to vote with our ballots, address systems of inequity nationally and worldwide, and restructure our understanding of and policy around food and consumption (M. Nestle, 2013; Penniman, 2017; Simley, 2017). Consider your niche, your career, your hobbies, and how you might develop the knowledge, skills, and networks to mobilize this change. We must work as a collective to make a real difference (Foer, 2019).

In summary, we are what we eat. Currently, we are eating a food system that is creating imbalances in social, natural, and economic systems. Let's fix our food system.

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COMMENTARY ON COVID-19 AND THE FOOD SYSTEM

JAFSCD Responds to the COVID-19 Pandemic

COVID-19 and consumer demand for local meat products in South Carolina

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Introduction

The emergence of the novel coronavirus (COVID-19) pandemic and the associated economic disruptions have challenged local food producers, distributors, retailers, and restaurants since March 2020. COVID-19 was a stress test for the U.S. local food supply chain, exposing vulnerabilities whose impacts have varied by region and sector. Some local producers saw sales fall in 2020 due to COVID-19 restrictions and consumer foot traffic changes (O'Hara, Woods, Dutton, & Stavely, 2021). In other areas, local food producers were able to pivot from collapsing market channels by finding opportunities elsewhere (Thilmany, Canales, Low, & Boys, 2020).

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Steve Richards and Clemson University's Agribusiness, Livestock and Forages, and Food Systems and Safety Teams led the local meat supply chain study in South Carolina.

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Recent studies have shown that local foods have gained popularity over the last 12 months as consumers are buying more food to eat at home (USDA Economic Research Service, 2021). Surveys show that consumers are desiring to make more sustainable, local food purchases and are eating less fast food (Accenture, 2020; Daus, Clement, & Ding, 2020; Lalley, 2020). National brand purchases have slipped as consumers shifted their buying behaviors in response to these products being unavailable or sold out (C+R Research, n.d.), leading to hoarding (Lusk & McCluskey, 2020) and stockpiling behaviors that even caused a national freezer shortage (Tyko, 2020).

The demand increase for local foods includes local meats (Food Insight, 2021; Richards & Vassalos, 2020), and meat processing capacity continues to be a key issue for many states as they react to supply and demand shocks (Hobbs, 2021). At least 17 states have started funding programs to expand or upgrade their meat processing facilities (Niche Meat Processor Assistance Network [NMPAN], 2021). As of this writing, South Carolina has not implemented any funding program and is still experiencing a supply push from livestock producers (Richards, 2020a) as a reaction to increased consumer demand for local meat products (Richards, 2020b).

While the previously mentioned studies examined the impact of COVID-19 on local agriculture and food markets, there is little research assessing whether the observed changes in consumer behavior will persist after the crisis is over. The present commentary is an effort to add to this research.

Specifically, this commentary examines whether South Carolina consumers will continue to purchase local meats at the same rate as they did in 2020. Preliminary results suggest a majority of consumers will continue to buy the same amount of local meat products, but there is a possibility that demand could decrease after COVID-19 restrictions have ended.

Consumer Survey

One thousand and forty-eight (1,048) South Carolina consumers were surveyed in November 2020. Screening questions ensured that these consumers both ate meat and made household food-purchasing decisions. The survey was administered online through Qualtrics.[1] The survey questionnaire was pretested in October 2020 for wording, length, and accuracy. The definition of local meat used in this survey was as follows:

> *Local meat products, for the purpose of this survey, are those products that are farm raised in South Carolina within 200 miles of your home. Products are also considered local if they are produced in North Carolina and Georgia and are a short distance from the South Carolina border. Nonlocal meat are those meat products found at most food retailers (grocery stores) that are not labeled as being local."*

Results

The survey sample revealed that 741 (71%) of respondents had purchased local meat products within the last 12 months. These purchases were mostly consumed at home (*n*=621 or 84%), followed by restaurants (*n*=379 or 51%) and barbecues (*n*=178 or 24%). Question logic was used to segment participants in order to collect more detailed data concerning local meat purchases for consumption at home versus away from home.

COVID-19's Impacts on Local Meat Purchases for Home Consumption

Survey participants who purchased local meat products to eat at home were asked how their purchases changed due to COVID-19. The findings indicate that most consumers did not change their local meat

[1] Qualtrics is an online survey software provider used often in applied economics research.

consumption habits (58%), while 21.6% increased local meat consumption and 20.4% of consumers decreased or stopped consuming local meats (Table 1).

The 127 (20.4%) respondents who indicated they had decreased consumption of local meats were asked why they had made this change. Respondents indicated that they had concerns about leaving the house due to COVID-19 (32.7%), local meat products were in short supply or sold out (30.6%), they were buying less costly nonlocal meats (22.4%), or their freezers were full of nonlocal meat (14.3%). These reasons suggest that local meat purchases may have been higher if not for meat shortages and full freezers (Table 1).

Table 1. Local Meat Purchasing Behavior at Home During COVID-19

	Percent
How has COVID-19 Changed Your Local Meat Purchases for Home Consumption? (*n*=621)	
I have increased my consumption of local meat products	21.6%
I have not changed my consumption of local meat products	58.0%
I have decreased my consumption of local meat products	20.4%
(If Increased) How Much Have You Increased Your Local Meat Consumption? (*n*=134)	
I have increased my consumption over 100%	17.2%
I have increased consumption by 75% to 100%	24.6%
I have increased consumption by 50% to 74%	27.6%
I have increased consumption by 25% to 49%	17.2%
I have increased consumption by 1% to 24%	13.4%
(If Decreased) How Much Have You Decreased Your Local Meat Consumption? (*n*=127)	
I have decreased my consumption by 100% (stopped)	21.4%
I have decreased my consumption by 75% to 99%	10.3%
I have decreased my consumption by 50% to 74%	20.6%
I have decreased my consumption by 25% to 49%	27.8%
I have decreased my consumption by 1% to 24%	19.8%
(If Decreased) Why Have You Decreased Your Local Meat Consumption Due to COVID-19? (*n*=127)	
I was concerned about leaving the house to buy local meat products	32.7%
Local meat products were in short supply or sold out	30.6%
I started buying less costly nonlocal meat products	22.4%
I had stockpiled nonlocal meat products in my freezer already	14.3%

Source: Survey results (Richards, 2021b)

COVID-19 Impacts on Local Meat Purchases at Restaurants

Respondents who ate local meats at restaurants were asked how COVID-19 affected their restaurant purchases (Table 2). Over half responded that they had not changed their restaurant purchases (51.7%), while 38% decreased or stopped their consumption and 9.8% increased their consumption.

When asked to quantify the amount of decreased consumption, 30.8% responded that they had stopped consuming local meats entirely. The top three reasons provided by respondents are that most of the consumers avoided eating out during the COVID-19 period (90.1%), restaurants were closed or had reduced seating capacity (81.2%), and consumers were trying to save money by not eating out as frequently (40.6%). The next two responses suggest that some restaurants may have stopped serving local meat products.

Table 2. Local Meat Purchasing Behavior at Restaurants During COVID-19

	Percent
How has COVID-19 Changed Local Meat Purchases at Restaurants? (*n*=379)	
I have increased my consumption of local meat products at restaurants	9.8%
I have not changed my consumption of local meat products at restaurants	51.7%
I have decreased my consumption of local meat products at restaurants	26.6%
I have stopped consuming local meat products at restaurants	11.9%
(If Decreased) How Much Have You Decreased Your Local Meat Consumption? (*n*=146)	
I have stopped consuming local meat products at restaurants	30.8%
I have decreased my consumption between 75% and 99%	14.4%
I have decreased my consumption between 50% and 74%	27.4%
I have decreased my consumption between 25% and 49%	17.8%
I have decreased my consumption between 1% and 24%	9.6%
(If Decreased) Why Have You Decreased or Stopped Your Local Meat Consumption at Restaurants? (*n*=146) (total is greater than 100% because more than one response was allowed)	
I am currently avoiding eating out due to risks of COVID-19	90.1%
Restaurants are closed or have reduced dine-in capacity	81.2%
I am trying to save money by not eating out as much	40.6%
Restaurants are offering fewer local meat items on their menus	23.8%
Restaurants are not offering local meat items for carry-out or delivery	15.8%
I do not want to order local meat products for carry-out	9.9%

Source: Survey results (Richards, 2021b).

Post–COVID-19 Purchases of Local Meat Products for Home Consumption

Most consumers (97.3%) who purchased local meats to eat at home intend to continue purchasing local meats after COVID-19 restrictions have been lifted. Responses to the question of how much local meat they thought they would purchase after the pandemic show that most intend to purchase the same amount (48.7%), with 28.1% expecting to buy less and 23.2% expecting to buy more (Table 3).

Table 3. Local Meat Purchasing Behavior at Home After COVID-19 (*n*=621)

After COVID-19 Has Ended, Will You Continue to Buy Local Meat Products?	
Yes	97.3%
No	2.7%
How Much Local Meat Will You Continue to Buy After COVID-19?	
I will buy between 75% and 99% less local meat	5.3%
I will buy between 50% and 74% less local meat	9.8%
I will buy between 25% and 49% less local meat	9.0%
I will buy between 1% and 24% less local meat	4.0%
The same amount as I did before COVID-19	48.7%
I will buy between 1% and 24% more local meat	6.3%
I will buy between 25% and 49% more local meat	6.9%
I will buy between 50% and 74% more local meat	4.9%
I will buy between 75% and 100% more local meat	4.2%
I will buy over 100% more local meat	0.9%

Source: Survey results (Richards, 2021b)

Lessons Learned and Further Study

COVID-19 triggered an increase in demand for local meats in South Carolina. However, it is not clear if this increase will be a long-term phenomenon. The study findings highlight that after the end of COVID-19, most respondents will continue purchasing local meat products to eat at home. However, only 23% intend to increase their purchases and 28% plan to decrease their purchases. These results indicate a potential risk for the local meat sector in South Carolina. An expansion of local processing capacity will most likely need to be accompanied by an expansion of local markets. South Carolina livestock producers should consider escalating their marketing efforts to preserve recent demand increases.

The survey mentioned in this article also collected consumer preference data that is currently being shared with local producers to help them retain current markets and develop new ones. Also, a restaurant buyer survey will be conducted in June 2021 to discover ways to offer more local meats on restaurant menus.

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Disease and disaster: Navigating food insecurity in a community affected by crises during COVID-19

SPECIAL ISSUE COSPONSORED BY INFAS:
THE IMPACT OF COVID-19 ON FOOD SYSTEMS

Inter-institutional Network for Food and Agricultural Sustainability

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Abstract
This exploratory study examines how a community experiencing food insecurity while navigating multiple crises can be a model to inform resources, processes, and systems supporting communities facing similar circumstances. Data for this study were collected from residents of a community in Oconee County, a rural county in the northwest corner of South Carolina experiencing pervasive food insecurity. The community was severely impacted by the onset of COVID-19 and further devastated by a tornado in mid-April. The area of the county that sustained the greatest damage from the tornado was the Utica Mill Hill community, home to the county's most vulnerable population. This cascading series of events constituted a crisis-within-a-crisis for the community. In this study, we sought to learn more about community members' experiences and the effects of the crises on community members' access to food. We conducted in-depth interviews with 14 residents living in the Utica Mill Hill community. The results provided

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insight into community members' experiences of the crises and the nature of community-level response and recovery efforts. We learned about participants' experiences with food insecurity, new food policy developments, and gained unexpected insight into community members' experiences with mental health challenges related to the crises.

Keywords
COVID-19, Crisis, Food Insecurity, Food Systems, Mental Health, Pandemic, Resiliency, Tornado

Introduction

In 2020, the U.S. faced an unprecedented number of hazards, threats, emergencies, and crises. Regional and national-level emergencies have been particularly devastating, including wildfires across the West coast, tornadoes across the Midwest and Southeast, and hurricanes across the Southeast and along the entire East coast. These events, in a typical year, would have been record-setting challenges for communities to manage. However, 2020 was not a typical year. As of this writing, the U.S. is roughly one year into a global pandemic following the first cases of COVID-19 reported in the U.S. in January and February of 2020 (Jorden et al., 2020). While the nation was facing unprecedented natural disasters and attempting to manage a pandemic and its related significant negative health impacts—e.g., "worse mental health outcomes, increased substance use, and elevated suicidal ideation" (Czeisler et al., 2020, p. 1057)—other widespread crises developed. For example, families facing food insecurity found that due to the economic effects of the pandemic food resources became even scarcer, especially for families with the highest risk of poverty and food insecurity (Dev & Kabir, 2020; Laborde et al., 2020).

To provide a window into communities facing multiple concurrent crises, this exploratory study focuses on a single neighborhood in Oconee County, South Carolina. This community is ideal for such a study for several reasons. First, even prior to 2020, members of this community were experiencing pervasive food insecurity. Second, the community was severely impacted by the onset of COVID-19, which thoroughly upended residents' daily lives. Third, the county was devastated by a tornado in mid-April 2020; the area sustaining the greatest damage was the Utica Mill Hill community, home to the county's most vulnerable population. Fourth, after the tornado parts of the community were affected by a public health crisis, a hepatitis A outbreak resulting from a lack of clean water. As these crises unfolded in the Utica Mill Hill community, community members began to report an increase in mental health-related challenges from the onset of COVID-19. As applied scholars representing a land-grant institution with a service-oriented mission, we believe that Utica Mill Hill presents a unique opportunity to develop knowledge that can support the residents, as well as other communities in the future facing food insecurity and extended crises. The background of these issues is explored in the subsequent sections, followed by a discussion of the study research questions.

Food Insecurity

The U.S. Department of Agriculture (USDA) defines food insecurity as a "household-level economic and social condition of limited or uncertain access to adequate food" (USDA, 2019). The official measure of food insecurity in the United States is established through the Current Population Survey Food Security Supplement (USDA Economic Research Service, 2020), in which respondents are asked 10 to 18 food security-related questions depending on family composition. Questions range from "We worried whether our food would run out before we got money to buy more" to "In the last 12 months did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food?" (Coleman-Jensen et al., 2016, p. 3). During the Great Recession, food insecurity was exacerbated by rising inflation, increase in food costs, increases in unemployment, and the collapse in the price of housing. Early evidence suggests, however, that levels of food insecurity are even higher during the COVID-19 pandemic than during the Great Recession (Schanzenbeck & Tomeh, 2020; U.S. Census Bureau, 2020).

Food Deserts

Food insecurity is often associated with living in a food desert, defined by Congress as "an area in the United States with limited access to affordable and nutritious food, particularly such an area composed of predominantly lower-income neighborhoods and communities" (Food, Conservation, and Energy Act of 2008). This definition addresses the complex interplay of cost, variety, decisional power, and nutritional quality influencing food security. Prolonged residence in areas of low access to healthful food and in "food swamps," areas of high access to energy-dense (highly processed) foods, may lead to higher rates of obesity and other diet-related diseases (Cooksey-Stowers et al., 2017; Danhong et al., 2016). This is especially troubling, as health care costs are almost 50 percent higher for food insecure households than food secure households (Tarasuk et al., 2015). While food deserts may not directly cause food insecurity, they do provide good indicators of areas where food insecurity is more likely.

Food insecurity and food deserts can be locally contextualized. For example, South Carolina has a food insecurity rate of 12.3%, compared to 13% for the U.S. Oconee County has a food insecurity rate of 17.5% for families with children and has two USDA- designated food deserts, one of which is the site of our study (Feeding America, 2018). Local community food systems are not only about food production, they also provide a vehicle for economic development and honoring local food heritages and food culture (Hossfeld & Rico Mendez, 2018).

Crisis and Resilience: Community Response to Disaster

Many residents in the study area are in a near-constant state of crisis resulting from food insecurity. A crisis is characterized as a "specific, unexpected, and non-routine event or series of events that create high levels of uncertainty and simultaneously present an organization with both opportunities for and threats to its high priority goals" (Ulmer et al., 2019, p. 7). While Ulmer and colleagues focus on the impact of crises on organizations, crises often have a broader impact on entire communities (Anthony & Sellnow, 2011; Pyle, 2018). This is especially true when considering the community-level effects of natural disasters.

Natural disasters. Natural disasters such as wildfires, earthquakes, and hurricanes are often devastating to communities, if not entire regions. Yet natural disasters create opportunities for renewal post-crisis, as communities seek to rebuild and re-establish normalcy (Ulmer et al., 2019). For example, the EF5 tornado that struck Greensburg, Kansas in May 2007 allowed very little time for the town to prepare and left almost no structures standing in the town of 1400 (Sommerfeld, 2015). Yet the Greensburg tornado demonstrated community resilience. After the devastation, the residents decided they would rebuild and restore their town. But rather than trying to rebuild what they had before the tornado, they decided to build a new, forward-looking, sustainable town. Tornadoes are distinct from other types of disasters in that they often affect small portions of a community, while other parts of the same community are unaffected or minimally affected. This was the case with the tornado that struck Oconee county in April 2020. The greatest damage ocurred in the Utica Mill Hill community. This renewal process is highly dependent on community resilience.

Resilience. Resilience is the "ability to recover the state of a system after it has been disrupted" (Anthony et al., 2019, p. 166). Community resilience, then, is a "community's ability to strengthen its response to deal with crises or disruptions … [a resilient community can] bounce back from an event, not necessarily to return to normal, but to return to a new normal in the initial days, weeks, and months depending on the size and scope of the disaster" (Veil & Bihop, 2014, p. 723).

Resilience is specifically tied to three aspects of efficacy: self-efficacy, system efficacy, and response efficacy. Self-efficacy is the ability of a person to implement some course of action to manage a risk or protect themself from harm (Witte et al., 2001). Self-efficacy is instilled within systems such as the "Run, Hide, Fight" heuristic for self-protection during an active shooter event (Ford & Frei, 2016). System efficacy involve a person's belief that they are part of a system which offers protections. As most citizens do not know how to fight house fires or offer emergency medical care, they trust and rely on fire departments and emergency medical technicians for this type of efficacy. Response efficacy is the belief that a particular response or action will solve a problem or reduce damage (Witte et al., 2001). A person may believe that comprehensive health screenings can accurately isolate carriers of COVID-19 from interacting with the rest of the community—system efficacy—but may not believe that the system is fully effective for catching all cases; therefore, that person may choose to wear a mask and wash their hands regularly—self-efficacy and response efficacy.

Community responses during and after disasters. Community response post-disaster has been studied intensely for more than a century. Since Prince's iconic study of the Halifax shipping disaster (1920), sociologists and scholars of crisis communication have demonstrated thoroughly that in the midst of disasters individuals tend to respond with prosocial behaviors of support and community care, often in emergent, spontaneous, unplanned efforts by individuals and groups (Pyle et al., 2019; Quarantelli & Dynes, 1977; Waldman et al., 2017). In line with this body of research, early studies of responses to the COVID-19 pandemic suggest that individuals, households, and communities are experiencing solidarity. For example, Tierney (2020) notes the long-term trend demonstrated in pandemic and disaster literature that community members help those in need, donations to food banks increase, customers intensify support of local businesses, and local cultural institutions expand community engagement. Additional literature supports the important role of individual-level and community-level social capital during all phases of a disaster, including mitigation, preparedness, response and recovery (Meyer, 2018; Monteil et al., 2020). For example, in terms of disaster preparedness, establishing connections between agencies and establishing trust between residents and decision-makers are essential (Koh & Cadigan, 2008). Similarly, social capital, in the form of networks, connections, and partnerships, are considered to be the "core engine" of the disaster recovery process (Aldrich, 2012, p. viii). In the context of food insecurity experienced after extreme weather events, social capital in the form of a lead actor who coordinates networks is especially important for rural communities (Chriest & Niles, 2018).

Considerations of Social Vulnerability in Crisis

While no one is immune to the impact of threats and disasters, some population groups are more vulnerable to such impacts. Disparities of morbidity and mortality among vulnerable populations increase in times of disaster. Low-income residents with limited access to food are less likely to have the resources needed to secure food during- and post-disaster. In addition, residents with limited mobility (e.g., due to disabilities or no vehicle access) are less likely to evacuate, thus depending on local and emergency resources to provide shelter and food (Mundorf et al., 2015). In a study examining social cohesion following Superstorm Sandy, residents in low socioeconomic status neighborhoods had more confidence in recovery when there was more informal social control (Cagney et al., 2016). Higher levels of perceived neighborhood social cohesion can protect residents from food insecurity (Denney et al., 2017).

In order to meet other survival needs, low-income families will often sacrifice food budgets (Frank et al., 2006, p. e1300). As a result, social capital seems to be a strong moderator of food insecurity. Community food resilience encompasses the social, economic, and physical environments to build the capacity to support local food systems (Tendall et al., 2015). Based on relevant research on social capital and low-income communities, we posited there would be high levels of community support in response to the multiple crises in Oconee County.

Rarely does a community experience an array of overlapping crises as described in the preceding literature. Thus, this exploratory, descriptive study examines a community impacted by multiple concurrent and consecutive crises, with the goal of understanding how a community experiencing food insecurity navigates multiple crises can serve as a model in order to inform resources, processes, and systems for supporting communities facing similar circumstances. To that end, we investigate the following research questions: (RQ1) To what extent did COVID-19 and the tornado impact local residents' access to food? (RQ2) What roles did community members play in supporting those affected by COVID-19 and the tornado?

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Method

IRB Approval

This study was reviewed and approved in May 2020 by the researchers' Institutional Review Board.

Figure 1. COVID Case Rate per 1,000 by ZIP

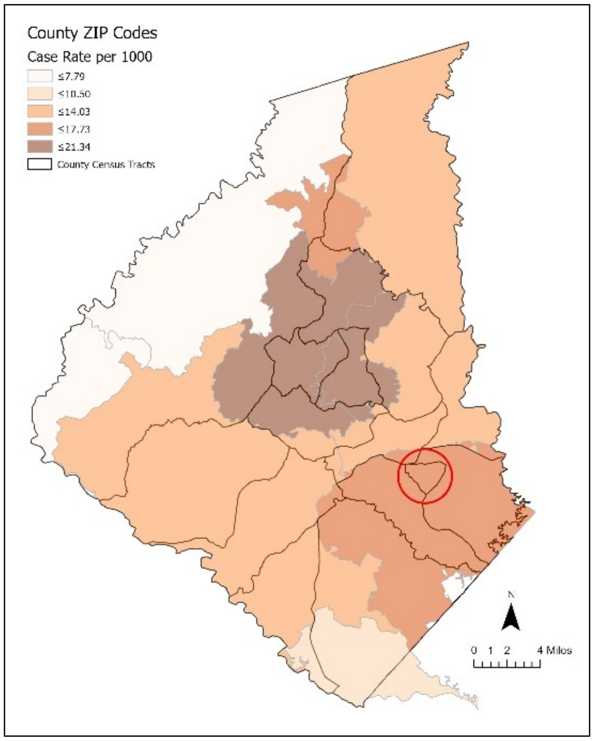
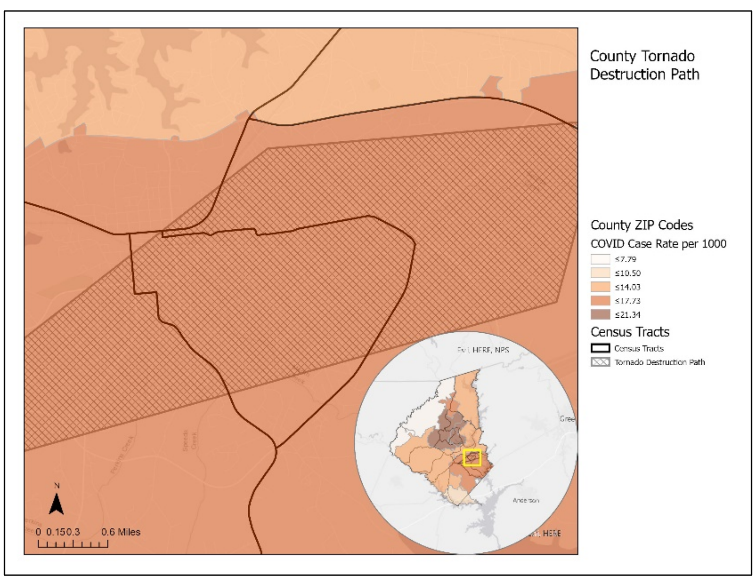


Figure 2. Inset of the Targeted Study Area that Included the Path of the EF-3 Tornado



Community Profile

Data for this study were collected from residents of a single neighborhood in Oconee County, a rural county in the northwest corner of South Carolina that like many U.S. rural counties has experienced challenges since the onset of COVID-19 (Fretwell et al., 2020). Oconee County comprises 626 square miles with a population of 79,546 (U.S. Census Bureau, 2019). According to the U.S. Census Bureau (2019), Oconee County includes 87.5% White, 6.6% Black, and 5.8% other races; 3.7% of the population is Hispanic. Just over one-fourth of county residents report earning a bachelor's degree or higher, and about 85% report an educational attainment level of at least 12th grade. Oconee County's median household income is US$46,056; 14.4% of the population lives in poverty (U.S. Census Bureau, 2019). The study targeted residents living in the under-resourced neighborhoods of Perry Hill, Dark Town, South Side, and Utica, as well as other small neighborhoods that are part of the Utica Mill Hill area, an unincorporated village adjacent to the city of Seneca in Oconee County.

Figures 1 through 5 illustrate the range of challenges that the community faces. Oconee County is largely rural and therefore did not see the immediate effects of COVID-19 until later in the summer. As of the end of September 2020, the Oconee County positive COVID case rate per 100,000 was 1,819 (Johns Hopkins University, 2020). COVID cases rates were available at the ZIP code level. As depicted in Figure 1, the COVID cases rate per 1000 residents was 17.73 in the ZIP code that includes the target area depicted by the red circle. While the ZIP code includes a larger area than the targeted area, Figure 2 identifies the path of the tornado destruction, which includes almost the entire census tract of the study. The most destructive path of the tornado encompasses nearly nine square miles.

The study area is one of the most socioeconomically vulnerable areas of the county. Figure 3 identifies the Social Vulnerability Index (SVI) that focuses on the household composition and disability in the census tracts. (An SVI closer to 1 indicates the most vulnerability.) The Agency for Toxic Substances and Disease Registry (ATSDR) developed the SVI as a measure to identify areas most at risk of adverse consequences prior to, during and following a disaster (Flanagan et al., 2018). The SVI provides guidance to disaster preparedness planning to prioritize areas for resource allocation. The SVI household composition and disability theme includes the following in its measure:

- Age over 65 years
- Age 17 years or younger
- Residents with a disability
- Single-parent households

The study area is also challenged by low household income (Figure 4) and lower life expectancy rates (Figure 5) compared to the rest of the state. The median household income for the study area was under US$28,402, while the median income for the state was US$52,306. The study area has the lowest life expectancy in the county, 72.4 years, compared to the state life expectancy of 79.1 years.

Figure 3. Social Vulnerability Index (Household Composition and Disability) by Census Tract

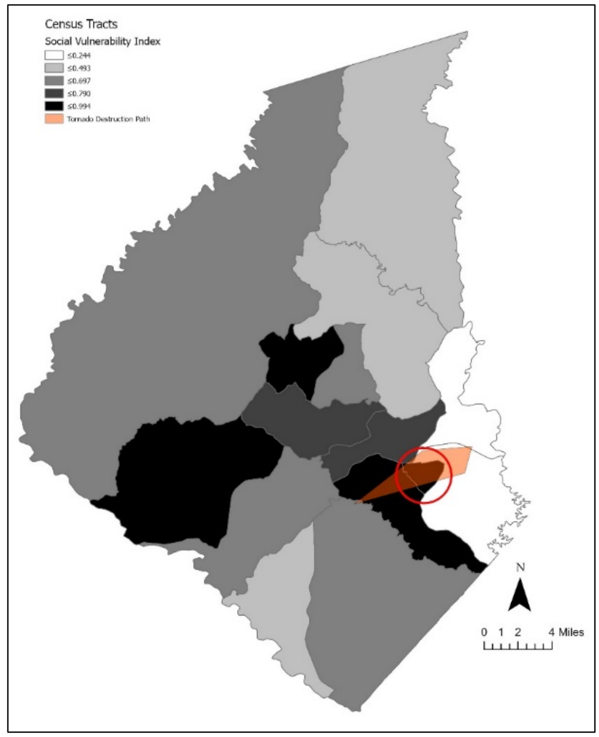


Figure 4. Median Household Income by Census Tract

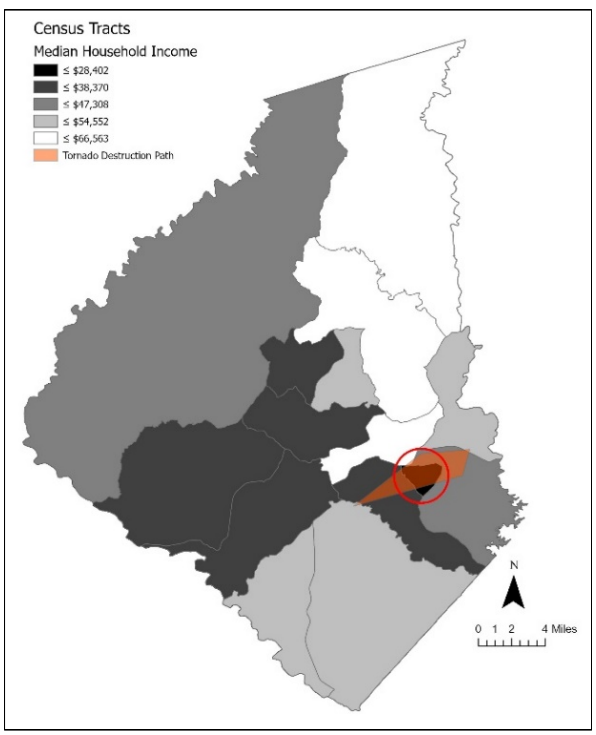
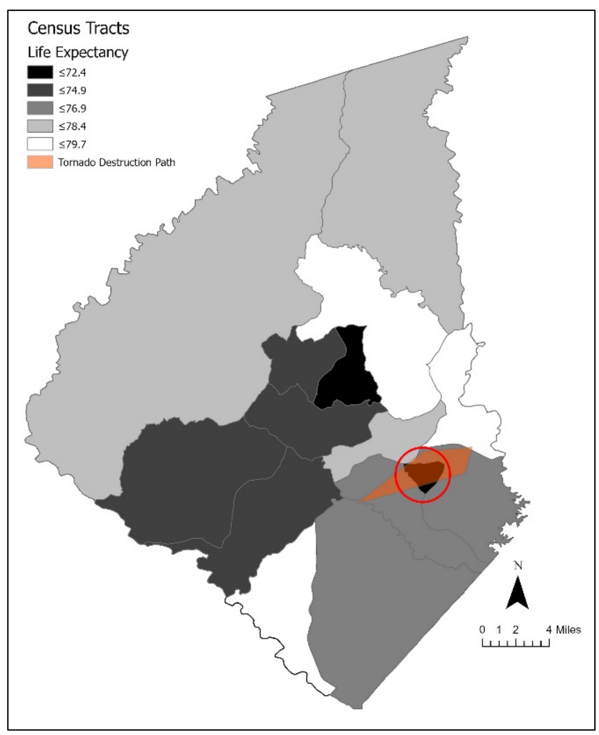


Figure 5. Life Expectancy by Census Tract



Participants and Data Collection

A qualitative research design explored how a community experiencing food insecurity navigates multiple concurrent health and environmental crises. Further, a postpositivist approach informed the study's critical realist perspective, through which reality (i.e., a participant's individual perceptions of their household's experience with food insecurity and other concurrent crises) was recognized as contextually dependent (Yin, 2016). A post-positivist theoretical frame was recognized as particularly appropriate for community-based (Yordy, 2012) food insecurity research (Beveridge et al., 2019). Within this frame, ethnographic methodolies (including in-depth interviews) are uniquely suited toward understanding a contextualized understanding of food insecurity (Beveridge et al., 2019).

As part of a larger effort to address food insecurity within Oconee County, prior to data collection members of the research team established relationships with community leader, such as persons working in food systems, community development, elected office, governmental administration, and agriculture. To recruit participants into the current study following the onset of COVID-19 and the tornado—the two crises contextualizing "crisis-within-a-crisis" in this study—an initial key informant helped the research team identify community leaders involved in the cleanup, food distribution, repairs and other critical responses soon after the tornado hit the communities. Through this informant, the research team engaged other community leaders (e.g., a church pastor, a tornado victim/local volunteer, and a school system food service director), three of whom became additional key informants. These key informants identified Utica residents impacted by multiple crises and believed to be food insecure based on community demographics. This sampling approach, which combined purposeful and snowball sampling (Patton, 2002), allowed the research team to identify residents affected explicitly by the multiple crises in the targeted communities. Out of 37 community residents recruited using this process, 14 individual in-depth interviews were completed (RR=37.8%). Reasons for non-participation included residents not answering their phone or having a phone number that had been disconnected when we attempted to reach them. Table 1 gives the full demographic details of the sample. Table 1 also includes comparisons to the census tract region of the sample.

Table 1. Description of Participants

Characteristics	Number of participants	Characteristics of tornado-impacted area (census tract)
Gender		
Male	4	45.6%
Female	10	54.4%
Race		
White	11	64.8%
Black	2	30.9%
Other	1	4.6%
Education		
Less than HS	4	14.9%
High school graduate or GED	4	58.4%
Some college, no degree	4	20.7%
Associate degree, 2-year degree, or technical school	2	13.3%
Bachelor's degree	1	7.8%
Household Income (US$)		
Unknown	3	14.5%
Less than $10,000	2	8.2%
$10,000–$14,999	3	16.6%
$15,000–$24,999	3	13.6%
$25,000–$34,999	1	16.9%
$35,000–$49,999	0	14.6%
$50,000–$74,999	2	15.6%
Home Tenure		
Unknown	1	7.1%
Rent	8	35.8%
Own	5	57.1%
Household Size		
1	7	46.4%
2–3	2	36.1%
4–5	5	17.5%

From mid-June through mid-September 2020, research team members conducted interviews using a semi-structured format. Interviews were conducted using mobile phones, and apps such as Rev.com recorded the interviews. All participants provided verbal consent. The interview protocol was designed to elicit information in critical areas associated with the study purpose and research questions, including how participants were faring financially, their experiences with food insecurity, COVID-19, the tornado, and their physical and emotional health. Interviews lasted an average of 45 minutes. Recordings were initially transcribed using Otter.ai and each transcript was verified by at least two research team associates. To ensure anonymity, each participant was given a pseudonym for the purpose of attributing quotes in the study.

Data Analysis and Trustworthiness

Transcripts were coded by a research team member using a deductive-inductive narrative analysis approach (Braun & Clarke, 2006) informed by sensitizing concepts within the food insecurity literature yet cognizant of emergent themes. Before coding, the research team member reflected on personal demographics, experiences, knowledge, and potential sources of bias (i.e., positionality) that could influence how the data were interpreted (Bourke, 2014). Data from the transcripts were then coded to identify portions of text representing unique ideas or perceptions (Patton, 2002). After codes were identified, categories representing relationships across codes were developed. Finally, themes were developed based on a conceptual analysis of the constructed categories and representative quotes were identified for each theme. After the data analysis was completed, an independent audit of these materials was completed by another research team member not involved in the initial coding (Akkerman et al., 2008). The audit evaluated congruence between the raw data, data reduction and analysis artifacts (i.e., codes), and data reconstruction and interpretations (i.e., constructed categories, subthemes, and themes) (Cutcliffe & McKenna, 2004). The audit process confirmed that the coders' interpretations accurately represented the participant's interview responses. Together these trustworthiness procedures (e.g., positionality, external audit) affirmed the trustworthiness of the data analysis process and interpretations.

Results and Discussion

The community was affected by a cascading series of crises (i.e., crisis-within-a-crisis), beginning with persistent household food insecurity and extending to include impacts of the onset of COVID-19 and the tornado on their families and community. Four themes emerged from the analyses that aligned with our research questions: crisis-within-a-crisis; community support; one region, two communities; and mental health in crisis. These themes are explored below.

Crisis-within-a-Crisis

Our first research question asked to what extent did COVID-19 and the tornado impact local residents' access to food. In the following section we outline the four crises facing the community. Then we describe reactions to the crises based on residents' circumstances and how they were personally affected by each crisis. Residents indicated varying degrees of concern about each of the crises facing the Mill Hill community; importantly, the degree of expressed concern seemed to be largely based on socio-economic status. The two-community dynamic emerged as one of our themes, as we discuss below.

Food insecurity was the first community crisis detected in participant responses. For many participants, food insecurity did not begin with the onset of the crises; rather, it was an ongoing part of daily life, already a "lingering crisis" prior to COVID-19 (DeVries & Fitzpatrick, 2006). DeVries and Fitzpatrick describe lingering crises as comprising seven potential factors. The two that are most relevant to this crisis include a challenge to an organization or community recurring over time, and insufficient organizational responses to stakeholder concerns. (The structural dynamics that have resulted in this area being categorized as a food desert have not been addressed by local governmental or corporate entities.) Participants identified myriad ways to meet their food needs. Some relied on a family member's job or benefits or supplies from friends and neighbors. Many depended on disability payments or SNAP benefits, and all described benefitting from church food distribution ("food boxes"), food pantries, or food banks. As one participant said, "If it wasn't for people at the church, we wouldn't be able to have food or water or anything" (Jane).

While food sources varied from one participant to another, a major recurring issue was scarcity of healthy foods and increase in food costs during the crises, especially during the early stages of COVID-19 and then continuing in the aftermath of the tornado. Participants reported they could not find their "regular foods," and often had to resort to buying "unhealthy" or "junk" foods. They also reported cost increases in certain foods following the onset of COVID-19, which is consistent with national trends in increases in food costs (Mead et al., 2020). Participants reported they often had to make trade-offs: for example, having to choose between food or the electric bill. For some, a loss of infrastructure due to the tornado played an ongoing role in food quality and access. For example, some participants lost cooking implements, while others lost their entire kitchen. Other participants lost stored resources, such as food in their refrigerator and freezer due to extended loss of power to their homes. As a result of this infrastructure damage, residents were not able to access or prepare healthy, fresh, or diverse foods.

The second crisis that affected the community was COVID-19. As a result of the pandemic, participants expressed increased concerns about their family's health, access to transportation or resources, or access to online resources for work and school. Many participants also lost employment because of the pandemic. As one participant shared, "The virus is affecting people on the Mill Hill because they have either lost their job, or like one family, he just moved here and was planning on getting a job and then all of a sudden there wasn't any jobs" (Sarah). In addition, restrictions tied to COVID-19 also affected participants' access to health care or medication. For instance, some participants said that COVID-19 made it harder to acquire needed medications, and another said she was not making doctor appointments because of COVID-19 concerns. While some participants expressed concerns about COVID-19, concern was not universal. Despite clear community-level impacts from the virus, many participants shared they were not concerned about the virus, particularly within the context of other crises. For instance: "I mean, we had so much [tornado] cleanup help and friends showing up. And, you know, it just … COVID sort of went out the window when you got 30 or 40 people working around your house trying to help you get stuff back together a little bit. You know?" (Stacy). Multiple participants shared the sentiment that after the tornado hit, COVID-19 was no longer an issue of concern.

The third crisis that affected the community was the mid-April tornado, which damaged homes, businesses, and non-residential property on privately-owned land. One participant described the tornado's impact:

> [My property will] never look the same again to me. But … in a little bit things will grow back. That's the thing about trees and bushes and things. They grow back, you know, and I'm pretty optimistic about stuff and I just … Okay you know, I'm not thrilled with it like it is. But I'm okay with it. Nobody in my family was hurt. One person in this whole tornado was killed. And if you saw all the damage around town, you would know that it was a miracle. (Stacy)

Some residents had to relocate temporarily due to the tornado, while others had to move away from Mill Hill permanently. The South side of the Seneca and Mill Hill communities was hardest hit, the section of Oconee County with the poorest residents and quite under-resourced to respond to the damage.

The fourth crisis facing the community was lack of clean water for many Mill Hill residents following the tornado: "We don't have any water at the moment still. So we can't really wash dishes. We're running low on tools, too. … We don't have the necessary tools to prepare other foods. … We don't have enough water to wash dishes" (Bill). Without consistent access to clean water, residents were faced with immediate health and hygiene concerns. Perhaps directly connected to lack of clean water, residents reported an ongoing hepatitis A outbreak in the community. The hepatitis virus can cause a highly contagious liver infection; symptoms often do not appear until weeks after contracting the virus. Participants reported feeling scared to see other people for fear of contracting hepatitis A. Risk of infectious diseases may increase following natural disasters when synergic factors align, including social and environmental conditions, displacement of populations, change in human conditions, and limited sanitation (Kouadio et al., 2012; McMichael, 2015). The transmission of infectious diseases can occur days, weeks or months following the disaster, often because of poor hygiene and lack of food, safe water, and adequate toilets (Kouadio et al., 2012).

Participants were concerned about the risk of hepatitis A exposure, but seemed largely unconcerned about contracting COVID-19. This finding is consistent with previous research on perceptions of risk, as by this time COVID had become a familiar risk, a part of every-day life. On the other hand, a hepatitis A outbreak was both novel and carried a social stigma and collective concern about the high risk of infection. Community members tend to become comfortable with familiar risks, such as COVID-19, while novel risks such as hepatitis A impose greater concern and fear (Kasperson et al., 1988).

These compounding crises left the community reeling and struggling to recover. In the following section, we explore how the community coalesced to respond to each crisis.

Community Support

Our second research question asked how community members supported other residents affected by COVID-19 and the tornado. A consistent and overriding theme throughout the interviews was that residents responded to the compounding crises by engaging in both emergent (spontaneous) and planned support of their fellow community members, similarly to what has been seen in other community-level responses to disaster (Quarantelli & Dynes, 1977). Support was expressed in different ways.

First, community support was embedded in participants' reports about their own food needs. Perceptions of food insecurity were relative in comparison with others' needs. For example, participants with children reported little concern about having enough to eat as long as their children had enough food: "I make sure my children can eat, at any given point in the day that they want to. If they feel like they want to eat, they can" (Arthur). Second, a common idea was that, "I lost some things, but my neighbor lost more. Others have it worse than I do" (Reginald). The community, in this way, expressed great resilience (Anthony et al., 2019), an attitude that "things may be bad, but it could be worse, and things will get better." They are demonstrating hope for the future. Third, community members also worked hard to provide food to neighbors. Neighbor-helping-neighbor support happened via the individual efforts of community members, as well as through contributions from organizations and community groups (e.g., food pantries, churches, and food banks).

Fourth, following the tornado people helped clear and clean damaged property. Neighbors reached out to one another to offer support and help on an individual basis:

> After the tornado hit, our area really came together. I mean, for the first few minutes when daylight hit that morning, everybody was just kind of shocked. And then all of a sudden, somebody is just like, we need to clear this tree off of this house, and it just kind of spiraled from there. And we've all been working together and helping each other. And, you know, it's been, we're all in it together. It happened to all of us. (Jill)

Another valuable aspect of the broader response efforts was the engagement of community organizations and groups. The community witnessed support from local churches and civic organizations. "They started bringing this ice and ice chests, water. They brought us plenty of foods, deodorants, and it was I mean, the people, I don't know who they was but they brought the Mill Hill a lot of stuff. I don't know who they were" (Sonia).

The second theme associated with Research Question 2 was that community members varied in the extent to which they accepted help from others. Many informants reflected on how much they rely on or need others. They described active acceptance and recognition of much-needed support with expressions of thankfulness and gratitude (as demonstrated in the previous quote from Sonia). Other community members relied on personal independence and rejected offers of support. For example, some participants indicated that they would not go to a food bank, despite a lack of resources. As Janell forcefully explained, "I'm the type of person, I don't go nowhere and ask. I will do without," capturing a sense of personal independence and self-efficacy evident with many of the participants.

Other participants indicated that although they were themselves experiencing certain challenges related to food insecurity, these difficulties were not as dire as those faced by some neighbors whom they felt called to help. For example, after explaining that he usually runs short of money at the end of the month to pay bills, Joseph said, "And then I still find myself, if I have a few extra dollars left at the end of the month, and I can help somebody else with it, I'll do it. . . . It's cutting my own throat and I admit it is." Sarah, who was experiencing health issues unrelated to COVID-19, also felt an obligation to help community members: "Everybody's telling me 'you need to take time for yourself.' And, my viewpoint is I am, because I enjoy what I'm doing. . . . They think I'm not taking care of myself and I think I am."

One Region, Two Communities

The third theme associated with Research Question #2 involved differential experiences of the various crises, based on their familial and community resources and support. That is, there seemed to be two distinct communities in our interview pool, although the participants resided in the same geographic area. The first group is represented by the Mill Village. These residents were experiencing the multiple crises concurrently, but also had the fewest resources. This group was already facing food insecurity when the crises began and was also experiencing a housing crisis, with several landlords raising rent at the outset of COVID-19 or after the tornado. This group lost important housing infrastructure, lacks clean water, and in some cases faces foreclosure. This group also has a range of neighborhood concerns, including crime and drug use—"Part of the neighborhood is really bad because there's a lot of drugs, meth heads walking around here, breaking into people's houses stealing. You can't keep nothing outside" (Sonia)—and challenges due to inadequate transportation. Many residents lack cars or access to transportation other than the bus system. Some residents are able to request a ride from a neighbor, friend, or family member, but then they rely on the schedules of others.

The second distinct group that emerged in the study findings is geographically within the Mill Hill community; however, these residents were not facing food insecurity before the multiple crises began. While they may face food insecurity now, they view it as a short-term, manageable concern. Food insecurity is simply not a regular part of life for this group. They also spoke more clearly of reliance on family and neighbors for support. While their lives have changed drastically, their daily needs can still be met. They may have lost income as a family, but they indicated that the losses are not overwhelming. While members of the other community reflected on having sufficient food for their children, members of this community were less concerned with availability of food for their children than they were about other concerns such as online learning:

> Both of my children had a big issue with online learning. Teachers had never done that before. So you've got some teachers that were not computer friendly. … And that's been a real issue with the online learning for both kids. (Sarah)

These results support recent research demonstrating that consistently food insecure households (i.e., households that were food insecure prior to COVID-19) were more likely to face challenges accessing food after the onset of the COVID-19 pandemic, as compared to newly food insecure households (Niles et al., 2020).

Residents also described changes in the way they spend time as a family. Members of this group reported spending more time together because of COVID-19; for example, "we play games a lot now." This was a positive change from what residents reported before the onset of COVID-19.

Mental Health in Crisis

The final theme that emerged in the findings was that the overlapping crises revealed a range of mental health challenges among community members, from pre-existing challenges exacerbated by the crises, to newly developed challenges. New challenges related to COVID-19 were generally tied to anxiety or depression primarily associated with isolation. For example, Jill described the new challenges that came after her spouse lost his job because of COVID-19; this couple was experiencing more conflict than before the pandemic: "My husband and I didn't pretty much argue before everything, but now we have gotten really well acquainted with that. So short tempers are definitely in the mix now." For other participants, the mental health challenges developed after the tornado:

> It was an emotional thing, a stress thing. … I've lived on this property 74 years. That's how old I am. So to look out my door and see all my trees gone. … It's like losing a friend in the property that you had. (Stacy)

The tornado brought concerns about safe housing, clean water, and where meals were going to come from, which precipitated increased anxiety and depression. Some participants indicated they already had anxiety and depression, which worsened following the onset of the community crises. Paula stated, "I get depressed. … I get anxiety attacks, especially from stress. When I'm stressed out, I start crying. [This has been going on] for almost three years." She described ways that lack of connection with others, food scarcity, and reduced transportation access had worsened her anxiety. Affected by an astounding series of compounding crises, people are feeling the strain of extended anxiety and the pressure of relentless uncertainty. A recent meta-analysis of the relationship between mental health and food insecurity reveals that food insecurity impacts the likelihood of experiencing stress or depression (Pourmotabbed et al., 2020). A recent study of food insecurity during the early stages of the COVID-19 pandemic revealed similar impacts of COVID-19 on mental health (Polsky & Gilmour, 2020).

Implications

This study has implications for food systems, disaster research, and policy, and reinforces the importance of informal social networks in addressing emergent food insecurity during and following disasters and overlapping crises. However, recovery has been slow for this community, as determined by the social vulnerability index, likely because of the community's level of vulnerability prior to the onset of COVID-19 and prior to the tornado. Therefore, equitable preparedness planning should prioritize areas of highest vulnerability, incorporate social capital, and integrate dimensions of food security—availability, access, and stability (Kais & Islam, 2016; Pingali et al., 2005).

Community Food Systems

When multiple crises strike, the absence of basic food needs becomes more acute. Response through community food systems is one mechanism communities can use to be more resilient. Community food systems development often emerges when community members come together to identify basic needs around food and production. Such initiatives provide a mechanism for greater food access, while strengthening communities in the process. Cornell University (1999) developed a primer on community food systems, which integrates food production, processing, distribution and consumption:

> [T]o enhance the environmental, economic, social and nutritional health of a particular place … by including the word "community" there is an emphasis on strengthening existing (or developing new) relationships between all components of the food system. This reflects a prescriptive approach to building a food system, one that holds sustainability—economic, environmental and social—as a long-term goal toward which a community strives. (Cornell Cooperative Extension, 1999, p. 1)

Opportunities in community food systems and food policy councils have begun to develop in

Oconee County in response to the multiple and overlapping crises. Indeed, just two months before the tornado and a month prior to the early stages of COVID-19, Oconee County residents held a successful multi-sector, day-long Food Summit to build on the existing Comprehensive Plan for the county (Oconee County, 2019), and to organize around food sovereignty and food systems initiatives and to enhance and develop access to healthy affordable food for their community through food policy councils and community organizing. Examining the work of this and similar food policy council efforts in the county is the focus of future studies. In a post-COVID food economy, local food systems initiatives like those underway in Oconee County provide the greatest likelihood for sustainable long-term healthy food access for communities and meaningful social change in attaining food security. Local food systems also present an opportunity to build on community assets and strengths, such as the mutual help model that was so important to community members during the overlapping crises described in this paper.

Food policy councils that seek to develop and sustain community food systems initiatives have, at their core, localized responses to food production, distribution, and consumption (Broad-Leib, 2013). Community food systems focus on issues of equity and social justice, grounding this work in community concerns around sustainability, food security, and food access (Community Food Strategies, 2020). Community food policy councils are one way of bringing together stakeholders from across a community to improve access to healthy food by addressing food policies that influence food sourcing, cost, and availability through means that promote local agriculture and local economic development (Boden & Hoover, 2018; Gupta et al., 2018). The Oconee County Comprehensive Plan recognizes local-level food insecurity and builds strategic goals around food systems planning, healthy food access incentives, and food policies into their county strategic visioning (Oconee County, 2019). These types of plans and community food systems are mechanisms that communities can use to become more resilient. Fostering resilience is vital for community success and renewal during and after a crisis.

Emergent Behaviors in Crisis

As we asked participants to discuss their disaster experiences, story after story included examples of community support and partnership. Yet the support people described was often developed and managed by word-of-mouth organizing or spontaneous supportive behaviors. These results support prior studies that emphasize the importance of social capital in post-disaster situations (Meyer, 2018; Monteil et al., 2020), although different forms of social capital can have varying post-disaster effects, both negative and positive (Montiel et al., 2020). Scholars have called for emergency response organizations and municipalities to foster partnerships that can lead to stronger frameworks for coordinated response post-emergency; specifically, these calls emphasize the need to coordinate emergent aid and spontaneous volunteers to ensure that community support efforts are not inadvertently wasted (Pyle et al., 2018; Waldman et al., 2017). In addition to building disaster response infrastructure that accounts for emergent behaviors, more structured agents such as community groups, civic organizations, municipalities, and nonprofits must cultivate relationships and develop plans to facilitate unified post-disaster food system management.

Limitations and Future Research

In this paper, we report on the results of 14 in-depth interviews with community members experiencing overlapping crises within a broader context of food insecurity. The study's contextualized post-positivist framing and use of in-depth interviews with community residents experiencing multiple crises (including COVID-19) were apropriatley positioned within the food insecurity literature (Beveridge et al., 2019; Ruszczyk et al., 2020). As such, this study sought to understand the experience of food insecurity in a way that was sensitive to participants' unique geographies and perspectives. Such a perspective grounded this study's methodology in a local contex (Wolfe et al., 2003). The study sample was predominantly white, which is a clear limitation in capturing the experiences of the full community. However, as is illustrated in Table 1, the sample tracks very closely with the racial composition of the community we examined. In addition to the demographic limitations of our sample, we must also acknowledge that the entire research team is white. This has undoubtedly affected our attempts to explore the dynamics of racial injustice in the community, as well as participant willingness to speak openly with us about these same issues. While the interviews explored questions related to participant perceptions of racial injustice, themes associated with racial injustice did not emerge related to the study research questions.

While the resulting narratives were rich in insights, the research could be enhanced with additional interviews from a more diverse population, a comparative framework (as noted above), and perspectives from other community stakeholders. To that end, our future research will integrate the results from our community focus groups in Oconee County and Hampton County, South Carolina which was also impacted by a tornado in mid-April 2020. The affected communities represent two contrasting cases regarding the role of local leaders in ameliorating food insecurity during the COVID-19 pandemic. We will also compare and contrast the results in Oconee County with research on food insecurity in the neighboring county of Pickens, where we are collecting qualitative data from individuals about the impact of COVID-19 on household-level food insecurity. Future research is also planned within South Carolina to examine how families in a variety of communities may experience food insecurity differently across the calendar year (i.e., summer compared with non-summer), particularly for families with school-age children who may have reduced access to food when school is not in session.

Conclusion

This exploratory study examined a community's experiences with food insecurity in the context of a cascading series of crises. We sought to learn how residents navigate multiple crises in order to inform resources, processes, and systems that support communities facing similar circumstances. The study yielded substantial insights into the responses and perspectives of residents in under-resourced communities struck by a perfect storm of successive crises. This study provides a foundation for future studies to explore how communities can develop systems and policies to help protect their most vulnerable members, and provide data and findings that can inform community leaders and partners seeking to address food insecurity and community vulnerability in the future.

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Examining food insecurity and areas with unmet food needs during COVID-19: A geospatial, community-specific approach

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Abstract
Food insecurity is a public health issue that has increased in the U.S. since the 2020 COVID-19 pandemic. Understanding how this increase occurs locally is crucial in informing appropriate food insecurity-related responses. Analyzing 2-1-1 call data is one way to examine food insecurity-related needs at a zip code level. The purpose of this work was to: (1) examine overall call trend data to 2-1-1 from March through July 2019 and March through July 2020, (2) examine changes in food need call volume to 2-1-1 during COVID-19 by zip code, and (3) identify areas with unmet food needs during COVID-19 in central Texas. Data for 2-1-1 calls from Travis County zip codes for March through July 2020 were compared to calls for March through July 2019 and categorized by reason for calling. Descriptive statistics and paired t-tests were used to analyze food need calls by zip code and mapped using ArcGIS. Communities with high food call volume and no emergency food assets located within the zip code were categorized as areas with unmet food needs. Results indicated there were more overall calls to 2-1-1 in 2020 (N=37,572) than in 2019 (N=28,623), and significantly more food need calls in 2020 than in 2019 (p<0.01). Eastern Travis County, a racially and ethnically diverse and lower-income area, had the largest increase in food need calls. Two zip codes were identified as having unmet food needs, which informed the strategic placement of emergency food assets. This study illustrates how 2-1-1 data can result in rapid translation of research to policy and program implementation.

Keywords
2-1-1 Calls, Community Health, COVID-19, Pandemic, Food Insecurity, Health Disparities

Introduction and Literature Review

Food insecurity is defined as the inconsistent access to a sufficient amount of food to live an active and healthy life (Pinstrup-Andersen, 2009). While considered a wealthy nation, the United States had high rates of household food insecurity prior to the outbreak of the novel coronavirus (COVID-19), with 11.1% of households identifying as food insecure in 2018 (United States Department of Agriculture Economic Research Service [USDA ERS], 2019). Since the start of the COVID-19 pandemic, the prevalence of food insecurity has increased dramatically in the U.S. (Niles et al., 2020; Schanzenbach & Pitts, 2020; Wolfson & Leung, 2020). Research conducted by Northwestern University found that domestic food insecurity has more than doubled to 25.5% during the COVID-19 pandemic (Schanzenbach & Tomeh, 2020). Similar to national statistics, food insecurity prevalence in Texas has doubled, with over 28% of Texans identifying as food insecure in April through June 2020 (Schanzenbach & Tomeh, 2020). To address the rising rates of food insecurity, local officials need rapid and local data to inform local policies and strategic implementation of food insecurity mitigation programs. The purpose of this paper is to describe how a novel data collection method can be used to rapidly identify areas experiencing unmet food needs and inform programming and policies during the pandemic.

Food Insecurity and Disparities Prior to and During COVID-19

Food insecurity is often the byproduct of poverty or economic disadvantage and does not occur in isolation (Bhattacharya et al., 2004; Finney Rutten et al., 2010; Gundersen et al., 2011). Additionally, food insecurity prevalence has historically increased during high unemployment and/or economic recession (Andrews & Nord, 2009; Loopstra et al., 2016). Some scholars identified that the combination of high unemployment rates, economic downturn, stay-at-home orders, school closures (and consequently the reduced offering of school nutrition programs), closure and/or limited hours of food retail, and social distancing policies during COVID-19 have had a particularly dramatic impact on food insecurity (Choudhury et al., 2020; Dunn et al., 2020; Laborde et al., 2020; Pérez-Escamilla et al., 2020; Shanks et al., 2020; Wolfson & Leung, 2020).

Before the pandemic, people of color and low-income households were more likely to be food insecure than people who lived in white and/or more wealthy communities (Hernandez et al., 2017; Odoms-Young & Marino, 2018; Seligman & Schillinger, 2010). Additionally, communities of color and low-income areas are more likely to have limited geographic food access, meaning that they typically do not have healthy food retail options in their neighborhoods and have to travel farther to access food (Alkon & Agyeman, 2011; Larson et al., 2009; Morales, 2011; Walker et al., 2010). These disparities are evident in central Texas, where eastern Travis County, largely due to historic redlining practices, has generally had a larger population of Black and Hispanic communities, lower median household income, fewer healthy food retail opportunities, and a higher prevalence of food insecurity than western Travis County (City of Austin Office of Sustainability, 2019; City of Austin Travis County Health and Human Services Department, 2015; Huggins, 2017; United Way of Central Texas, 2019; U.S. Census Bureau, 2018).

Since the start of the COVID-19 pandemic, national and state-level food insecurity data suggest that disparities between racial and ethnic groups are increasing (Morales et al., 2020). Individuals who identify as Black (34.9%) and Hispanic American (34.0%) have been found to have a much higher prevalence of food insecurity during COVID-19 than white Americans (25.5%) at the national level (Schanzenbach & Tomeh, 2020). Furthermore, state-level analyses using Census Pulse Survey data found that Black (35.2%) and Hispanic (33.2%) Texans have a higher prevalence of food insecurity than White Texans (21.6%) (Schanzenbach & Tomeh, 2020). These findings demonstrate that pre-existing food insecurity disparities could be widening during the pandemic; however, there is limited data about food insecurity rates at a local or zip code level. The smallest geographic unit of analysis for food insecurity data during the pandemic has been at the county-level, and it is projected that food insecurity in Travis County has risen significantly during the COVID-19 pandemic (Gundersen et al., 2020). However, determining food insecurity prevalence at a more local level, such as by zip code or census tract, is often only available in national data sets and takes years to become available (Coleman-Jensen et al., 2018). Thus, community-specific food insecurity data is necessary to ensure that all high need areas have additional food assets available during the pandemic and that pre-existing disparities do not widen.

One solution for decreasing food insecurity is to connect individuals who have emergency and chronic food needs to resources that address food insecurity, such as food banks, food pantries, soup kitchens, the Supplemental Nutrition Assistance Program (SNAP, formerly known as food stamps), and hotlines or call lines that can connect individuals to needed resources (Bacon & Baker, 2017; Boyum et al., 2016; Linnan, 2012; O'Connell et al., 2008; Robaina & Martin, 2013).

Food Insecurity Resources and the United Way 2-1-1 Call Line

One resource that has successfully facilitated network building and resource referrals for individuals in need for the last two decades has been the United Way's 2-1-1 call line program (Daily, 2012). Established in 2000 by the Federal Communications Commission (FCC), the network of 2-1-1 call line programs became operational in all 50 states and Puerto Rico during the next decade (Daily, 2012; Linnan, 2012). By 2018, 2-1-1 call lines were considered a well-established resource for the community throughout the country. For example, in 2018, the United Way for Greater Austin received over 50,000 2-1-1 calls, of which approximately 11% regarded food insecurity-related issues (Janda et al., 2020). United Way considers all callers to 2-1-1 to be clients of United Way.

The United Way for Greater Austin operates the 2-1-1 call line in Travis County. Since the start of the pandemic, United Way has helped disseminate information pertaining to COVID-19 through the central Texas region (United Way for Greater Austin, 2020a, 2020b). In Texas, 2-1-1 is considered a key COVID-19 information resource publicized by billboards, radio, and many government officials' public addresses, including Governor Abbott and City of Austin officials (Weber, 2020). Additionally, United Way for Greater Austin kept consistently updated records on the location and availability of emergency food assets and open resources during the COVID-19 pandemic (United Way for Greater Austin, 2020b).

United Way for Greater Austin/2-1-1 also collaborated with Austin Public Health and the City of Austin Office of Sustainability's Food Policy Team (which existed prior to COVID-19) to help coordinate responses to local food systems issues. The Food Access Coordination Taskforce, led by the City of Austin Office of Sustainability, became crucial in this coordination and consists of approximately two hundred individual contacts representing city and county departments, school districts, nonprofits, and community-based organizations. The taskforce met weekly to share updates on organizational operations, identify areas of need (including opportunities for collaboration and directing resources), and develop a longer-term strategy to address the anticipated increase in food access needs throughout the community after the pandemic. However, the taskforce realized that it needed more data to understand how food insecurity was changing at a community level throughout the county and to inform policy and program implementation.

Gaps in the Literature and Community Needs

At the start of the pandemic, there were no datasets or reports available that included data regarding what areas of Travis County were experiencing especially high food insecurity rates. 2-1-1 call data were identified by the City of Austin and other collaborators as a potentially valuable source for information regarding food needs that could provide zip-code level data and could be paired with geographic food asset location data. Additionally, these data could fill a notable gap to better inform policies and programs to strategically place assets in areas with high food insecurity needs. Thus, in early April 2020, the City of Austin Office of Sustainability contacted UTHealth School of Public Health in Austin and Dell Medical School to utilize 2-1-1 call data to examine changes in food needs in Travis County and identify areas with unmet food needs in Austin during COVID-19.

Research Objective

The objective of this work was to build a transdisciplinary collaboration that could: (1) examine overall call trend data to 2-1-1 in March–July 2019 and March–July 2020, (2) examine changes in food need call volume to 2-1-1 during COVID-19 by zip code, and (3) identify areas with unmet food needs during COVID-19 in Travis County, Texas.

Applied Research Methods

Study Design and Study Area

The study design was a natural experiment and utilized 2-1-1 call data from Travis County, Texas, during March–July 2019 and March–July 2020, with 2019 dates considered a pre–COVID-19 comparison. Participants were callers to the 2-1-1 call line from March 1 through July 31, 2019, and March 1 through July 31, 2020. The 2020 time frame was selected because awareness of COVID-19 gained traction in early March 2020; federal, state, county, and city COVID-19 policies were announced, and the closure of universities, schools, and large events all started occurring in Travis County (Weber, 2020).

The sample was restricted to those who made calls to the United Way for Greater Austin in the aforementioned time frame from Travis County, Texas. Callers who did not specify their county of residence, who did not specify their zip code of residence, or who reported a post office box–only zip code as an address were dropped from the analysis. Data about emergency food assets were obtained from collaborators at the United Way for Greater Austin and the City of Austin Office of Sustainability. This study was approved and considered exempt by the Institutional Review Board (IRB) at UTHealth School of Public Health (HSC-SPH-20-0518) because the callers were unidentifiable, and there was no way to follow-up with callers. Furthermore, the IRB determined that consent was implied because all callers to the 2-1-1 call line are informed that information regarding the nature of their call will be included in 2-1-1's call log and records.

Examination of Overall and Food Need 2-1-1 Call Data Methodology

Call data categorizations

All 2-1-1 calls used in this analysis were categorized into thematic groups based upon the resources requested by the caller. The thematic categories were finance and unemployment, food needs, health and mental health, housing, transportation, utilities, and other related calls. For this analysis, food need calls to the 2-1-1 call line served as a proxy for food. Examples of food need calls included callers looking for food pantries, soup kitchens, food banks, food assistance (such as the Supplemental Food Nutrition Assistance Program and Pandemic-EBT), and other food-specific resources. Demographic data, including the caller's zip code, sex, and language spoken during the call, were noted in the call log and were self-reported by the caller. No other identifiable data were included in the call log.

Call data analysis

Descriptive statistics and paired t-tests were utilized for this analysis. Frequencies were calculated for March–July 2019 and March–July 2020 by call categories, demographic information included in the 2-1-1 call log, and zip code. To contextualize call trends longitudinally during the pandemic, overall and food need call volumes were also analyzed by week. Paired t-tests by zip code were calculated to determine if there were statistically significant differences in the mean number of food need calls by zip code in March–July 2019 to March–July 2020. The change in the percent of food need calls by zip code was calculated and then mapped using ArcGIS (ESRI, 2019). All frequencies and t-tests were run utilizing Stata (version 14) (StataCorp, 2015), graphs were made using R (R Team, 2017), and maps were created with ArcGIS (ESRI, 2019; StataCorp, 2015; R Team, 2017).

Methodology for Identifying Areas with Unmet Food Needs

Location of emergency food assets was needed to identify areas with unmet food needs. United Way for Greater Austin and the City of Austin Office of Sustainability provided information on the location and addresses of these assets. These locations were consistently updated during March–July 2020 to reflect potential changes in operation. These locations were then geocoded using ArcGIS and included in the analysis for identifying zip codes with unmet food needs (ESRI, 2019).

More specifically, zip codes with unmet food needs were determined by the convergence of high food need call volume, a high proportion of food need calls, a large change in food call volume in the zip code from 2019 to 2020, and a lack of emergency food assets present in the zip code. Zip codes with above-average food need call volumes (with the average determined to be 191 calls during March–July 2020) were classified as having a high food need call volume. Zip codes with an above-average percentage of food need calls for Travis County (i.e., more than 29%) during March–July 2020 were classified as having a high proportion of food need calls. A large change in food call volume within a zip code from 2019 to 2020 was determined as being a greater than 10% increase.

Results

2-1-1 Call Trends during COVID-19

The total sample consisted of 28,623 calls during March–July 2019 and 37,572 calls during March–July 2020 (Table 1). From March through July 2019, health and mental health was the most common reason for calling 2-1-1 (30.07%), followed by food need calls (23.29%). During March–July 2020, food needs were the most common reason for call-

Table 1. Call-Level Descriptive Statistics for March–July 2019 and March–July 2020

	March–July 2019		March–July 2020	
Overall Call Volume	***N*=28,623**	**Percent**	***N*=37,572**	**Percent**
Call Need Categories				
Food	6,667	23.29%	13,197	35.13%
Health/Mental Health	8,606	30.07%	10,327	27.49%
Housing	5,086	17.77%	7,385	19.66%
Finance/Unemployment	2,810	9.82%	3,942	9.02%
Utilities	2,129	7.44%	2,409	6.41%
Transportation	1,689	5.90%	512	1.36%
Other	6,073	21.22%	6,688	17.8%
Demographics				
Gender				
Male	7,539	26.34%	10,644	28.33%
Female	20,737	72.45%	26,353	70.14%
Uncertain	347	1.21%	575	1.53%
Preferred Language				
English	24,753	86.48%	31,075	82.71%
Spanish	3,804	13.29%	6,436	17.13%
Other	66	0.23%	61	0.16%

ing 2-1-1 (35.13%), followed by health and mental health calls (27.49%). During both periods, callers were predominantly female (2019: 72.45%, 2020: 70.14%) and spoke English (2019: 86.48%, 2020: 82.71%) or Spanish (2019: 13.29%, 2020: 17.13%). The 2-1-1 call line navigators do not ask about the caller's race and/or ethnicity and income level; therefore, that information could not be provided. However, information regarding sociodemographic composition (including race/ethnicity, income level, etc.) by zip code for Travis County is provided by the 2018 American Community Survey and can be found in Figure A in the Appendix.

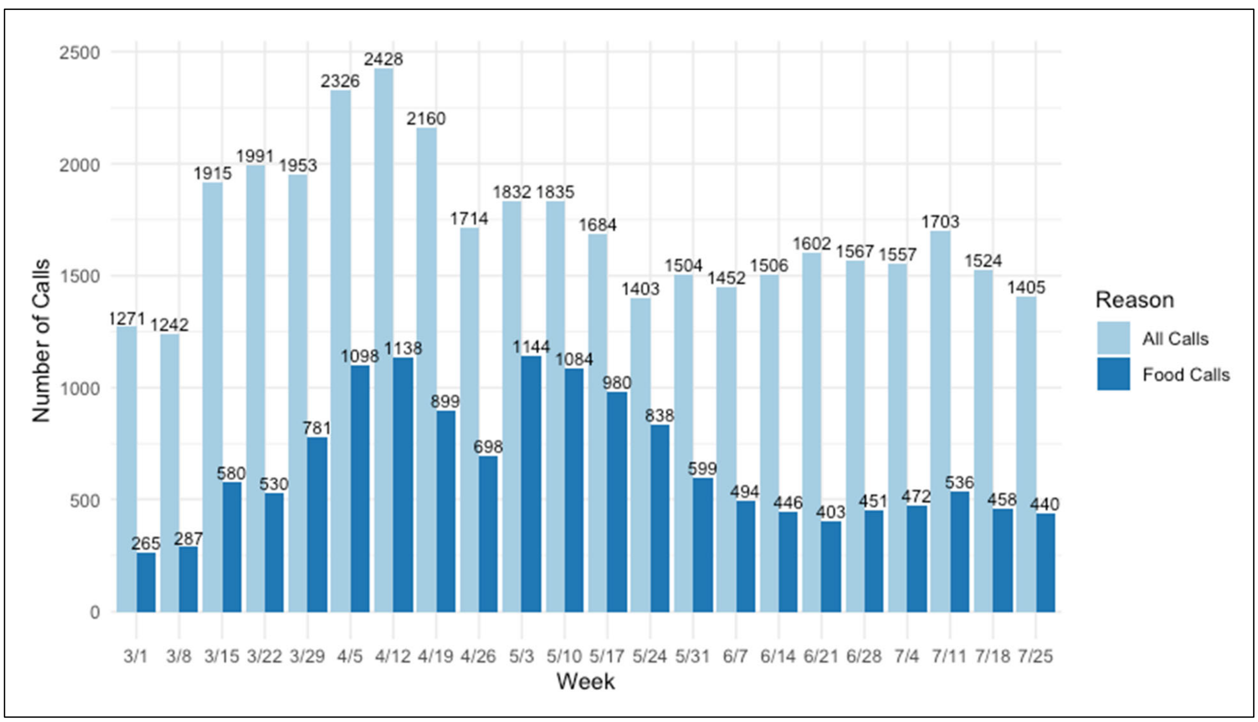
To better contextualize the call trends longitudinally during the COVID-19 pandemic, overall and food need call data were also analyzed by week (Figure 1). Overall call volume increased sharply during the middle of March, peaked the week of April 12, 2020, and then fluctuated with smaller increases in overall call volume at the end of April and beginning of May, and in early July. Food need call volume also rose sharply in mid-March, peaked the week of May 3, 2020, and consistently declined with small increases in early July. The large increase in food need calls in April and May was mostly due to calls regarding food assistance benefits, such as SNAP.

Changes in Food Calls to 2-1-1 during COVID-19 by Zip Code

During March–July 2019 and March–July 2020, callers to 2-1-1 resided in 69 zip codes of Travis County. Results from the paired t-tests found that there were statistically significant differences in food need call volume (t=-4.93, df=68, $p<0.01$) and percentage of food need calls (t=-5.77, df = 68, $p<0.01$) in zip codes from 2019 to 2020. Thus, there were significantly more food need calls to 2-1-1 across Travis County during the COVID-19 pandemic than there were during the same months in 2019.

The changes in percent of food need calls by zip code were calculated and then mapped (Figure 2). Over 78% of zip codes (n=54) saw an increase in the percentage of food need calls made to 2-1-1 during 2020 compared to 2019. Additionally, over half the zip codes (n=36) saw an increase greater than 10% in the percentage of food need calls made in the zip code during March–July 2020 compared to March–July 2019, as shown in red and

Figure 1. Overall and Food Call Data by Week, March 1–July 31, 2020



scarlet in Figure 2. Eastern Travis County has more zip codes in dark orange and red than western Travis County.

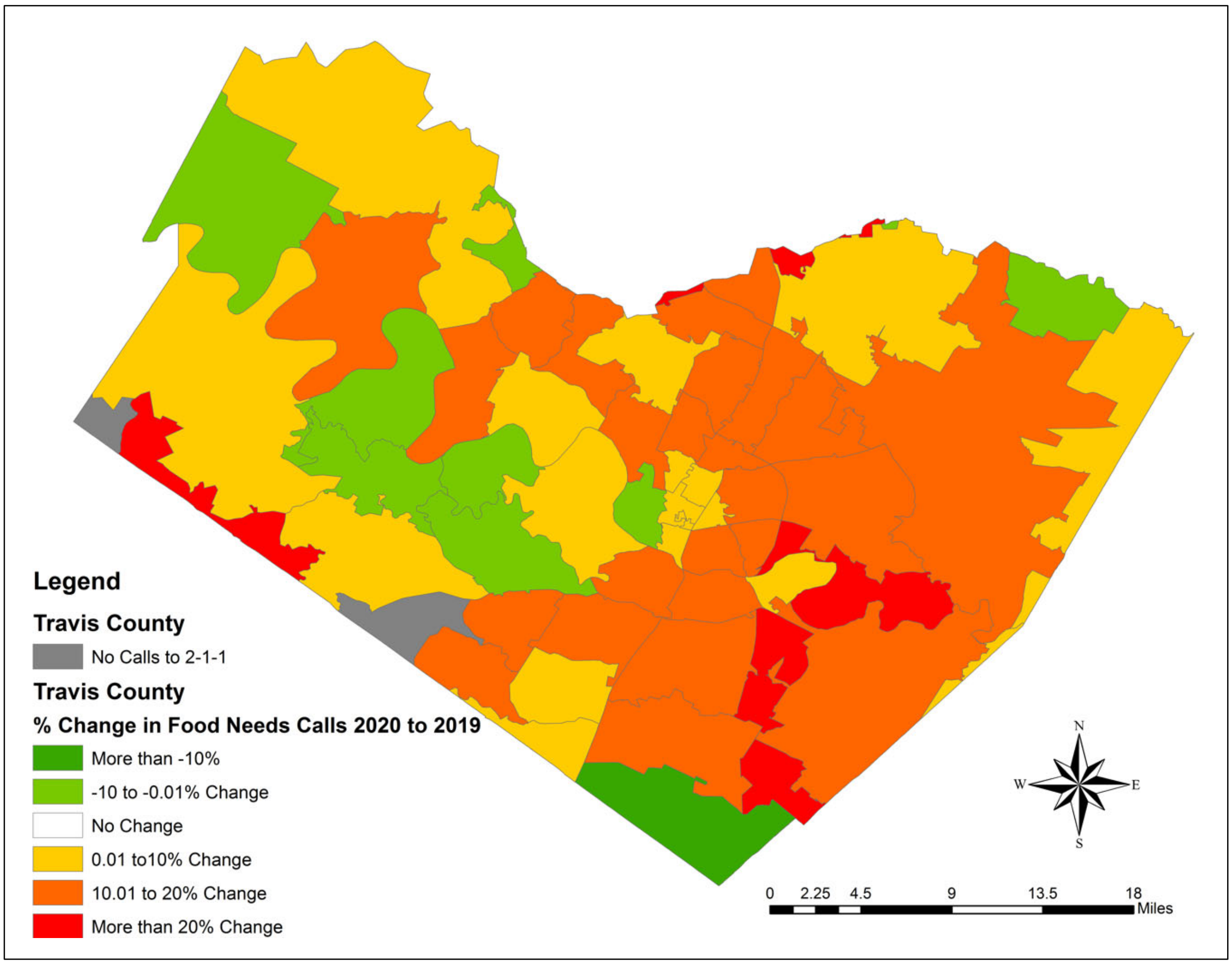
Identification of Areas with Unmet Food Needs
The final component of this analysis was to identify areas with unmet food needs during the pandemic in Travis County. Geographic analyses of food need calls were compared to locations of open emergency food assets monthly. Zip codes with potential unmet food needs were identified if they had a high overall food need call volume (more than 191 food need calls), a high proportion of food need calls (over 29% of calls regarded food needs in the zip code), an over 10% increase in volume and percent of food need calls in March–July 2020 compared to March–July 2019, and lack of an operating emergency food asset located in the zip code from March–July 2020. Two zip codes met the aforementioned criteria. These zip codes were identified by City of Austin officials and other stakeholders as needing a strategically placed food asset during the pandemic.

Discussion

Summary and Implications of Findings

2-1-1 overall and food need call level findings and implications
The purpose of this component of the analysis was to examine overall call trend data to 2-1-1 during March–July 2019 and March–July 2020 and to examine changes in food need call volume to 2-1-1

Figure 2. Changes in Percent of Food Need Call Volume by Zip Code, March–July 2019 to March–July 2020



during COVID-19 by zip code. The results showed higher overall call volume and significantly higher food need call volume throughout Travis County during the COVID-19 pandemic. While there was an increase in overall call volume, the category with the greatest percent increase from 2019 to 2020 was food need calls. Additionally, results from the weekly call analysis shed greater insight on public response to key policy announcements and reports about the prevalence of COVID-19 cases and hospitalizations. The first "Stay Home, Stay Safe" order for Austin and Travis County was announced in late March and was extended in mid-April. Interestingly, the rise in call volume in June and July matches the reporting of a spike in cases in the Travis County area during that time (City of Austin, 2020; Osborn, 2020; Weber, 2020). Additionally, the peak of food need calls in early May coincides with the first announcement about Pandemic-EBT (Office of the Texas Governor, 2020). Thus, the results demonstrate an increase in calls to 2-1-1 during COVID-19 compared to before the pandemic and that local policy changes and announcements correlate to a rise in 2-1-1 call volume.

While an increase in food need calls using 2-1-1 data is not a precise or validated measurement of the prevalence of food insecurity, the results demonstrate that food insecurity–related issues and needs are being experienced by a growing number of United Way clients. Additionally, this increase is consistent with the projected increases in food insecurity calculated by Feeding America and the increased prevalence of food insecurity experienced by Americans and Texans found in the Census Pulse Survey analysis (Feeding America, 2020; Schanzenbach & Tomeh, 2020). This dramatic rise in food insecurity is alarming, given that it has taken 10 years to recover to pre–Great Recession levels (Gundersen et al., 2020).

Results show a greater increase in food need call volume and the change in the proportion of food need calls from 2019 to 2020 in eastern Travis County than in western Travis County. This is an important distinction because eastern Travis County has been identified as a historically underserved and racially and ethnically diverse area with a higher prevalence of food insecurity than western Travis County (U.S. Census Bureau, 2018). Thus, these findings demonstrate that COVID-19 could be widening the food-insecurity disparities in Travis County and the greater Austin area that existed before the pandemic.

Implications of identification of areas with unmet food needs

The third aim of this analysis was to identify areas with unmet food needs during the COVID-19 pandemic in Travis County. This analysis was also able to provide timely and zip-code level recommendations to government officials and nonprofit organizations to implement programs and strategies to potentially ameliorate food insecurity in areas with unmet food needs. The researchers (KJ, AB) disseminated their findings through monthly reports to the City of Austin (SN, WEM, AR), United Way for Greater Austin (AP), Dell Medical School (KH, ME), the City of Austin Food Access Coordination Taskforce, and other collaborators. They also recommended strategically placing an emergency food asset in the two zip codes with unmet food needs. Due to sharing these results and findings, a local nonprofit organization has strategically placed an emergency food asset in one of the identified areas as of late September 2020, and other county and city officials have utilized these data as rationale for additional funding for existing but overburdened resources. Also, this work has informed where other studies should concentrate sampling for their research (KH, ME). Future research should dive deeper into what factors contribute to these communities' increased proportion of food need calls and how this informs additional policies.

Implications of methodological approach

This methodology provided a rapid translation of research to policy and program implementation and has implications for food insecurity research. As discussed previously, food-insecurity data often takes years to obtain, analyze, and disseminate, especially at a granular level such as by zip code. This methodology has enabled close to real-time analysis of food needs at a countywide and zip-code level, resulting in the ability to strategically place additional emergency food assets in areas with unmet food needs. This methodology has potential for implementation across the U.S., given the nationwide presence of United Way and 2-1-1 call lines to provide local insight into how food insecurity is changing during COVID-19.

Limitations of Study

There are certain limitations to this study. There are potential threats to the validity of this sample, specifically selection bias and limited generalizability. Since inclusion in this sample required an individual to be aware of and call the 2-1-1 line operated by United Way for Greater Austin, this sample is most likely predominantly low-income, resulting in selection bias. While there were campaigns to promote the utilization of 2-1-1 during this period, it is still unlikely that all Travis County residents experiencing food insecurity were calling 2-1-1 during this time. The sample was predominantly female and English-speaking; therefore, these findings may not be generalizable to all Travis County residents. This was a natural experiment, and so a randomly selected sample was not possible to obtain. While the findings are generalizable to the population of 2-1-1 callers in Travis County, future research could expand on these findings with a more representative sample from the county.

Additionally, food need calls were used as a proxy for food insecurity–related issues, which, while used in previous analyses with 2-1-1 call data, is not a validated food-insecurity measurement (Janda et al., 2020). Adding validated food insecurity items as part of the 2-1-1 call protocol, such as the USDA 18-item measure, or two-item food insecurity screener, would result in a more precise measurement of the prevalence of food insecurity among callers (Gundersen et al., 2017; Jones et al., 2013; Pinstrup-Andersen, 2009). Future work should explore rising trends in food insecurity and widening disparities during COVID-19 with a more representative sample to minimize selection bias and should utilize validated food-insecurity survey instruments to more precisely measure food insecurity.

Conclusions

Research indicates that food insecurity is increasing during COVID-19 throughout the U.S. Results from this study indicate that these projected increases occur at the local level in central Texas and potentially widen pre-existing disparities during the pandemic. Additionally, this study demonstrates that cross-sector collaboration and utilization of this methodology of analyzing 2-1-1 call data at the zip-code level can result in rapid translation of research into policy. Thus, greater research and transdisciplinary and sector partnership are needed to gain a more nuanced understanding of how food insecurity is increasing at a local level and to subsequently inform effective program and policy implementation.

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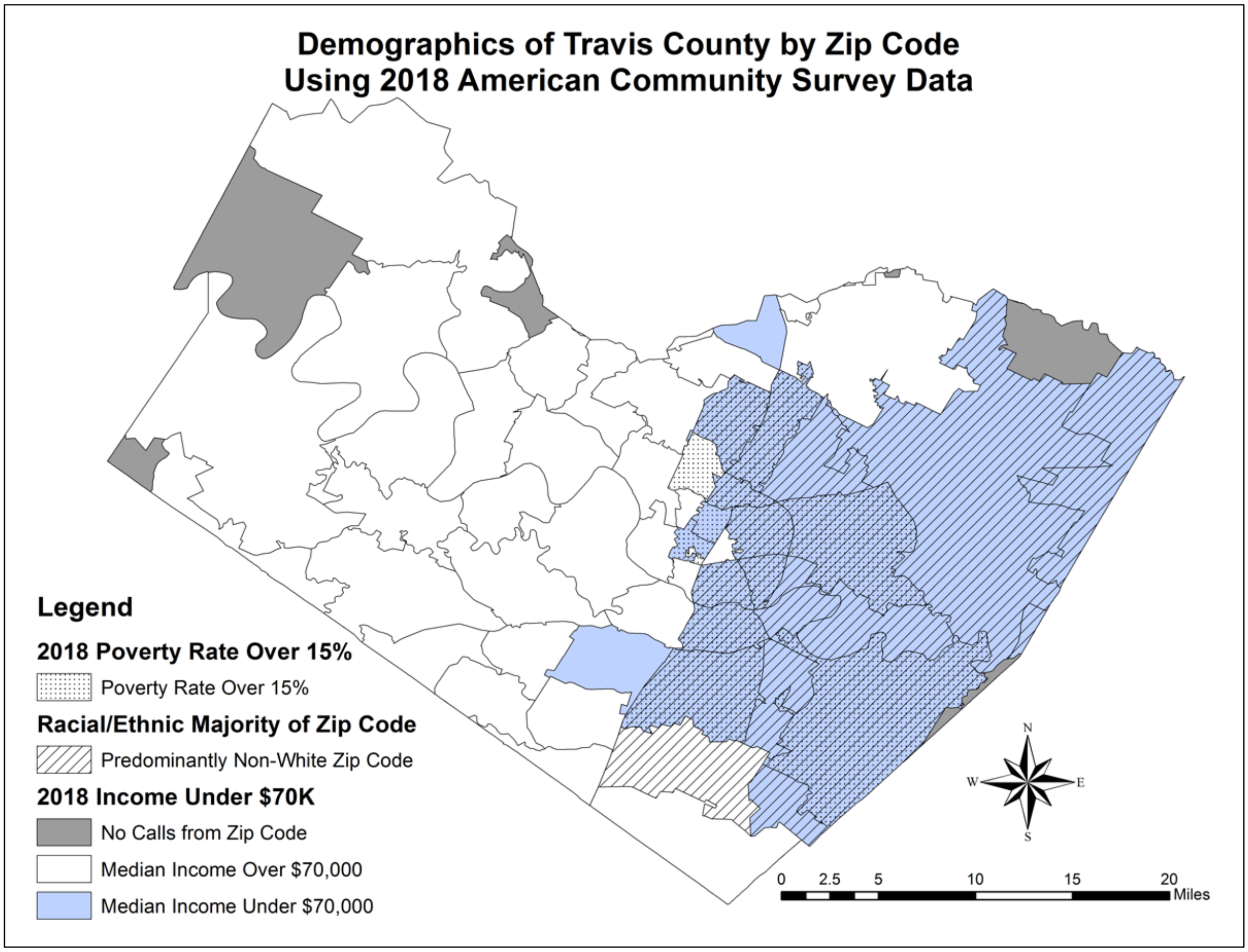
Appendix

Figure A. Map of Demographic Data of Travis County by Zip Code Using 2018 American Community Survey Data



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The scope of U.S. state soil health legislation: A mixed-methods policy analysis

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Abstract

Links between soil health and public health are established and growing in the scientific literature, and soil health bills in the U.S. have increased since 2016, but the extent to which current soil health legislation addresses public health implications has not been examined. Does the scope of current legislation explicitly address links to public health? This question will grow more pressing as population growth places higher demands on soils. In this study, we examine the scope and content of recent soil health legislation and investigate the importance of context, processes, and actors through semistructured interviews with soil health profes-

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Statement on Any Previous Reporting of Data
These findings have not been previously published. The findings in this manuscript have not appeared elsewhere, but a pre-edited version of the manuscript was published on the University of Washington ProQuest Dissertation and Thesis database in 2019.

Conflict of Interest
The authors report no conflicts of interest and have had full control of all primary data and agree to allow the journal to review data if requested.

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sionals involved with identified bills. Twelve bills from 11 states were analyzed and 10 interviews were conducted. Legislation focused primarily on soils' capacity to sequester carbon and improve water quality, while public health had minimal representation. Interviews illuminated themes such as climate change motivating bill proposals and recognition of soils as living ecosystems, yet also demonstrated structural and knowledge limitations to including public health in soil health policies. These findings provide a novel perspective on the scope and passage of soil health legislation and demonstrate the opportunity for broader collaboration with public health.

Keywords
Soil Health, Public Health, Legislation, Policy, Policy Analysis

Introduction

Since 2016, the introduction of agricultural policies targeting soil health in U.S. state legislatures has increased. Prior to 2016 only two U.S. states had proposed legislation regarding soil health. By August 2019, overall state legislatures had seen over 20 proposals related to soil health. Along with the addition of soil health language to the 2018 federal farm bill, this increase suggests a turning point in soil conservation efforts (Soil Health Institute, 2020). Usage of the term "soil health" is also a relatively new phenomenon in the scientific community. In 1996, soil researchers Doran, Sarrantonio, and Liebig defined soil health as the "continued capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain biological productivity, maintain the quality of air and water environments, and promote plant, animal, and human health" (Doran, Sarrantonio, & Liebig, 1996, p. 11). This definition has since become standard language among researchers (Bennett, Mele, Annett, & Kasel, 2010; Larkin, 2015; Moebius-Clune et al., 2016, p. 12) and was adopted by the U.S. National Resource Conservation Service (NRCS) in 2012 (NRCS, 2018).

While the language around and the interest in the concept of soil health is relatively new, U.S. soil conservation policies date back to the 1930s dust bowl (NRCS, 2020b). During this time, conservation policies focused mainly on mitigating topsoil erosion (Dumanski, 2015; NRCS, 2020b). Since the early 20th century, the scientific understanding of the role of microorganisms in sequestering atmospheric carbon has greatly advanced understanding of soil as a complex system, facilitating development of conservation as more than a concern with erosion (Lal, 2004; Schmidt et al., 2011). Intensive farming practices common to the U.S. industrial agricultural system, such as frequent tillage, synthetic pesticide and fertilizer application, and large-scale monoculture, have been found to degrade soil ecosystems and health (Matson, Parton, Power, & Swift, 1997). Appreciation of the complex processes of soil led to promotion of new soil management practices as a way to mitigate climate and soil degradation (Doran & Zeiss, 2000; Lal, 2004). Practices to enhance soil health include no-till and low-till systems, crop rotation, addition of compost and organic fertilizers, polycultures, and cover cropping (National Soils Survey Center, 2015). Programs incentivizing these practices began to emerge in national conservation policy. In the late 1990s to early 2000s, the Environmental Quality Incentives Program and Conservation Stewardship Program established financial and technical assistance to help farmers implement and maintain soil conservation practices (Environmental Quality Incentives Program, 2016; NRCS, 2020a). In 2014 the NRCS created a Soil Health Division as a way to strategically manage national efforts to improve soil health (NRCS, 2020b). The 2018 Farm Bill included soil health in national initiatives through expanded funding for incentive programs, specifically promoting crop rotation, cover cropping, and rotational grazing (Agricultural Improvement Act, 2018). The Bill also allocated additional funds for on-farm demonstration trials and grant funding for soil health research (Harrigan & Charney, 2018).

As soil health policies have evolved, so has the understanding of soil's connection to human health. At the most basic level, soil is the foundation for almost all agriculture and food production, yet the breadth of ecosystem services that soil provides reaches far beyond agriculture itself. Soil serves as a biofilter protecting drinking water supplies from contaminants such as pesticides, heavy metals, pathogens, and nitrates (Keesstra et al., 2012). Airborne dust from agricultural soils can carry pathogens, synthetic chemicals, heavy metals, and animal waste particulates that can cause respiratory irritation and lung tissue damage (Brevik & Burgess, 2014). Healthy soils are less erodible by wind and, therefore, create less particulate matter detrimental to air quality (Brevik & Burgess, 2014). By limiting the spread of pathogens through air and water, soil plays a role in human disease control (Brevik & Burgess, 2014; Wall, Nielsen, & Six, 2015). Healthy soils can also help protect communities from the hazardous effects of floods and droughts, while degraded soils worsen the effects of such natural events (Basche, 2017). Soil degradation that reduce yields has led to greater application of chemical fertilizers, which have been linked to increased risk of certain cancers, birth defects, and thyroid conditions (Tan, Lal, & Wiebe, 2005; Ward, 2009). In terms of crop nutrients, the research linking soil health to nutrient quality of fruits and vegetables is limited. However, evidence suggests soil microbes can increase the ability of crops to take up soil nutrients, thereby increasing the nutrient content of food for human consumption (Antunes et al., 2012). Humans rely on soils to provide many ecosystem services, demonstrating the paradox that anthropogenic activities cause much soil degradation, yet soils are also necessary for preserving public health.

While the evolution of federal soil conservation policy promotes many aspects of soil health as defined by the scientific community, inclusion of healthy soil's role in promoting human health is limited. The 2018 Farm Bill connects soil to human health only in the consideration that soil testing can prevent food contamination (Agricultural Improvement Act, 2018). The recent increase of soil health legislation at the state level provides an opportunity to widen the scope of such policies, yet the extent to which current state soil health legislation neglects public health represents a potential gap which will only grow more pressing as population growth places increasing demands on soil in the future (Cumming et al., 2014; Tilman, Balzer, Hill, & Befort, 2011). At the same time, pressures from climate change will continue to contribute to degradation and loss of soil, lessening agricultural capacity to meet growing needs (Amundson et al., 2015; Tilman et al., 2011). Including a public health focus in soil health legislation could enhance public health benefits of soil stewardship and help mitigate future threats to soil ecosystem services.

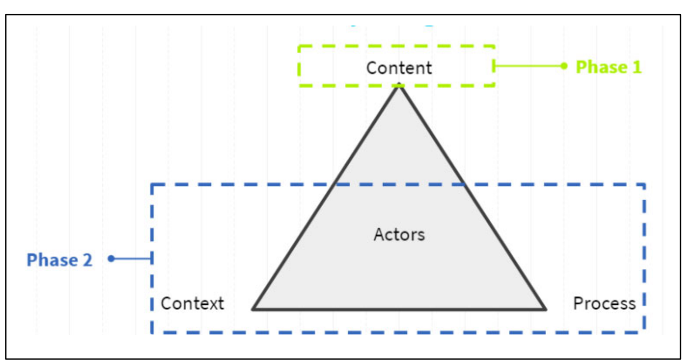
The aims of this research are two-fold: to assess the scope of recently introduced U.S. state soil health legislation and to identify opportunities to better connect soil health and public health in state-level soil health legislation. To achieve these aims, we used the Health Policy Triangle (Walt & Gilson, 1994) to assess 12 bills proposed in U.S. state legislation from 2016 to 2019, of which three had passed prior to this study, three passed during project analysis, and six remained in legislative committee as of August, 2019 at the project's culmination.

Methodology

Policy Framework

We assessed the current scope of U.S. state soil health legislation through document review and semistructured interviews. Walt and Gilson's Health Policy Triangle (HPT) was chosen as a theoretical framework to inform and structure study design. The HPT (Figure 1) consists of four policy components which must all be working synergistically for policies to be effective: content, context, process, and actors (Walt & Gilson, 1994). For this project, content is the text of legislation documents and context is the environmental or situational circumstances in which policy processes occur, in-

Figure 1. Walt and Gilson's Health Policy Triangle



cluding but not limited to agency structures, resources, and values. The third HPT component is process, or how the policy works, such as style of decision-making, interventions, and evaluation. Within the HPT are the actors, the stakeholders who identify problems and shape decisions (Walt & Gilson, 1994).

To address all aspects of the HPT, we examined content via a quantitative analysis of current legislation and assessed context, process, and actors through semistructured interviews with individuals involved with soil health legislation.

Legislation Collection

Legislation library databases from all 50 U.S. state government websites were used to identify current state soil health legislation. Legislation libraries were searched for key words—soil health, healthy soil, regenerative agriculture, and carbon farming—from 2000-2019. Text copies were subsequently obtained from legislative libraries. The search identified 24 bills, including both introduced and enacted, from 15 states. From this pool, a purposive sampling method was utilized to include bills which met a set of pre-determined criteria (Palinkas et al., 2015). Any bills from the 2019-2020 legislative session that were proposed before February 2019 were included in analysis. Bills were excluded if soil health was merely mentioned but was not an aspect of legislation interventions. Amendments and concurrent resolutions without related soil health interventions were also excluded. Of the original 24 bills, 12 bills from 11 states were analyzed.

Legislation Analysis

A codebook was developed to ensure consistent bill content analysis. To assess both the breadth in which individual bills addressed soil health, as well as to compare between bills, our codebook was constructed using ontological categories from the accepted definition of soil health commonly recognized in scientific literature: biodiversity, bioproductivity, air quality, water quality, animal health, soil organic carbon (SOC), and public health (Bennett et al., 2010; Larkin, 2015; Moebius-Clune et al., 2016). Soil health definitions themselves were also coded to compare and contrast the characterization and extent of definitions within the bills.

Two codes for influencers of soil health determinants (land management practices and climate change) were included based on the emphasis found during literature review. To better understand the potential impacts of legislation, bills were coded for proposed interventions, outcome evaluation methods, and financing. Codes from each bill were recorded in Microsoft Excel.

Determinant codes (Table 1) from all bills were compiled and the number of total determinant codes counted. Codes from each determinant were divided by the number of total codes to find the proportion of codes for each determinant by bill and across bills. Additionally, the diversity of codes within each bill was compared across bills.

Interview Recruitment, Collection, and Analysis

An interview script (see the Appendix) was created to address the remaining three aspects of the HPT: context, process, and actors. All questions were submitted to and approved by the University of Washington Institutional Review Board (IRB). To gain a better understanding of soil health legislation context, process, and actors, we recruited individuals involved with the creation, proposal, or implementation of the bills and laws analyzed in this study. Potential interview participants were identified through a state soil health legislation Google group and the Soil Health Institute policy resources

Table 1. Summary of Legislation Codebook Categories and Codes

Category	Code
Terms	Soil Health Definition
Determinants	Biodiversity Bioproductivity Air quality Water quality Animal health Carbon sequestration Public health
Influencers	Land management Climate Change
Interventions	Policy actions or interventions Evaluation Finances

Table 2. Summary of Interview Codebook Categories and Codes

Category	Code
Context	Motivations Vision/goals Target audience Self-reported soil health definition Perspective on increased proposal of legislation Factors linking soil health and public health Gaps or barriers to linking soil health and public health
Process	Evaluation Challenges and barriers to bill adoption Challenges and barriers to law implementation Rationale Facilitators/enablers
Actors	Key partners in creation Intervention stakeholders Connected programs

webpage and subsequently sent a recruitment email. Interested participants were scheduled for a one-hour phone interview with the primary author. A consent script was read prior to each interview, and interviews were audio recorded with participant permission. Recordings were transcribed for coding.

An additional codebook, based on the interview script, was created to analyze the HPT concepts of context, process, and actors. It used a deductive or directed approach to create codes based on the structure of the interview guide. As interviews began to be coded according to this structure, an inductive approach was used to identify themes and sub-themes within these categories and code them accordingly (Fereday & Muir-Cochrane, 2006). As more interviews were coded, themes and sub-themes were assessed for their persistence until no further codes were identified. The final codebook was used to code all interviews. To confirm inter-rater reliability of the coding process, two trained study authors (MD, RC) double-coded 10% of the interviews, updating the codebook until 80% percent agreement was achieved (McHugh, 2012). The final codebook consists of seven context codes, five process codes, and three actor codes (Table 2). As with legislation coding, coded text was recorded in Microsoft Excel. Codes in each category were analyzed for frequently mentioned concepts between multiple interviewees; these concepts were considered category themes. Participant names have been changed for Interviewees 1–10 to maintain confidentiality, but participant affiliation (e.g., farmer, community volunteer) and general geographic location are shown after quotes in order to provide context to interviewee perspectives.

Interviews were conducted with individuals involved in soil health legislation from 10 of the 11 states with legislation included in the quantitative analysis. Iowa was not included due to nonresponse. Professional affiliations of interviewees varied (Table 3) and included government agency program coordinators, policy directors at environmental nonprofit organizations, volunteer citizens, a farmer, an organic business consultant, and an environmental attorney. Some volunteer citizens were associated with a community climate action group while others worked for agricultural or environmental programs but had dedicated their personal time to support the legislation. Interviewees were involved with the legislative process in different ways, such as managing enacted soil health programs, drafting legislation, and testifying for soil health legislation before state congresses. Several themes emerged from these interviews, which are organized in the Results section within the Health Policy Triangle framework categories of context, process, and actors.

Limitations of Methods

A key strength of this research is its incorporation of both policy analysis and qualitative interviews, including participation of interviewees from diverse

Table 3. Distribution of SHP Affiliations

SHP Affiliation	Number of Interviewees
Volunteer citizens	3
Environmental non-profit policy advisor	2
Government agency employee	2
Farmer	1
Organic business consultant	1
Environmental attorney	1

backgrounds ranging from governmental agency employees to organic farming. Nevertheless, policy analysis involves several inherent limitations, especially when comparing legislation between U.S. states, because each state has different legislative requirements, such as bill length and structure. To address this, we calculated proportions to normalize the appearance of code data, and thereby offset any effect of varying lengths of bills. To create the proportions, the total number of bill codes was used as a denominator, and bills were also compared by using each bill as its own denominator. In addition, for our interviews only one individual involved in soil health legislation was interviewed from each state, providing singular insight for contextual factors that may not fully reflect the viewpoint of other policy constituents involved. While interviews spanned a variety of individuals, only one farmer responded to interview recruitment. This may be due to the nature of agricultural policy proposal efforts, in which nonprofit and community groups advocate for associated farmer constituents, yet presents the potential for bias. Similarly, we are missing key state government representative perspectives because this research was conducted during the legislative cycle and no representatives responded to interview requests. Finally, perspectives on limitations and facilitators to collaboration between soil health and public health disciplines are also one-sided, as no public health professionals who were involved in soil health legislation proposal, creation, enactment, or implementation of bills and laws analyzed for this study were able to be identified for interviews.

Results

Legislation Status

Three states—California, Hawaii, and Maryland—had passed soil health legislation prior to the 2019 legislative session. California was the first to enact soil health legislation, in 2016; Maryland and Hawaii followed in 2017 (see the map in Figure 2).

Nine soil health bills were proposed during the 2019 legislative session: bills from Washington, New Mexico, Iowa, Illinois, New York, Vermont, Massachusetts, and two from Nebraska. A table of the bills with legislative number and status as of July 10, 2019, is in Table 4.

Legislation Analysis: Content

Defining soil health

While the nine bills all mention soil health, only legislation from California, Massachusetts, Maryland, New Mexico, and Illinois define the term, with little diversity, most using a variation of the California definition:

> "Healthy soils" means soils that enhance their continuing capacity to function as a biological system, increase soil organic matter, improve soil structure and water- and nutrient-holding capacity, and result in net long-term greenhouse gas benefits. (Agricultural lands: greenhouse gases: Healthy Soil Program SB-1350, 2016, Sec. 3)

Figure 2. Map of States with Proposed or Passed Soil Health Legislation as of February 2019

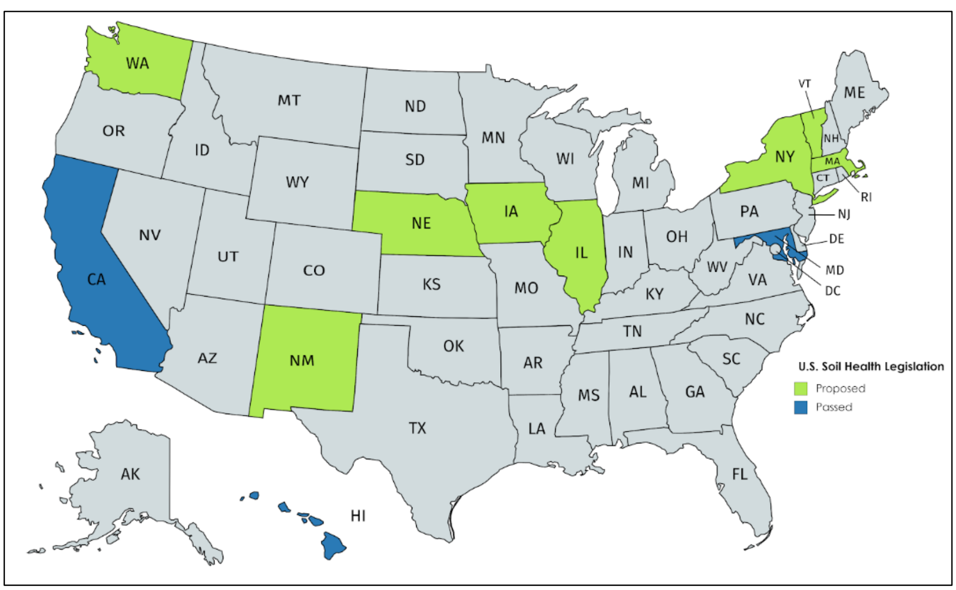


Table 4. Status of Legislation as of July 2019

State	Bill	Status as of February 2019	Status as of July 2019	Year/Session
CA	SB 1350	Passed	Passed	2016
MD	H.373	Passed	Passed	2017
HI	Act 15	Passed	Passed	2018
MA	S438	In committee	In joint committee	2019
VT	H.903	In committee	Incorporated into H.525 and passed	2019
NY	A2781	In committee	In committee	2019
NM	S.218	In committee	Passed	2019
IL	S1980/H2737	In committee	Passed	2019
IA	H102	In committee	In committee	2019
NE	LB243	In committee	Passed	2019
	LB729	In committee	In committee	2019
WA	S5947/H2095	In committee	Passed senate, tabled in house committee	2019

The exception is Illinois, whose bill adds a reference to soil's capacity to "sustain plants, animals, and humans" as a characteristic of soil health (An Act Concerning Local Government, 2020, Sec. 5, 405/3.23).

Some states chose to use a different overarching term in place of soil health. For instance, the definition of regenerative agriculture in Vermont's bill closely resembles soil health definitions found in other state legislation:

> Regenerative agriculture describes farming and grazing practices that, among other benefits, reverse climate change by rebuilding organic matter in soil and restoring degraded soil biodiversity, resulting in carbon drawdown, improved retention of water in soil, and improved water quality. (An Act Relating to Regenerative Farming, 2018, p. 2)

New York and Washington used the term carbon farming, which represents a more targeted approach focusing primarily on carbon sequestration. New York defines carbon farming as the "implementation of a land management strategy for the purpose of reducing, sequestering, and mitigating greenhouse gas emissions on land used in support of a farm operation" (Carbon Farming Act, 2017, Sec.1, Subdiv. 5). Although all bills discuss soil health, the difference in terms demonstrates variation in the broader legislative vision, goals, and contexts.

Determinants

Overall, 142 determinant codes were identified among the 12 bills. Carbon sequestration was cited the most often, accounting for 45 of the 142 codes (31%). Water quality followed with 36 mentions (25%) but was mentioned more widely (11/12 bills) than carbon sequestration (10/12 bills). Biodiversity and bioproductivity represented a similar percent of determinant codes (12% and 13% respectively) and were also mentioned in a similar number of bills (9/12 and 8/12). More than half of the bills referenced public health (7/12), but public health was mentioned only a total of 11 times, contributing to 8% of determinant codes. Animal health appeared slightly less than public health, accounting for 10 of the 142 determinant codes (7%) and mentioned in 5/12 bills. Air quality accounted for both the lowest proportion of total determinant codes, with 5/142 codes (4%), and the least common determinant with mention in only two bills (Figure 3).

Figure 4 illustrates the relative composition of each bill by determinant code. No bill addressed all even soil health determinants as outlined in the legislation analysis methods. The average number of determinants mentioned was 4.3. The California, Illinois, and Nebraska bills included the highest diversity of soil health determinants with six of the seven determinants cited, followed by New Mexico (5/7). Washington's bill included the least variety of soil health determinants, citing only carbon sequestration (1/7).

Influencers and interventions
Land management practices were the primary influencer and focus of legislative interventions, mentioned in 11 of 12 bills. Only seven of the 11 bills cited specific land management practices, cataloged in Table 5. The most commonly cited land management practices included cover cropping and no-till or conservation tillage. Main legislative interventions (Table 6) include financial and technical assistance programs offering incentive-based grants, equipment loans, and education. Five of the 12 bills included methods of intervention evaluation. Only four bills (Hawaii, New Mexico, Massachusetts, and Vermont) discuss funding sources.

Figure 3. Which Soil Health Determinants were Mentioned the Most Often in Soil Health Legislation by Illustrating the Percent of Each Soil Determinant Over Total Codes from All Bills

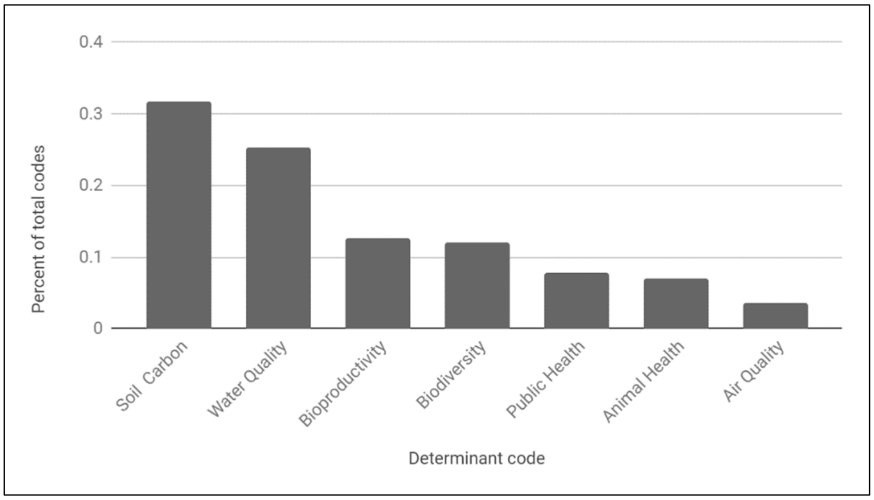
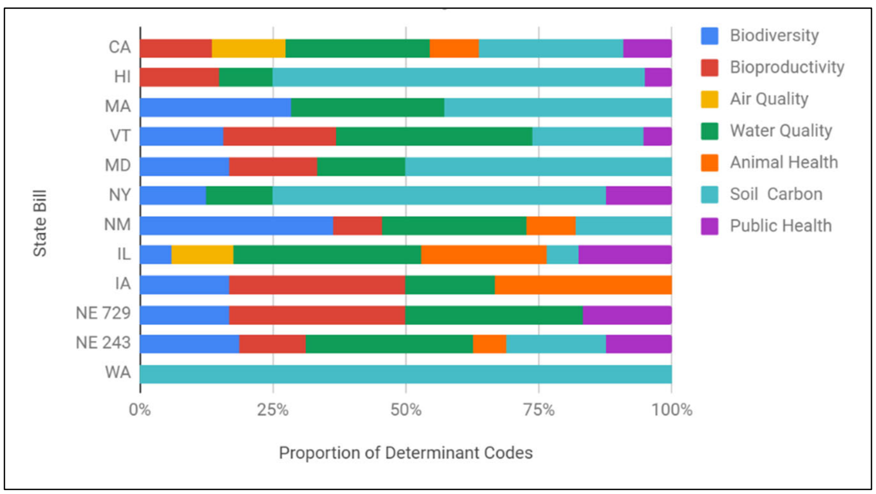


Figure 4. Percent of Soil Health Determinant Codes Mentioned by State
Each color represents a different soil health determinant. The more colors per bar demonstrates a higher diversity of determinants in a bill.



Legislative Context
As Walt and Gilson (1994) discussed, context is the background information about the environment and situational factors that influence policy development. Many contextual themes emerged during our analysis: (1) the desire to normalize and mainstream soil health, (2) climate change motivating bill proposals, (3) improved bill support due to heightened visibility of research and more frequent extreme weather events, (4) understanding of soil as a living ecosystem, and (5) connections between soil health and public health. Each of these is further discussed below, with illustrative quotes from interviewees.

Normalizing and mainstreaming soil health
A general mission for legislative bills, as described by interviewees, was to increase the visibility of the concept of soil health to make soil health practices more normalized and mainstreamed. Interviewees noted that while many important land management practices have been around for hundreds of years, they have yet to be thoroughly articulated in policy. While gathering research for writing legislation, an interviewee observed very little adoption of soil health practices, such as no-till or cover cropping, by farm and land managers. Many entities were

Table 5. Land Management Practices Cited Within Bills, by Number of Bills That Refer to a Specific Practice

Land Management Practice	Number of bills that refer to practice
Cover cropping	7
No-till/low-till	4
Rotational/planned grazing	4
Agroforestry	2
Compost/manure application	2
Integrated crop-livestock systems	2
Planting perennials	2
Reduce chemical application (fertilizers, insecticides, and herbicides)	2
Biochar application	1
Planting hedgerows	1
Planting native vegetation	1
Mulching	1
Multicropping	1
Soil microbial inoculation	1

Table 6. Distribution of Legislative Interventions by State

Legislative Intervention	States
Task force creation	NE 243, HI
Technical and financial assistance program	CA, MD, NM, WA, VT, MA
Financial assistance only	NE 729
Tax credit	NY
Expanding scope of Soil and Water Conservation Districts	IL

promoting soil health as a concept, but the efforts had yet to be translated into increased action.

> We needed to figure out a way to promote wider use of these practices among farmers and land managers. We thought we needed to put a big spotlight on these practices through the creation of a healthy soils initiative and the formation of a task force. (Midwest volunteer citizen)

In a related comment, one interviewee underscored the need to emphasize more the history of soil degradation in the U.S., and believed that creating legislation was one way to increase the visibility of the issue:

> We aren't working in a vacuum; we are working with other very forward moving leaders who are already doing a lot around the country. What we want to achieve is to spread this good work and make it mainstream. So it becomes the norm and not the exception. (Southwest volunteer citizen)

Another interviewee noted that many soil health efforts were directed solely on preserving topsoil, and saw a need for broadening perception to include preserving an environment sustainable for crops and animal production over time: "We want to get some of these practices to be more commonplace and not make it something wacky that one of your neighbors is doing that you don't understand." This interviewee also noted that to accomplish this goal means educating not only farmers, but lawmakers as well.

Three other interviewees echoed these sentiments, adding that normalizing ideas among legislators is the first step to bringing about change. According to them, lawmakers often are unaware of healthy soil concepts prior to bill proposals:

> When you take just 15 minutes to explain how soils can store carbon from the atmosphere and how that helps with life within the soil, [and] therefore plants and animals, people get it. People understand. It's just trying to make people see how wide the reach of soil health is. That it's not just one metric like soil carbon but also biodiversity, water, animal and human health. It's a very large system to explain. (Northeast farmer)

Climate change mitigation

The capacity for soils to sequester atmospheric carbon as a potential mitigator of climate change was cited as a motivating factor by eight of the 10 interviewees. They believe that climate change policy has historically focused on transportation and energy systems, but that only recently has agriculture been recognized as a player in climate change solution. One interviewee perceived an "upward trend in recognizing how soils are an untapped climate change mitigator. I think as climate change has become more dire, people are looking for any and all options." Another interviewee stated that the impacts of climate change are compelling legislators to start to "think about how to make farms more resilient to the changing climate down the road."

In some states, like California and Washington, passage of climate action plans has motivated healthy soil legislation as a strategy to meet emission goals. States with more conservative constituents used the healthy soil issue to address climate change indirectly.

> We realized the chance of getting the climate action plan passed was limited, so we started to look at alternatives. We found that healthy soil has a lot of benefits to the agricultural community, but also had benefits beyond in terms of its ability to sequester carbon and reduce greenhouse gas alternatives. So, we decided to make a healthy soils bill as a plan B to the carbon action plan. (Midwest volunteer citizen)

For other interviewees, lack of climate change action at the federal level served as a powerful motivator. One interviewee believed the increase in proposals for soil health legislation over the last few years is a consequence of people being "tired of waiting for things to be done by the national government, so they are starting to find ways to protect nature themselves through state action." Another noted that frustration with the absence of federal efforts has likely "encouraged some states to get their act in gear."

While climate change was a major and primary motivator, one interviewee pointed out that the other benefits of improving soil health trump those of carbon sequestration:

> My argument is that if someone waved a magic wand and there were no more problems with carbon, we were essentially at pre-industrial levels of greenhouse gases, we would still have only 60 years of topsoil left. We would still have all these flooding problems because of soil compaction. We would still have water quality issues because of chemical amendments. If we address all these other issues, carbon [sequestration] is a significant bonus. (Northeast volunteer citizen)

The perfect storm: Research and weather influencing policy

When discussing the recent increase in soil health legislation, interviewees suggested two chief explanations for increase in farmer support for soil health policies: recent research and more frequent extreme weather events. In 2012, the Natural Resource Conservation Service of the U.S. Department of Agriculture started a soil health campaign, "Unlocking the Secrets of Soil Health" (NRCS, 2018). Mentioned by several interviewees, the initiative has helped spread awareness of soil health through educational programming. Interviewees also reported increased discussion of soil health in local news publications, university extension programs, and community nonprofits.

> There has been enough research, successful case studies, and examples of farmers adopting things like no-till and cover crops that people are starting to recognize the benefits to their bottom line. Also, in terms of yield, soil retention, and water retention. (West Coast nonprofit policy advisor)

> Soil health has almost become a buzz word in agricultural conservation with the explosion of scientific knowledge in the last few years. Historically, soil health was very much considered by farmers. I think a rediscovery is occurring due to the increased support from the scientific community. (Northeast government agency employee)

In addition, an interviewee reported that many farmers and ranchers are starting to feel substantial pressure from extreme weather such as droughts and flooding, which have become more frequent in the last few decades (Mallakpour & Villarini, 2015; Peters, Iverson, & Matthews, 2014). One interviewee, whose state has recently experienced multiple severe floods, observed that farmers who do not believe in climate change are starting to notice that "things are changing" and the risks those changes pose to agricultural production. Another interviewee believed the perceived increase in extreme weather events improved issue visibility to create the "perfect storm" for legislation proposal: "The latest changes to storm water and drought have elevated the awareness about the need to address soil issues. In a way, the ground was ready for legislation to take hold."

Soil as a living ecosystem

When asked to define soil health, interviewees provided a resoundingly unified answer: soils are living ecosystems. While interviewees cited more specific soil health characteristics, such as those defined in Doran, Sarrantonio, and Liebig's definition of soil health (e.g., biodiversity, water system health, and plant and animal health), many stated soil can be thought of simply as an ecosystem. One interviewee said, "soil is a living organism with worms, fungi, insects, and organic matter. We are just trying to increase the naturally occurring nutrients and minerals to make a perfect medium for growing plants and crops." Another interviewee agreed, stating healthy soil is soil that is "full of life." Some interviewees described the soil ecosystem as analogous to the human body, relating the different soil functions to organ systems.

> When we think of health we think of systems function and lots of different services. So I think there is a natural metaphor with the body. Soil health means soils that are biologically functioning and providing the ecological services that they would provide in their natural state. (West Coast nonprofit policy advisor)

> Soil is its whole own ecosystem. I like to think of soil as earth's digestive system. Just like your body takes food and breaks it down into something your body can use for energy, the earth is taking inputs and breaking them down into products plants can use, and then animals can use. (Northeast farmer)

One interviewee compared soil to the human gut, drawing specific parallels between soil and gut microbiota. Similarities have been described between the systematic functions of both microbiotas, in terms of immunological function and metabolic capacity (Ramírez-Puebla et al., 2013). The interviewee believed that not acknowledging these connections is based on limitations in people's imagination and perception of soil: "we cannot see what we kill in the soil every day, so it escapes our compassion."

Connecting soil health and public health

Interviewees not only reported analogies between soil and the human body, but also discussed ways that soil health directly impacts public health. Seven of the 12 bills analyzed mentioned soil health's connections to human health through improving water quality, increasing crop yields, and improving community health. Interviewees discussed similar factors but emphasized two: soil nutrient level and chemical pollutants.

Five of the nine interviewees reported soil nutrient level as a main connection between soil and public health due to soil's capacity to transfer nutrients, specifically micronutrients, to crops.

> I think one of the things that comes to mind immediately is nutrient density of foods. Those are very closely related. A healthy soil is integral in increasing nutrient density and nutrient density is critical for healthy food. Which leads to a healthy population. (West Coast organic business consultant)

Specifically, interviewees reported conventional agriculture as a culprit in soil nutrient degradation, responsible for reduced food nutrient density. One interviewee stated that concentrations of certain micronutrients in produce had drastically decreased or gone "completely missing" over the last 50 years. Another interviewee agreed:

> The old saying that an apple a day keeps the doctor away is no longer true; now it takes something like 15 apples to equal the nutritional equivalent of an apple from the 1930s when that saying gained popularity. We've changed nature to the point where it looks the same, but it is fundamentally different. (Northeast farmer)

One interviewee claimed that an inverse association exists: the types of crops that fuel an unhealthy diet are related to agricultural practices that erode soil health. Significant amounts of herbicides and chemical fertilizers are often used for commodity crops such as corn and soybeans to maximize yields from even degraded soils. These crops are often used in more highly processed food products.

> We know those foods in the Western diet are not particularly healthy, which leads to multiple issues. And we know that the desire to produce as much of those crops as cheaply as possible is what is leading to a significant negative impact on soil health. So, it flows both ways. (West Coast organic business consultant)

Two interviewees expanded this connection, stating that healthy soils are crucial in maintaining future crop yields as climate change continues to put stress on the food system:

> Especially in the next couple of decades soil health is going to become increasingly crucial to overall food system resiliency. Events that capture this are droughts and flooding. NRCS says that a 1% increase in soil organic matter results in soil having the capacity to hold 2500 more gallons of water per acre. That's a drought and flood resilience solution, but also erosion control. So that will be really important for food security in the future. (West Coast nonprofit policy advisor)

In addition to improving crop nutrient density, interviewees also associated healthy soil with reduced pollutants which have negative effects on public health.

> If you can reduce the amount of chemicals and fertilizers you put on the soil, you are going to reduce the exposure that farmers have to things that have been scientifically proven to have carcinogens in them and produce cancer. (Midwest volunteer citizen)

One interviewee stated similar sentiments: "healthy soil practices pretty much exclude using harmful pesticides or chemical fertilizers, so you do create a healthier product." In addition to reduced chemicals, two interviewees discussed nitrate pollution of drinking water due to water running off agricultural lands into streams and rivers, and nitrates seeping into groundwater. One described how these benefits are paired with a reduction in "leaking of nitrogen in any direction. So, it would reduce volatilization of nitrogen into the air and leakage of nitrogen into waterways."

Legislative Process

The HPT framework describes process as how policies are developed implemented to bring about change (Walt & Gilson, 1994). A crucial process theme that was identified in interviews was that discussing climate change posed either limitations or benefits to gaining support for bills during the bill proposal process. Interviewees brought up a variety of other process limitations, but they did not fall under one unifying theme. Reported limitations to evaluating policies was also identified as a process theme.

The climate change divide

For some states, addressing carbon sequestration and climate change in the text of the legislation reportedly facilitated bill support or passage. For other states, interviewees shared that discussing carbon and climate change in legislation presented a significant barrier to legislation proposal and passage: "if you mention climate change to the legislature, then 50% of them are already against what you are going to talk about." Another interviewee reported a similar response in their state:

> Any program that mentions carbon is sort of toxic to begin with regardless of where the money flows. It seems to be a domino theory where [people believe] if you have a program that relies on cap and trade funds to incentivize agricultural practices that will add more momentum to the cap and trade carbon initiatives that could hurt farmers down the road by increasing the costs of diesel or what have you. (West Coast organic business consultant)

The pushback comes not just from legislators, but from agricultural organizations as well, such as state Farm Bureaus.

> [The Farm Bureau] did not want us to talk about carbon at all. So we ended up taking it out so that they would have our back going forward. There is a weird stigma with some of those words like carbon. Ultimately our organization believes climate change is a very real thing and that the conventional farming practices have contributed a lot in the way of our carbon loss and dead zones in the gulf. We believe this is all man's doing in the end. But organizations like the Farm Bureau aren't on board with admitting that yet. (Midwest non-profit policy advisor)

> The folks that seem to be the most opposed to the bill are the Farm Bureau and Dairy Federation. I still don't understand why they would be opposed to [the bill] since it is tax dollars going to farmers to upgrade pumps and put in equipment and such. So, I don't understand the rationale to their opposition, but it's politics so it doesn't always make sense. (West Coast organic business consultant)

Two interviewees believe that words such as climate and carbon have an innate political stigma because many farmers in rural America are very conservative and do not believe in climate change. Therefore, these words present a barrier for passing legislation.

> The realities of being pragmatic in a legislative setting is that you need to not say things to keep bipartisan support. Everyone can agree that using a cover crop can reduce soil erosion and adds carbon to the soil. If we know that using a cover crop can increase soil health and therefore increase human health down the road, why even mention it in the first place if you risk losing support of the people you need to get the bill through legislature? (West Coast organic business consultant)

This experience differs from that of three interviewees who received bipartisan support for soil health legislation that included discussions of carbon sequestration and climate change. One reported their state Farm Bureau, Farmers Union, and American Farmland Trust co-sponsored the state's healthy soils bill: "This is one of those issues that is very bipartisan. The co-sponsors of the bill are essentially the same proportion of Republican and Democrat as the general legislature." Furthermore, another interviewee believed that soil health bills themselves could help bridge the climate change political divide:

> One motivation of this bill was a broader political interest in trying to enlist rural communities, particularly farmers, into a climate change debate. This will perhaps reduce the urban/rural divide that has become so pernicious in American politics. (Northeast environmental attorney)

Farmer antipathy to government regulations

Some interviewees reported other process limitations, including farmers' distrust of laws and desire to remain unregulated: "There are two big issues beyond climate change. One of them is that farmers don't want to be told how to farm and the other is farmer's fear of regulations." Another interviewee discussed similar limitations:

> You also have a lot of people who are distrustful of laws, even if they agree with the tenants of the legislation. You have farmers who don't want to be told what to do or how to do it, even if they already agree or are already implementing that practice. (Northeast farmer)

One interviewee reported response to talking to agricultural groups about the soil health bill; many pushed back due to fear of losing member support if leadership promoted a law creating more regulations on land management:

> I think a lot of people in leadership roles were supportive of our bill if you would get them into a place where nobody could hear what they were saying. But the members of these groups feel so strongly about these two points

> that [leadership] doesn't want to lose their jobs. (Midwest volunteer citizen)

Two interviewees noted that while most farmers have good intentions, telling farmers how to farm creates tension between farmers and policymakers. One interviewee suggested that this resistance to change could also stem from the financial incentives agribusinesses use to encourage farmers to continue current practices, as well as from farmers' desire to remain autonomous. In the experience of one interviewee, promoting certain land management practices in soil health bills can be interpreted by farmers as blaming current practices for environmental degradation, and therefore blaming the farmers:

> No farmer goes out there thinking they are doing something bad or with the intention to poison the world. They think they are doing the right thing. So, if you set a value statement to a practice it inherently creates a reaction. (West Coast organic business consultant)

Improving farmers' bottom line

In addition to citing limitations to soil health legislation adoption or implementation, interviewees shared factors that facilitated bill proposal or passage. A commonly cited facilitator to improving farmer buy-in was demonstrating a benefit to profits:

> When we talk to farmers, we really emphasize that over time this could increase their bottom line, their profitability. Because they will produce crops with lower input costs because they won't use as high amounts of fertilizers. And you retain soil moisture and reduce erosion. In some cases, you even increase yields. Most importantly you are increasing your profit margin. Because the most important thing to this population is profit per acre. (Midwest volunteer citizen)

One interviewee believed that no agriculture program can be successful unless there is proven benefit to farmer profits: "if you can make an argument for how [you will improve their bottom line] like reducing use of fertilizer, pesticides, fuel, and irrigated water, you get their attention." Another interviewee believed that such facilitation is based on the structure of the agricultural system: "Like it or not the agricultural market is based solely on bottom lines. So, you have to try and reach [farmers] from an economic basis as well as an environmental lens." For one interviewee, focusing on profit as well as on farmer experience and farm families helps improve farmer buy-in for adopting new practices:

> 1) I'm having fun again, 2) I'm making more money, and 3) My kids are staying home and not going to the city. If you can make those three statements true about a practice, farmers will do it in droves. (West Coast organic business consultant)

Evaluation plans

Many interviewees reported that there were no formal evaluation plans to assess the effects of soil health legislation in their states. For some states still in the process of passing a bill, evaluation is set to come after the bill is ratified. Different challenges were brought up in deciding future evaluation processes. One interviewee stated that the lack of a standardized method to assess soil health that has been endorsed by the scientific community means that states will have to create their own standards for measuring change. Two interviewees discussed how a time frame could be a limiting factor, as reportedly it can take 3-5 years to start perceiving changes in soil health metrics based on changes in land management practices.

The California interviewee reported the most robust evaluation of any of the interviewees. California's Healthy Soils Program has performed informal qualitative evaluations through focus groups and interviews with participating farmers and technical-assistance professionals who are helping farmers apply to the program. The Healthy Soils Program is also using a modeling program managed by USDA and Colorado State University, COMET-Farm,[1] to estimate carbon sequestration

[1] https://comet-farm.com/

on participating farms. These data have yet to be formally evaluated, according to the California interviewee.

Legislative Actors

Actors—the individuals and group members responsible for policy making—make up the last factor of the HPT. Within the HPT model, actors are inside the triangle, illustrating that policy content, context, and process are influenced by the values of policy actors (Walt & Gilson, 1994). Two actor themes emerged from interviews: the common key partners in bill proposal and implementation, and the untapped potential in partnering with public health entities for soil health policy.

Common key partners

Interviewees reported a large variety of significant partners instrumental in the proposal or passage of soil health legislation in their states. The most commonly cited partners were local Soil and Water Conservation Districts (SWCD), which are managed by the National Association of Conservation Districts, a national nonprofit association that supports land managers through grassroots advocacy and education (National Association of Conservation Districts, 2019). SWCDs were mentioned by seven of the nine interviewees as major partners in bill creation. In some cases, state SWCD employees provided interviewees with research to justify a bill or helped interviewees find other professionals to help write the bill or testify on its behalf. One interviewee described how SWCDs contributed to the creation of soil legislation in the state:

> The [SWCD] branch director was a huge help because they are well steeped in the political game and we are beginners. So, she really took us under her wing. And their organization works with ranchers and farmers every year. That was really crucial. I don't think we could have done it without her and the help of those ranchers. (Southwest volunteer citizen)

While SWCDs were frequently mentioned partners in bill creation, the NRCS was mentioned by several interviewees as a partner in program implementation. Nebraska Bill LB243 creates a Soil Health Task Force, a member of which would be the state NRCS chair. The California interviewee claims the California Healthy Soils Program was created to be "supplemental to and unique from the NRCS conservation program." The Healthy Soils Program works with farmers who have already received grant funding through the program to continue to receive funding through NRCS. The New Mexico interviewee hopes that the proposed healthy soils program in the state could match grant funds provided by the NRCS to participating farmers.

Other interviewees mentioned unique key partners such as state universities, local climate initiatives, and tribal communities. Regional key partners also emerged, with interviewees from Massachusetts and Vermont reporting collaboration with Northeast Organic Farming Association and the climate organization Soil4Climate. Overall, all interviewees mentioned more than one key partner, often from governmental and nonprofit sectors, but none indicated collaboration with public health organizations.

Partnering with public health organizations

Many interviewees believe there is an opportunity to include public health organizations in conservation efforts, but multiple barriers to increasing collaboration were identified. Some interviewees perceived an education gap, with the connections between soil health and public health not well understood by either entity. An interviewee suggested that this knowledge gap can create tension and misunderstanding between the two fields, while another attributed low collaboration to limited scientific research:

> I think it's an education thing. A lot of people who think about public health think about eliminating anything that is a threat to public health, but just because something exists doesn't mean it's 100% bad. So, some of the choices that are being made are based on black and white thinking. (Northeast volunteer citizen)

> I think one reason is the limited research.

> Specifically, no definitive research has linked soil nutrients to plant nutrition. Everything should be done with a basis in science. (Northeast government agency employee)

Other interviewees believe the disciplines of public health and natural resources conservation are siloed, so that there is too much distance for collaboration. An interviewee asserted that lack of precedence is a current barrier: "There don't seem to be a lot of institutions that are overlapping between the two areas. So just from an institutional capacity and social capital perspective that seems to be a barrier into getting more collaboration." Another interviewee believes that collaboration between disciplines will require a larger paradigm shift:

> We are all so siloed. There is a huge disconnect between human health and the natural world. Health care is now what you can take as a pill, not what you are eating. Soil is a major support system for humans, and I think that is very overlooked. (Northeast farmer)

An interviewee has started to observe positive changes, however, especially in the issue of air quality:

> One of the things that we work with a lot is air pollution and public health professionals are already very involved on that front. There are obvious ties between breathing bad air and health. I think nutrient loss and soil health has not received as much attention yet, but as we continue to talk about it there will be more space to see how these practices affect communities around the country. (Midwest nonprofit policy advisor)

Discussion

Through policy analysis and interviews, we assessed the content of U.S. state soil health legislation and the context, process, and actors involved in bill proposal and implementation. Proposals of state soil health legislation has grown from two states prior to 2016 to more than 20 proposals in the last four years. Of the legislation analyzed in this project, nine bills were proposed in the 2019 legislative cycle. Bill content focused mainly on soil carbon sequestration and water quality, with minimal reference to public health. Interviews illuminated context themes: desire to normalize soil health practices, influence of climate change, appreciation for soil as a living ecosystem, and the need to better understand links between soil nutrient levels, soil health, and public health. Themes that emerged about the legislative process included climate change as both limiting and facilitating passage, farmers' dislike of regulations as a barrier to policy support, and the benefit of focusing on farmer profit margins to increase policy support. The most cited legislative actors were Soil and Water Conservation Districts and the NRCS, but interviewees recognized opportunities for collaboration with public health organizations in the future. To our knowledge, no prior studies have aggregated data on soil health legislation content, process, context, and actors. Nor has prior research assessed the extent to which public health is addressed in soil health legislation. Therefore, these findings provide a novel perspective.

As our study illustrates, despite well-established evidence connecting soil health to public health, more intentional inclusion of public health in recent legislation has remained minimal. This could be attributed to the lack of definitive research linking soil health and crop nutrient density, which would make a clear connection to the quality of food (Marles, 2017). A structural limitation also exists wherein policies for agriculture and policies for public health are handled in separate congressional committees, reducing ability for a multidisciplinary approach. Additionally, federal legislation often provides impetus for state legislation, and currently there are no federal policy examples linking agricultural soil management and public health.

As recognized by interviewees, opportunities for multidisciplinary collaborations are needed to better link public health with the agricultural and food system. Examples of multidisciplinary approaches do exist. For example, the One Health approach has gained traction over the last decade as a "collaborative, multisectoral, and transdisciplinary approach—working at local, regional, national, and global levels—with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment" (Centers for Disease Control and Prevention, 2018, para. 1). Federally funded, in part through the Center for Disease Control, these initiatives involve a collaboration between farmers, researchers, and public health officials to address the spread of contagious diseases from animals to humans (CDC, 2018). Currently, this approach is being applied to zoonotic diseases and food safety in relation to the poultry and livestock industries, but it was not designed for this exclusively. Current One Health efforts understate upstream environmental solutions to public health threats, such as healthy soil's role in mitigating disease spread, supporting safe drinking water, and protecting the human food supply (Barrett & Bouley, 2015). For example, the One Health approach could be applied to sustainable grazing initiatives, as a way to improve soil carbon sequestration to mitigate climate change and to reduce pathogen contamination through runoff to drinking water or recreational water sources. Expanding the focus of One Health to include soil health may be one way for policymakers to surpass current barriers limiting multidisciplinary approaches. Another multidisciplinary approach may be for actors from livestock, water, and public health sectors to collaborate on interdependent issues for mutual benefit, such as addressing nitrate, phosphorus, and heavy metal groundwater contamination from livestock production.

In addition, opportunities also exist to expand the current climate change focus in soil health legislation to include public health, and thus broaden support for soil health. For example, interviewees cited the benefit of emphasizing profit margins as a way to increase farmer support; it is possible farmer buy-in could also be achieved by bridging the gap between climate change and dietary patterns or by illustrating the productivity—and thus profitability—gains due to improved soil health. To elaborate, there has been a growing emphasis on dietary solutions to greenhouse gas emissions, such as using policy incentives to promote plant-based diets and reduce meat consumption (EAT-Lancet Commission, 2019; Smith et al., 2019). These dietary patterns have been linked to both reduced fossil fuel output and reduced risk of chronic diseases such as cardiovascular disease and diabetes (Boeing et al., 2012; Smith et al., 2019). While this shift in eating patterns yields both environmental and public health benefits, it would lead to an even greater importance for soil health, to protect the viability of croplands. As healthy soils have the known capacity to sequester atmospheric carbon, the question should not be what to eat to reduce greenhouse gases, but what to eat to support soil health. Promoting this connection between climate change, soil health, and public health may benefit state soil health legislation aiming to promote sustainable land management practices. Recent findings that agricultural practices that build soil health prove more profitable without sacrificing productivity are starting to incentivize adopting such methods (LeCanne & Lundgren, 2018; Montgomery, 2017). If consumers begin to purchase more food from producers using sustainable soil management practices, this will further increase farmers' bottom lines and encourage other producers to adopt similar practices.

Moreover, acting on opportunities to include public health in soil health legislation is becoming increasingly important as the momentum of state legislation proposal continues to strengthen. During this project, three of the analyzed bills were ratified into law, including NE LB243, IL HB2737, and NM HB204. The VT bill was incorporated into a larger act "relating to miscellaneous agricultural subjects" and was passed in the 2019 session. VT passed a second bill regarding soil health, VT S.160, which was proposed after the inclusion window of this research (VT S.160). According to the Healthy Soils Google Group, soil health legislation has now been submitted in Florida, Iowa, New Hampshire, Washington, and Massachusetts; legislative efforts in 2020 expanded to more states, including Missouri, Ohio, Pennsylvania, and Wisconsin (Soil Health Google Group, private communication, 2020).

Recommendations

While proposal and passage of soil health legislation in state legislatures has increased in recent years, inclusion of soil health and public health linkages remains minimal. Therefore, soil health policymakers have an opportunity to broaden the scope of new policies by adding or expanding educational interventions to improve producer and consumer knowledge of the connections between soil and public health. Many of our interviewees suggested legislation aimed at creating soil health task forces should consider including public health experts. Public health metrics, such as reducing concentrations of agricultural pesticides and heavy metals in water supplies, could be added to soil health assessments. Soil health legislation providing research grants could allocate funds specifically to investigate soil and public health connections.

State legislative policies do not occur in isolation. If current state-based efforts can be used to amplify attention to soil and public health connections, this may provide impetus for similar inclusion in federal policies. As population growth and climate change increase stress on agricultural soils, broadening the scope of soil health legislation to include public health could be a means of mitigating future threats to both public health and soil ecosystem services.

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Appendix: Interview Script

Context Questions

1. To begin, can you please state your name, position, and agency?
2. Can you please describe soil health in your own words?
   Probe for:
   - Factors that make up soil health.
   - Difference between soil health and soil quality.
3. Why do you think is it important to define or characterize soil health?
   Probe for:
   - In your position, how is this definition used in practice?
   - Why did your program/state choose these variables to categorize soil health?
     - What led you to choose this definition of soil health?
4. In what ways have you been, or are you, involved with soil health legislation or policies?
5. Why is it important to you to have a policy around soil health?
   Probe for:
   - Beliefs and values relating to including soil health in conservation.
6. Do you believe there is a link between human health and soil health? Please explain.
   Probe for:
   - Associations between human health and water, air, plants, animals, etc.
7. Do you think human health should be considered in soil health laws? Why or why not?
8. Why do you think human health is not included in current legislation?
   Probe for:
   - What are some current barriers?

Process Questions

9. What are the strategies or programs your organization/state are involved in that promote healthy soils?
   Probe for:
   - What is the vision/goals of this legislation?
   - Actions/interventions associated with program/policy?
   - Target audience? Farmers, researchers, other policy makers, general public?

10. Have these programs been evaluated? If not, have you seen any noticeable changes to soil health or practices since the introduction of the law?

    Probe for:

    - Is the policy meeting intended goals? Why or why not?

11. What are some challenges/barriers you've encountered in adopting soil health legislation?

12. State soil health legislation has increased in the last couple years; do you have any insight into this trend?

    Probe for:

    - Many states have soil health programs, but do not have soil health legislation. Do you think soil health legislation is important to improve soil health practices?

Actor Questions

13. Who are the key partners helping to support/fund these programs in your state?

    Probe for:

    - What disciplines/fields are working together on these policies?
    - Any inclusion of public health professionals?

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Food forests: Their services and sustainability

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Abstract

Industrialized food systems use unsustainable practices leading to climate change, natural resource depletion, economic disparities across the value chain, and detrimental impacts on public health. In contrast, alternative food solutions such as food forests have the potential to provide healthy food, sufficient livelihoods, environmental services, and spaces for recreation, education, and community building. This study compiles evidence from more than 200 food forests worldwide, with detailed insights on 14 exemplary food forests in Europe, North America, and South America, gained through site visits and interviews. We present and illustrate the main services that food forests provide and assess their sustainability. The findings indicate that the majority of food forests perform well on social-cultural and environmental criteria by building capacity, providing food, enhancing biodiversity, and regenerating soil, among others. However, for broader impact, food forests need to go beyond the provision of social-cultural and environmental services and enhance their economic viability. There is a need for specific trainings and other measures targeting this deficit. This study appraises the current state of food forests and provides an orientation for food entrepreneurs, public officials, and activists to better understand food forests' potential for advancing sustainable food systems.

Keywords

Food Forests, Forest Gardens, Food Economy, Food Entrepreneurship, Case Studies, Sustainability Assessment

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Introduction

Large-scale industrial food system are characterized by unsustainable development, including land degradation, water contamination, climate change, negative health impacts, and unfair distribution of economic benefits (Garnett, 2011; International Assessment of Agricultural Knowledge, Science and Technology for Development [IAASTD], 2009; Swinburn et al., 2011; Tilman & Clark, 2014). Alternative food solutions such as food forests address these challenges in various local contexts. Food forests are multifunctional biodiverse agroforestry systems using several (3 to 7) plant layers of different height (strata), including trees, shrubs, and groundcover. They have the potential to provide food, livelihoods, environmental services (habitat, heat mitigation, carbon storage), and spaces for recreation, education, and community building. Many food forests exist for self-sufficiency, with little formal organization and recognition. Yet, in this study, we focus on food forests with impacts on the wider food economy.

Mimicking nature in food production is still common in indigenous and traditional agricultural production systems, especially in the tropics, and dates back 4,000 years (Belcher et al., 2005; Kumar & Nair, 2004). In Europe, the concept of 'forest gardens' emerged in the 1980s in Great Britain (Hart, 1996; Sholto Douglas & Hart, 1984). At about the same time, the permaculture movement started in Australia, with 'food forests' being a major outcome (Mollison, 1979; 1981), and professionalization efforts at larger scale (Shepard, 2013). There is little distinction in research and practice between 'forest gardens' and 'food forests.' Both are defined as multi-strata ecosystems using mostly edible, perennial plants. Following definitions of what a 'forest' is (Chazdon et al., 2016; Food and Agriculture Organization of the United Nations [FAO], 2000), it seems reasonable to define the minimum size of a food forest as 1 acre (0.5ha) and at least 10% canopy cover to provide forest-like ecosystem services. However, in this study we do not apply this definition strictly and instead use the term 'food forest' as a synonym for both forest gardens and food forests, so as to not exclude interesting cases of smaller size. The practice of forest *farming*, i.e., growing edible or medicinal plants in existing forests or forest management for the purpose of food production, is *not* included in this study.

Food forests adopt basic principles of *agroforestry* that improve water cycle and soil formation, store carbon, regulate the microclimate, increase biodiversity, and create livelihood opportunities (Jose, 2009; Toensmeier, 2017). In Brazil, 'syntropic farming' or 'successional agroforestry' developed as a biodiverse multistrata design and management approach (Götsch, 1992) with high yield and ecological restoration potential (Schulz et al., 1994; Young, 2017).

Unlike agroforestry at large, specific research on food forests is still at a nascent stage. Recent research compiled practical knowledge on different types of food forests (Bukowski & Munsell, 2018; Remiarz, 2017), their cultural transformation (Wartman et al., 2018), their nutritional benefits (Nytofte & Henriksen, 2019), and their ecological restoration potential (Park & Higgs, 2018). Common are single case studies and a focus on the social and ecological impacts of food forests (Hammarsten et al., 2019; Knuijt, 2020; Riolo, 2019; Schafer et al., 2019). Recent research also considers urban forestry, an internationally established planning and management practice for public spaces, as a potential scaling opportunity for (community) food forests (Konijnendijk & Park; Vannozzi Brito & Borelli, 2020). Very few of these studies consider the economic dimension, which is necessary for a *comprehensive* sustainability solution (Schaltegger & Wagner, 2011).

A systematic knowledge base about food forests that comprehensively maps out the state of food forests is still missing. The present study intends to close this gap and open the field more widely by addressing the following research questions:

1. What are the general characteristics (location, size, age since its founding, services) of food forests?
2. How are food forests organized and managed?
3. To what extent are food forests *sustainable,* as measured against a broad set of criteria?

This research aligns with the approach of solution-oriented sustainability research that aims at developing evidence-supported solutions to sustainability problems (Miller et al., 2014; Wiek & Lang, 2016). We used a mixed-methodology approach to answer the research questions, combining literature and document review, interviews, and site visits (data collected in 2018). We reviewed more than 200 food forests and conducted in-depth case studies on a sample (14) of exemplary food forests in Europe, North America, and South America. The focus was on food forests that pursue social, environmental, *and* economic activities, going beyond self-sufficiency. The study might inform the work of food entrepreneurs, public officials, activists, and researchers interested in building upon current food forest practices from around the world. The insights on food forests' service diversity and sustainability can help realizing the full potential of food forests to advance sustainable food systems.

Research Design

First, we conducted a web-based search in English ("food forest," "forest garden") and German ("Waldgarten"), and did snowball sampling, and identified 209 food forests with activities that go beyond self-sufficiency. Networks and research initiatives in the U.S. and U.K. like the Agroforestry Research Trust and Bukowski (2015) provided larger lists of sites and contributed to 45% of the overall sample. For each food forest, we created a standardized profile with up to three main services and other relevant information, including location, size, etc. Not all relevant data were available for all food forests, e.g., size or age. For some cases with information gaps, we were able to estimate plot size through Google Maps measurements and photos of the site.

Second, we selected 14 exemplary food forests for in-depth case studies. Selection criteria included primarily age and main service (see Table 2, below) and secondarily location and access to primary data through site visits. We identified the main services by standardizing the most common activities carried out at each food forest such as generating regular income through food-forest related workshops (main service: education), hosting regular community events (main service: community building), or selling food from on-site production (main service: food production). Environmental services, especially plant biodiversity, are inherent to food forests, hence, this was only tracked for explicit major services (e.g., flood protection). In addition to a wide spectrum of services, we covered in the sample of case studies different age groups to provide insights on the diverse practices of early pioneers and later adopters. We conducted semi-structured interviews and site visits that focused on the food forest's organization, management, and implementation process.

Third, each of the 14 exemplary food forest was assessed against a set of sustainability criteria (Table 1) identified from the literature on sustainability (Gibson, 2006), agroforestry and food forests (Jose, 2009; Park & Higgs, 2018), as well as expert interviews. Scorecards (see Table 3, below) indicate criteria fully (2), somewhat (1), or not (0) met.

Results

1. Food Forest Location, Size, Age, and Services

The food forests in the overall sample (n=209)[1] are located in 19 countries (Figure 1), predominately in the U.S. (86) and Europe (96). About 50% are in rural areas, 30% in large cities and metropolitan areas (>0.5M inhabitants), and 20% in small to medium-sized cities (50,000-0.5M inhabitants). According to the available data (n=129), food forests are managed by nonprofit organizations (46%), conventional businesses (31%), social enterprises or cooperatives (7%), foundations or land trusts (3%), or public institutions like universities (2%).

According to the available data (n=78), the average food forest plot size is 4.7 acres (1.9 ha), with 50% of food forests being less than 1 acre (Figure 2).

While a few food forests started back in the 1970s (e.g., Langerhorst in Austria), many early adopters began in the 1990s (Figure 3). Starting in 2004, food forest start-ups steadily increased, with

[1] All data refer to the year 2018, if not indicated differently. Sample sizes vary due to data availability.

Table 1. Sustainability Criteria for Food Forests

	Criteria	Definition
Social-Cultural Criteria	Meaningful, safe employment and activities with social purpose	• Workplace with protective gear, diverse work activities, precautionary measures • Activities for community benefit, social justice, environmental regeneration
	Contribution to community wellbeing	• Affordable and healthy products and services, i.e., regional, seasonal, fresh food, and/or inclusive activities (e.g., for school kids, seniors, minority groups)
	Capacity building	• Learning activities for cognitive, normative, affective, and motoric development
Environmental Criteria	Water conservation and soil formation	• Measures for water conservation (e.g., drip irrigation, rainwater harvesting) and soil formation (e.g., chop-and-drop, mulching, Terra Preta)
	Cool microclimate	• Cooling and shading measures, e.g., dense, multi-strata design with high canopy cover and ground cover, surrounded by green infrastructure
	High biodiversity	• High species diversity and cultivation of rare varieties (flora), undisturbed areas for fauna, connection to green corridors
Economic Criteria	Economic viability	• Sustaining livelihoods of staff by providing fair wages (for at least one part-time position) and covering operating costs
	Formalized organization	• Reliability and foresight, for example, through having a site plan, tracking yields, bookkeeping, registered organization, related professional background
	Shared ownership and decision-making	• Institutionalized cooperative principles for shared and long-term ownership and decision-making, e.g. employee-owned business or foundation-based business

Figure 1. Geographical Distribution of Food Forest Sample (*n*=209)

Map created with Leaflet.

a peak of 19 food forests started in 2014.

Food forests offer a variety of services: they produce food (primary production, processing, nurseries), regulate and support the environment, and provide social-cultural services (community building, education, recreation). The majority of sampled food forests (*n*=209) focuses on education (40%), community building (32%), or food production (11%), often on larger sites (Figure 4). Few cases (<10%) prioritize self-sufficiency (while still offering other services), recreation, food processing, or environmental services, or serve as nurseries.

In summary, the sampled food forests are predominantly located in the U.S. and in Europe, with equal distribution across rural and urban areas. They are managed mostly by nonprofit organizations or run as conventional businesses. The number of annual food forest start-ups has been constant for many decades (<5), but has been increasing since the mid-2000s, with more than 10 start-ups in most years of the past decade. The majority of food forests focuses on providing educational or community-building services, with only about 10% of food forests prioritizing food production.

Figure 2. Distribution of Small, Medium, and Large Food Forests (*n*=78)

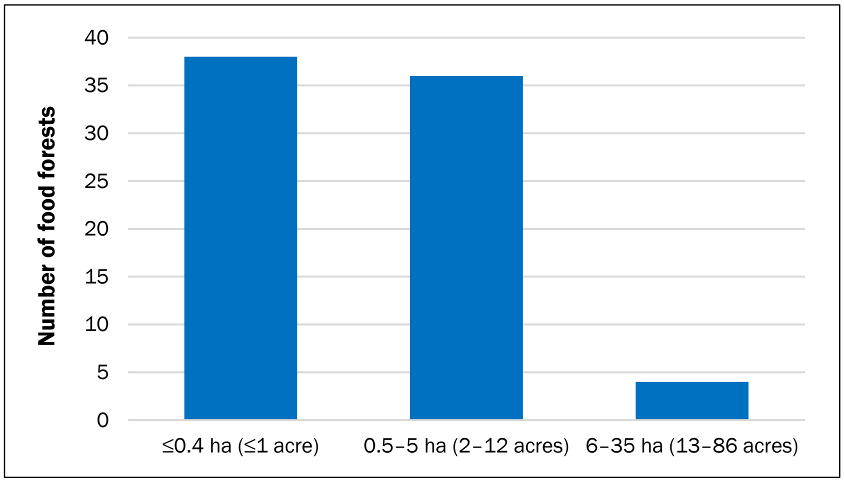


Figure 3. Number of Food Forest Started by Year, 1971–2017 (n=155)

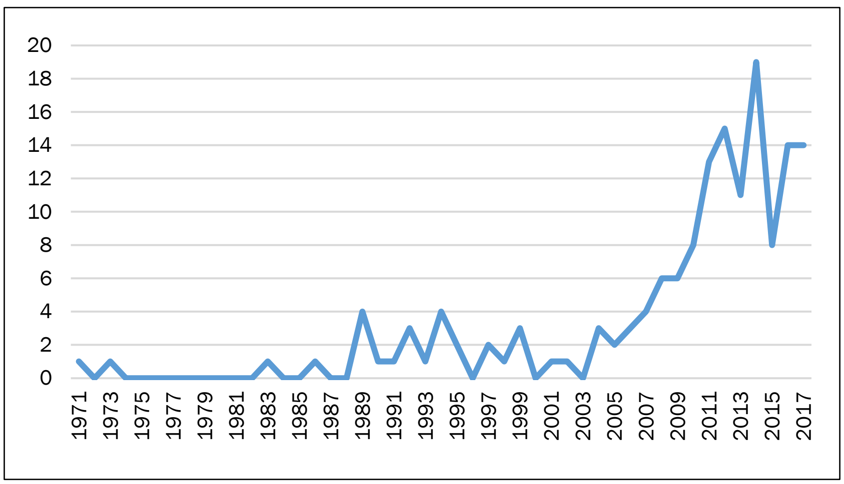
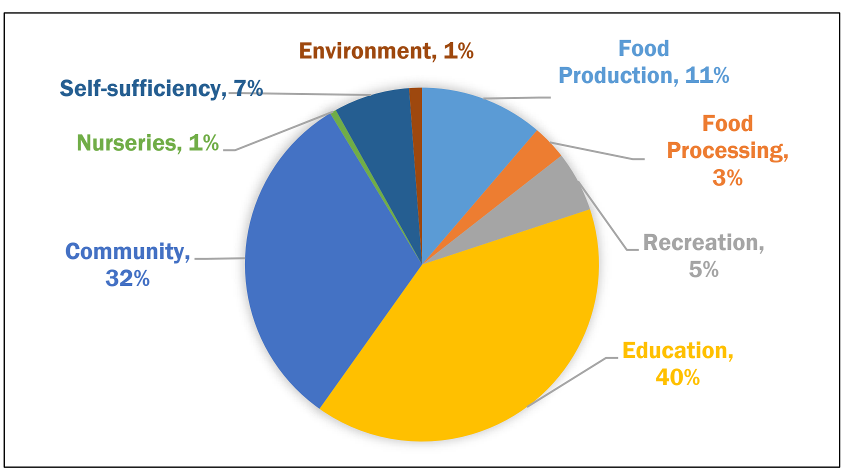


Figure 4. Main Services of Food Forests (*n*=209)



2. Exemplary Food Forests for Each Service

The exemplary food forests selected for in-depth analysis and showcasing (*n*=14; Table 2) represent all services mentioned above. Below, we provide descriptions of exemplary food forests for each service, detailing location, size, products and services, ownership, staff, and management.

Food Production Services

Primary Production. Food forests in this category produce herbs, vegetables, fruits, and nuts. They sell their produce through diverse channels from community supported agriculture (CSA), food box or u-pick schemes, and onsite and market sales (B2C) to cooperation with local food businesses (B2B).

Foodforest Ketelsbroek operates on 6 acres (2.4 ha) and markets its produce directly to three local businesses (gastronomy, catering service, and cider brewery) that participate in weekly harvestings. Two private owners have run the food forest in a nature-regulated approach since 2009. The design, inspired by agroforestry and food-forest pioneer Martin Crawford and farmers in Kenya, is partly “rational” in rows, partly “romantic” with high biodiversity (W. van Eck, personal communication, July 12, 2018). Input is very low, following the guideline “we must make ourselves become useless” (W. van Eck, personal communication, July 12, 2018), and consists mostly of harvesting and minimal agro-ecological interventions. Produce derives mainly from tree layers (fruits, herbal plants, edible flowers) and provides for one part-time position. According to the farmer, yield increases slowly, but the land seems more profitable than the neighboring conventional farm. Consultation and workshops are the main income source (W. van Eck, personal communication, July 12, 2018). In 2017, 1,200 visitors received a guided tour.

Ökohof Waldgarten (Eco-Farm Food Forest) operates on 12 acres (5 ha) and was started in 2006 by a private owner planting chestnuts, soon thereafter also producing annual vegetables for market sales. The farm has run a community supported agriculture (CSA) operation since 2012 that currently delivers about 120 food boxes per week (20% fruits, 80% vegetables) to its 200 members. The site includes an older 5-acre (2 ha) dome food forest, and a 7.4-acre (3 ha) vegetable garden (*Demeter*-certified), which successively changes into an agroforestry system. The lead gardener-owner, three gardeners, two trainees (all full-time), and two part-time staff manage the farm. In the growing seasons, the CSA members participate in co-working days.

Den Food Bosch has operated on 2.5 acres (1 ha) since 2017, with an intricate food forest design inspired by permaculture and syntropic farming to harvest on all layers. Produce is sold weekly on-site. Additional sales channels and processing options are currently under development. Den Food Bosch resulted from a student initiative, received public funding, and is steered by a foundation that contracts two managers who are responsible for generating their income. The local water authority owns the land.

Smaller food forests focusing on primary production are often part of a larger farm or network using direct-sales channels to restaurants or local markets. For example, the Rotterdam Forest Garden Network initiated 10 sites that produce food for market sales (in 2020, the network reorganized and sites are now managed by the Cooperative Ondergrond).

Processing. Food processing is rarely the main activity of food forests. It is more common as an educational activity or for catering to workshop participants. Ownership of the few food forests prioritizing processing is mostly private, the workforce is small (four employees, on average), and common distribution channels are on-site gastronomy or direct sales.

Fazenda Ouro Fino operates on 62 acres (25 ha) and processes high-value crops like açaí

Table 2. Overview of 14 Exemplary Food Forests (Two Main Services Indicated per Case)

		Young Cases (<5 years)	Established Cases (5–10 years)	Mature Cases (>10 years)
Food Production Services	Primary Production	W. C. L. (USA) Den Food Bosch (NL) The Secret Garden (NL)	Foodforest Ketelsbroek (NL) Voedselbos Kralingen (NL)	Ökohof Waldgarten (GER)
	Processing		Castle Garden (UK) Cafe Botanico (DE)	Fazenda Ouro Fino (BRA) Hotel Haferland (GER)
	Nursery		Mienbacher Waldgarten (GER)	
Social-Cultural Services	Community Building	Peace of Land (GER) The Secret Garden (NL)	Voedselbos Kralingen (NL)	
	Education	Peace of Land (GER) Keela Yoga Farm (PRT)	Castle Garden (UK) Cafe Botanico (GER) Mienbacher Waldgarten (GER)	Fazenda Ouro Fino (BRA) Essgarten (GER)
	Recreation	Keela Yoga Farm (PRT)		Essgarten (GER) Hotel Haferland (GER)
Environmental Services	Supportive		Foodforest Ketelsbroek (NL)	Ökohof Waldgarten (GER)
	Regulative	W. C. L. (USA)		

(puree) and cacao (fermenting) for sale at the local market and international distribution. The privately owned site produces a dozen food crops and offers educational trainings. As a neighbor and partner of agroforestry pioneer Ernst Götsch, the site contributes to the development of syntropic farming.

Café Botanico (0.5 ac; 0.2 ha) and Castle Garden (0.12 ac; 0.04 ha) process specialty crops that are sold at on-site cafés. While Café Botanico builds its dishes around the on-site food and limits its sales to yield availability, Castle Garden Café adds mostly preserves and teas from the site to a broader menu. Both businesses have high staff costs and are cross-financed by the owner(s) through a second job or a second business.

Nursery. Nursery services are informally present at many sites either for a small income or to propagate plants for other sites. Some use them formally to generate an income, although mostly on a very small scale; for example, Mienbacher Waldgarten (3.7ac; 1.5ha) sells plants and seeds online. Several professional nurseries connected to food forests exist; for example, the Balkan Ecology Project in Bulgaria offers polyculture plants, exotic varieties, and multilayer packages (Remiarz, 2017), and Forest Agriculture Enterprises in the U.S. offers wholesale.

Social-Cultural Services

Community Building. Community-oriented food forests are usually located in urban areas, often on public land, and are managed through a core (member) group with support from volunteers. A prominent example is the Beacon Food Forest (7ac, 2.8ha) in Seattle, Washington, U.S. (Bukowski & Munsell, 2018). At Peace of Land (0.1ac; 0.04ha), core members from across the city meet for weekly gardening activities and offer educational workshops to educate both their core group as well as others who are interested. At The Secret Garden (0.1ac; 0.04ha), one trained volunteer maintains the site for a retirement home and a school.

Education, Consultation, Research. Educational food forests are located in urban and rural areas. They offer tours, workshops, courses, and programs from day- to year-long, about permaculture, food forestry, and related specialty topics (e.g., grafting). Educational offerings often help with the setup of a food forest through volunteer labor and provide a source of income. Mienbacher Waldgarten has specialized in self-sufficiency education since 2010. One full-time manager and other trainers use the food forest and its seminar house. The site also contributes to the food self-sufficiency of the manager's family and the property owners' families. Some food forests generate revenue by consulting on the design and management of food forests, including permaculture, regenerative agroforestry, holistic management, and syntropic farming. Only a few food forests engage in substantial research in collaboration with research organizations and universities; examples include Bec Hellouin in France, collaborating with AgroParisTech, the French National Agronomy Research Institute, and the Free University of Brussels (Dendoncker et al., 2017; Morel et al., 2016).

Recreation. Some food forests offer aesthetic and recreational value through their multilayered design, cool microclimate, high biodiversity, medicinal plants, and fresh food, as well as opportunities for foraging, relaxation, and discovery. Aesthetics and ecological benefits may require guidance, e.g., through signage about wildlife or insect-friendly practices. The food forest of Hotel Haferland (0.5 ac; 0.2 ha) has a seating area for relaxation, enjoyment, and contemplation. A hotel janitor manages the site, and the restaurant's chefs harvest from it. The professional design requires little maintenance. The site is too small for significant food production but offers aesthetical value. Another example is Keela Yoga Farm (2% of 46 ac; 19 ha) that offers yoga retreats combined with a tour of the food forest.

Environmental Services

Supportive. Many interviewees expressed concerns about the degraded soil and biodiversity loss associated with conventional agriculture and pointed to the regeneration of nature (and human health) as a major motivation for implementing their food forest. Foodforest Ketelsbroek limits access for visitors to reduce disturbance. The manager also regenerates soil in a slow, *laissez-faire* approach with a naturally occurring groundcover. Fazenda Ouro Fino does "chop-and-drop" management to increase biomass, soil building, and early yields. While Fazenda Ouro Fino manages around 20 species/ha, Foodforest Ketelsbroek manages around 200 species/ha. Plant biodiversity is often high in social-culturally focused food forests. Essgarten (6 ac; 2.5 ha) offers habitat to around 1,200 species.

Regulative. Keela Yoga Farm, for example, manages its food forest with chicken and sheep for fire protection. In semi-arid Arizona, U.S., the new food forest of W. C. L. (2.5 ac; 1 ha) aims at cooling the microclimate while producing food.

3. Sustainability of Food Forests

Assessing each food forest by social, environmental, and economic criteria indicates their sustainability and highlights areas for improvement (Table 3). Scores indicate that criteria are fully (2), somewhat (1), or not (0) met.

Overall, the assessment shows that food forests perform well on social-cultural and environmental criteria by offering benefits such as educational attainment, community happiness, high biodiversity, healthy soil, and resourceful water management. However, economical practices and structures tend to be unsustainable. Ownership and decision-making are often in private hands or instable due to insecure tenures. Few have business and financing plans. Young (<5 years old) food forests tend to receive a lower score due to being less developed ecologically and economically. Most food forests perform higher in the areas related to their main services.

In Table 3, we provide general insights on each assessment criterion across all 14 cases.

Social-Cultural Criteria A – Meaningful, Safe Employment and Activities with Social Purpose

All food forests in this study (14 of 14) offer work activities with meaningful outputs like ecological regeneration, quality food production, and nature-based education. Food foresters are motivated by regenerating the land and people's health. They enjoy the diversity of tasks and often develop strong emotional connections to the food forest. However, many food foresters experience high stress levels at times, due to the diverse activities, lack of qualified staff, or financial insecurity during initialization.

Social-Cultural Criteria B – Contributing to Community Wellbeing

Almost all food forests (13 of 14) offer affordable food products or educational services. For example, Mienbacher Waldgarten provides food education in a rural neighborhood to adults and children, donates food surplus, and is engaged in setting up a community garden in the nearby town. Young food forests attract specific user communities and struggle with wider uptake. For example, the Rotterdam Forest Garden Network aims at connecting a school and a retirement home at The Secret Garden. With little activity from the partners, a volunteer maintains the site for the retirement home. The site acts as an investment for plant propagation, food sales, and display.

Social-Cultural Criteria C – Capacity Building

Almost all food forests (13 of 14) offer various learning activities on food production and ecology to guests, students, and co-workers. Offerings depend on the land management approach (nature- vs. human-regulated). The depth and quality of the offerings depend on the length of stay, expertise of the trainer, and content focus; for example, tours facilitate basic understanding of food forests, while workshops facilitate experiential learning and skill development. Structured educational programs vary significantly in duration, ranging from the more common 1 to 2 weeks (e.g., Mienbacher Waldgarten) or, less often, 1 month (Keela Yoga Farm) to, exceptionally, 2 years (Fazenda Ouro Fino).

Environmental D – Water Conservation and Soil Formation

Mulching is a common management practice at all food forests to build soil and conserve water. Several food forests irrigate lightly, and some integrate rainwater harvesting. Only one site with major annual vegetable production has high irrigation needs

Table 3. Overview of Sustainability Assessment of 14 Food Forests by Social-Cultural, Environmental, and Economic Criteria

Food forests are listed in alphabetical order, scores indicate that criteria are Fully (2), Somewhat (1), or Not (0) Met

	Social-Cultural criteria			Environmental criteria			Economic criteria			
Food Forest Cases	**A. Meaningful, Safe Employment**	**B. Contribution to Community Wellbeing**	**C. Capacity Building**	**D. Water Conservation and Soil Formation**	**E. Cool Micro-climate**	**F. High Biodiversity**	**G. Economic Viability**	**H. Formalized Organization**	**I. Shared Ownership and Decision-Making**	**Average Score**
Castle Climbing	2 – Four part-time staff, shared responsibility	2 – Educating especially the climbing community	2 – Educational, experiential events	2 – Substantial rainwater harvesting and composting	0 – Micro-site	1 – Micro-site	1 – Subsidized by climbing center	2 – Yield report, automated volunteer system	2 – Employee-owned company	1.6
Den Food Bosch	1 – Two managers, high stress (start-up)	2 – Regional, affordable food supply, test site	2 – Research, volunteering, tours, consultation	2 – Mulch, chop and drop, biomass plants	1 – Young site, high layer diversity	2 – High species diversity, rare varieties, green corridors	0 – Micro-income for two full-time managers	2 – Foundation, evidence-based site plan, yield record	1 – Foundation board, land leased	1.4
Essgarten	2 – Balance to main job, investment for pension	2 – Affordable food and education	2 – Short holistic education, events	1 – On-site well and lake, no special soil management	2 – Mature site	2 – Over 1,200 species	2 – Diversified income	2 – Registered gastronomy business	0 – Private ownership and decision-making	1.7
Fazenda Ouro Fino	2 – Family, diverse activities (mature)	2 – Diverse products and education	2 – Short and long-term holistic education	2 – Low irrigation, chop and drop, biomass plants	2 – Large mature site	2 – High species diversity, rare flora and fauna	2 – Sustained family livelihood, diversified income	1 – Registered agricultural business, no economic analysis	1 – Family business, informal democratic principles	1.8
Hotel Haferland	1 – Partly seasonal contracts	0 – Exclusive experience for hotel guests	0 – No tours (lack of staff)	1 – Water sprinkler irrigation, composting	1 – Mature, small site	2 – High species diversity, rare varieties	1 – Contributes to hotel marketing	1 – Hotel business, no yield records	0 – Private ownership and decision making	0.8
Keela Yoga Farm	1 – Two owners, diverse activities, high stress (start-up)	2 – In-depth affordable education, local bartering	2 – Long-term, hands-on education, volunteering	2 – Sparsely used pipe and flood irrigation, (pond, well)	0 – Small part developed, very arid	2 – High species diversity, rare varieties	1 – Yoga retreat and work abroad income	2 – Registered agricultural business, documented site plan	0 – Private ownership and decision making	1.3
Foodforest Ketelsbroek	2 – Two owners, low stress and work input, high local demand	2 – Regional food supply (B2B), school garden	2 – Tours, seminars, research, co-harvesting	2 – Connection to waterways, pond, slow natural regeneration	2 – Mature site	2 – High species diversity, rare varieties, undisturbed areas	2 – One full-time position, low input and cost	1 – Registered agricultural business, rough yield figures	0 – Private ownership and decision making	1.7
Mienbacher Waldgarten	2 – One manager, diverse activities	2 – Gifts surplus food, community-engaged	2 – Self-sufficiency education with external experts	1 – High irrigation in dry years (well), partly low humus	2 – Mature site	2 – High species diversity, rare varieties, undisturbed areas	2 – Seminars finance 1 manager and co-educators	2 – Registered business, documenting activities	0 – Private ownership (1 year lease by manager)	1.7

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Food Forest Cases	Social-Cultural criteria			Environmental criteria			Economic criteria			Average Score
	A. Meaningful, Safe Employment	B. Contribution to Community Wellbeing	C. Capacity Building	D. Water Conservation and Soil Formation	E. Cool Micro-climate	F. High Biodiversity	G. Economic Viability	H. Formalized Organization	I. Shared Ownership and Decision-Making	
Ökohof Waldgarten	2 – CSA for more than 120 households, partly stressful	2 – Regional food at solidarity pricing	2 – Experiential co-working, farm updates and events, politically active farmer	0 – High irrigation and fertilizer needs for annuals (80% of land)	1 – Partly cool in tree-canopy dense area	1 – Mostly classic varieties, propagates rare vegetables varieties	2 – Sustains the livelihood of at least 8 people	2 – Registered agricultural business, informal, self-organized CSA	1 – Private ownership (farmer), yearly plenary meetings	1.4
Peace of Land	2 – Mostly volunteers, community-oriented, high self-learning motivation	2 – Affordable workshops	2 – Diverse experiential and cognitive inputs, social events, volunteering	1 – Poor urban soil, mulch, regular irrigating	0 – Young micro-site	1 – Micro-site	1 – Start-up funding incl. staff, insecure long-term funding	1 – Trusteeship of permaculture institute (lease taker)	1 – High tenure insecurity (yearly lease); low-hierarchy organization (sociocracy)	1.2
Permakultur-garten Botanico	1 – Staff partly aware of or interested in sustainability	2 – Local food (urban core)	2 – Tours, food experience	2 – Low irrigation, dense ground cover, compost from busy café	1 – Small site, green oasis in urban center	2 – High diversity in ground cover	0 – Fluctuating customers, high staff cost, subsidized by owner	2 – Registered restaurant business, comprehensive calculations	0 – Private ownership and decision-making, tenure insecurity	1.4
Voedselbos Kralingen	1 – Occasional volunteers	1 – Display site, some complaints about messy look	1 – Volunteering, occasional tours or events, few signs	2 – No watering, slow natural regeneration	1 – Small site, dense canopy	2 – High species diversity	1 – Low income, low costs	2 – Network, formal agreement with local government	1 – Informal decision-making along pragmatic principles	1.3
The Secret Garden	2 – One trained volunteer, maintains elderly home garden	1 – Aesthetic, failed to connect school and elderly home	2 – Trained volunteer, education and co-working offers	2 – No irrigation, mulching	0 – Micro-site	1 – Micro-site	2 – Low costs, income investment	1 – Network, informal agreements	0 – No lease, informal decision-making	1.2
W. C. L.	1 – One owner with strong vision, high stress ("survivalist")	1 – Community vision	1 – Educates WWOOFers, silence in nature to reconnect to self	2 – Mulching, earthwork for passive rainwater harvesting	0 – Small part developed, very arid	1 – Very small part developed	0 – No income, very low cost	0 – Informal, no site or business plan—trial and error approach	0 – Private ownership and decision-making	0.7
Average	1.5	1.6	2	1.8	1	1.6	1.2	1.5	0.5	

and observes soil degradation. Syntropic sites like Den Food Bosch use strata and succession-based management for efficient water storage and biomass production.

Environmental E – Cool Micro-Climate
The majority of food forests (10 of 14) are very small or too young to yield significant cooling effects. Ten food forests are large, mature sites or connect to other green infrastructure. Due to dense canopy covers, they contribute to cooler microclimates.

Environmental F – High Biodiversity
The majority of food forests (9 of 14) shows a very high plant species diversity. In addition to traditional species, most food forests include diverse rare and specialty crops, often from other regions with similar climatic conditions. Climate change resilience and curiosity about specialty foods motivates these plant choices. Some food forests support high genetic diversity and have areas reserved for wildlife only.

Economic G – Economic Viability
The weak point of many food forests (8 of 14) is economic viability. While many food forests develop site plans, very few use financing plans and business plans due to a lack of experience or interest, or resistance to conventional business practices. For example, Ökohof Waldgarten, while envisioned as a food forest business, was implemented without a business plan or training (e.g., planted seeds for chestnut trees that do not carry edible fruits), and now generates most of its income from annual vegetables.

For many, idealism acts like an alternative currency: a natural lifestyle and resistance to conventional food production compensate for economic burdens. Common income sources are fees (tours, workshops and consultation) and grants, especially for young sites. Small food forests with on-site gastronomy primarily provide an aesthetic service, and their owners subsidize them. Large and mature food forests are economically viable with diversified income sources or a few high-selling products or services (e.g., Essgarten, Foodforest Ketelsbroek, and Fazenda Ouro Fino).

Economic H – Formalized Organization
Almost all food forests (13 of 14) are run through a registered association or a business. Few practitioners, however, track yields and do full bookkeeping. Younger food forests design a site plan. Design and management techniques differ, building on British forest gardening, Australian permaculture, Swiss-Brazilian syntropic farming, farming practices from Kenya, and Indigenous food systems in Brazil. Apart from Permaculture Design Certificate and Permaculture Teacher Certificate for general design principles, there is no certified food forest education. Accordingly, food foresters have diverse educational backgrounds, often in creative or social professions. The managers of four food forests—all focused on food services—have professional backgrounds in agriculture, forestry, or landscape architecture.

Economic I – Shared Ownership and Decision-Making
The majority of food forests (9 of 14) are in private ownership. Often, one person manages the site and has exclusive decision-making power. A few food forests, like Den Food Bosch or Castle Garden, formed a foundation or employee-owned business with a board for collective decision-making. About half of the food forests face lease insecurity, with short-term leases on private or public land.

Discussion

Services of Food Forests
Food forests are often part of multifunctional spaces and organizational hybrids with diverse services, products, and other income sources. Apart from producing food, all of them offer social-cultural and/or environmental services. The large majority of the food forests in the full sample (n=209) are small and focus on education and community building (70%), while only a few pursue food production on a substantive level (11%). Still fewer cases (<5%) prioritize food processing or serving as a nursery. The focus on social-cultural services reflects the community gardening trend (Bukowski & Munsell, 2018) and the social-cultural background of many food forest initiators. For developing food forests as food businesses, practi-

tioners often have insufficient farming or market gardening experience, specialty crop knowledge, and entrepreneurial training. Guidance on efficient design and management techniques like syntropic farming or restoration agriculture was not widely available (in English) until recently (Giezen, 2018; Shepard, 2013). To harness the food production potential of food forests and contribute to wider food system change, specific training and research on food forests should to be offered and conducted more broadly.

Sustainability of Food Forests

Food forests contribute to a diverse food system with perennial crops and experiential educational and recreational offerings around food and ecology. Many perform well on social-ecological criteria but display weaknesses on economic criteria. As 30% of the food forests studied in-depth are young (<5 years), their economic viability may still be developing. They could learn from mature food forests that diversified their product range or focused on a few main products or services. Weak economic viability—common in many permaculture farms—may also be overcome by monetarizing the value of ecosystem services and receiving adequate compensation (Fiebrig et al., 2020). However, such compensation policies to date focus on agro-*industrial* sites; this poses a structural barrier to the economic viability of agro-*ecological* solutions such as food forests (Fernandez et al., 2013; Smith et al., 2012).

Generally, the pursuit of cooperative ownership models may address several sustainability challenges, such as work overload, high land prices, limited start-up funds, and late return on investment. Initiated collectively, a group (and community) could invest into setup and management, share specialty knowledge, value individual net benefits, and promote self-governing practices (Bukowski & Munsell, 2018; Poteete et al., 2010). Collective ownership models such as cooperatives, land trusts, or foundations may also help accessing larger land parcels to increase food production potential. Generally, for wider agroforestry uptake, a "cognitive unlocking process" might help with adopting holistic agro-ecological practices rather than following the dominant reductionist paradigm towards agriculture (Louah et al., 2017). This calls again for specific training and research to be offered in vocational schools, colleges, and universities. Interestingly, for all sustainability gaps identified at individual food forests, we found solutions at other sites—which points to an even larger cooperation potential.

Study Limitations

The presented findings cannot simply be extended to all food forests worldwide due to a number of factors. First, while the overall pool of 209 food forests analyzed is large (the most extensive pool analyzed to date), it is somewhat biased. First, the pool (and subsequently the sample of 14 exemplary food forests) draws mostly on sites in Europe, North America, and South America. This regional bias is due to the search language (English), the general search engines used (DuckDuckGo, Google), and the researchers consulted (inventories). For example, few Australian and New Zealand food forests came up in the general online search, although the permaculture movement that contributed to food forest designs started there (Mollison, 1979, 1981) and country-specific online searches yielded a number of sites. Additionally, a search in Portuguese and Spanish yielded some potentially relevant cases. Finally, some renowned food forests did not respond to our interview request.

Beyond the sampling, the study displays other limitations. There were some relevant data gaps for many food forests due to a lack of data collection capacity or due to nondisclosure of data. In addition, the presented assessment offers initial results for a moderately sized sample (n=14) with a broad criteria set, which could be further specified for in-depth research. For a full assessment, longer monitoring periods of outputs and outcomes at each site are necessary (Park & Higgs, 2018). And for higher validity, more cases would need to be studied in detail and included in comparative studies.

Conclusions

Food forests differ in what main services they offer and how sustainable they are. For the main services, there is a focus on social-cultural services (education, community building) and less on food production. Food forests often perform well on social-cultural and environmental criteria, while displaying weaknesses in economic ones, especially regarding economic viability and sustainable business model innovation. Yet, best practices can be found across the cases, e.g., for inclusive ownership through cooperative, land trust, and foundation models. Advances in specific food forest education (farming, business practices) and the transfer of best practices across food forests are necessary to harness the full potential of this multifunctional sustainability solution. While this study offers a broad exploratory overview, there are several limitations calling for additional research to validate these findings and allow for wider applicability.

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Wild gardening as a sustainable intensification strategy in northwest Cambodian smallholder systems

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Abstract

Within the last decade, Sustainable Intensification (SI) has emerged as a strategy to respond to future food security challenges. It incorporates increased food production without the cultivation of more land while incurring no net environmental cost. Frameworks attempting to measure SI often focus heavily on production indicators while overlooking other important indicators, such as impacts on economic, social, or human conditions. In this study, we evaluate the purposeful assemblage and management of neglected and underutilized species (NUS) in fringe areas around rural homesteads as a potential SI strategy. We use a recent SI assessment framework developed by the Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification (SIIL) that incorporates

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five measurable domains (productivity, economic, environmental, human condition, and social). We present findings from a qualitative case study in northwest Cambodia to assess local conceptualization of wild gardening, current uses of NUS, perceived benefits and challenges to their use and management, and the potential of wild gardening as a SI strategy. The qualitative methods employed 65 key informant interviews and four focus group discussions with both men and women participants. Our results indicate that wild gardening is an important component of rural livelihoods in northeast Cambodia. However, a general lack of knowledge of strategic benefits, such as nutrition potential, inhibits its use for maximum benefits. Wild gardening addresses multiple SI domains simultaneously and demonstrates the potential to be a promising SI strategy for improving rural livelihoods in Cambodia.

Keywords
Perennial Vegetables, Cambodia, Neglected and Underutilized Species (NUS), Qualitative, Sustainable Intensification

Introduction

It is estimated that by 2050 the world's growing population will require 25% to 70% more food (Hunter et al., 2017). This presents a challenge given the increased global competition for required food production resources such as land and water. Within the last decade, sustainable intensification (SI) has emerged as a strategy to address these future intersecting food security challenges. SI posits that increased food production (intensification) must play a role in meeting this food security challenge, but that this increase should come from existing agricultural land, and that the increased food production should incur no net environmental cost (sustainable) (Peterson & Snapp, 2015; Pretty & Bharucha, 2014, 2018; Tilman et al., 2011). For example, SI tools or practices may include selecting disease-resistant varieties that reduce the need for chemical inputs, or opting for precision farming for improved fertilizer use efficiency while simultaneously minimizing detrimental nutrient runoff or leaching.

As a strategy to sustainably increase agricultural production, SI holds particular promise for smallholders and the systems they manage, as these land managers, by definition, are generally already constrained by available land resources. An SI approach enables smallholders to diversify their production and income potential and enhance household food security and nutrition, while returning positive ecosystem services and environmental benefits (Mockshell & Kamanda, 2018; Tilman et al., 2011). However, SI is not a one-size-fits-all approach. Instead, approaches to sustainably intensify a food production system should be locally adapted and fitted to address pressing food security issues within a specific geographical region.

SI is of particular interest for smallholder systems in Southeast Asia, where the average landholding is 1.0 ha (Rigg et al., 2016). Cambodia's farming system is largely composed of rain-fed paddy rice on these small landholdings. Following a single harvest, much of the landscape remains idle and without vegetative cover. Agricultural land degradation is widespread, and Cambodian household diets are among the least diversified in Southeast Asia. Many rural households confront challenges to improving their agricultural system, including a lack of resources and limited availability of and access to land (Gill et al., 2020). Additionally, low income and limited income-generating opportunities impact levels of food and nutrition insecurity. While rice-based smallholder agriculture is the primary farming system in rural Cambodia, but it may also incorporate other livelihood activities, such as livestock, wild food collection, trade, and vegetable or palm sugar production (Culas & Tek, 2016). There is a pressing need in Cambodia to increase the diversification of agricultural systems to both improve human nutrition and restore degraded landscapes. This needs to be achieved in a sustainable manner by increasing the resilience and profitability of smallholder production and marketing systems.

As there is limited additional fertile land in this region that could be brought into agricultural production to meet rising production demands, other strategies are needed to intensify the production of these smallholder systems sustainably. While much emphasis has been placed on strategies to intensify traditional cropping and livestock practices, little attention has been paid to sustainably intensifying the management and use of assemblages of neglected and underutilized species (NUS) around smallholder homes, through what we term wild gardening. This qualitative study explores the potential of wild gardening as a scalable SI strategy in rural Cambodia using a recently developed SI assessment framework (Musumba et al., 2017).

Wild Gardening

Wild gardening is the intentional cultivation of a variety of NUS by smallholders for different uses across time and space. NUS are defined as possessing under-exploited potential for contributing to food security, health, income generation, and environmental services (Jaenicke & Hoschle-Zeledon, 2006). Typically, NUS are naturally occurring wild or semidomesticated native varieties of trees, shrubs, vines, and groundcovers adapted to local environments and considered 'wild' by cultural perception (Cruz-Garcia & Struik, 2015; González-Insuasti & Caballero, 2007). However, the term 'wild' does not necessarily imply a lack of human management; rather, these types of species are considered to lie along a management continuum from 'truly' wild (no management whatsoever) to wild-cultivated and semidomesticated species (Cruz-Garcia & Struik, 2015; Harris, 1989).

Little attention has been paid by agricultural researchers, plant breeders, and policy-makers to NUS and their potential to enhance agricultural development outcomes (Abebe et al., 2010; Bates et al., 2013; Padulosi et al., 2002; Vogl-Lukasser et al., 2010). However, a growing body of research has examined the extent to which NUS exists in the Southeast Asian context (Cruz-Garcia & Price, 2014a; 2014b; Cruz-Garcia & Struik, 2015; Price, 2003; Price & Ogle, 2008; Somnasang & Moreno-Black, 2000). Wild gardening yields tremendous opportunities to fight poverty, hunger, food insecurity, and malnutrition, and increase resiliency of agricultural production systems to climate and environmental change (Betts & Hawkins, 2014; Ebert, 2014). Wild gardening also offers potential for high levels of species, temporal, and spatial diversity, which helps rural households optimize their use of space around the homestead for maximum benefits (Cruz-Garcia & Struik, 2015). These smallholder systems can be supported further to optimize these spaces by adopting a sustainable intensification approach that focuses on three primary dimensions: function, space, and time.

Functional dimension

Wild gardening is a critical and strategic source of household food, nutrition, medicine, fodder, and other livelihood resources for rural households worldwide (Cruz-Garcia & Struik, 2015). NUS are often managed by women (Sachs, 2018). They are important sources of household food and nutrition, generally complementing rural diets and providing an array of sources for nutritional and dietary diversity by yielding essential minerals, micronutrients, vitamins, and secondary metabolites (Padulosi et al., 2013; Rowland et al., 2017). For example, *Moringa oleifera* is high in vitamin A and calcium; *Basella alba* (Malabar spinach) is high in fiber, vitamin A, C, and potassium; and turmeric (the spice from *Curcuma longa*) is high in magnesium, manganese, and fiber. This nutritional diversity is particularly important in Asian countries, where diets rely heavily on rice (Freedman, 2015).

NUS may also indirectly contribute to household nutrition as a source of income or livestock feed, as an integrated element in a farming system, or as a component in traditional medicinal systems (Cruz-Garcia & Price, 2014a; Cruz-Garcia & Struik, 2015; Freedman, 2015; Laval et al., 2011; Rowland et al., 2017). Wild gardening also serves a functional purpose in maintaining, propagating, and exchanging NUS among farmers via informal seed systems as opposed to seed sold by commercial or formal seed systems (Delang, 2006).

Spatial dimension

Wild gardening is a core component of the cultivation of a range of diverse plant species in Southeast Asia smallholder systems across multiple spaces. It is assumed to be predominantly a rural phenomenon, as urban spaces for agriculture in Cambodia are dwindling, suggesting that fringe spaces for wild gardening may also be reduced or limited in number and acreage (Underhill, 2013). Wild gardening most commonly occurs in and around home gardens in rural areas, and it is arguably one of the longest agricultural traditions practiced in the region (Wiersum, 2006). It also occurs in multiple 'fringe' areas, such as those along the road, at the edge of the forest, or surrounding rice paddies. Household members may gather and actively cultivate NUS in these varied spaces for household use and/or transplant NUS to their homestead to manage in wild gardens.

Smallholders frequently cultivate NUS to maximize the use of both vertical and horizontal space, particularly in land-constrained areas common to Southeast Asia. Figure 1 provides an illustrative example of using vertical and horizontal space to maximize the productive potential of the land. Wild gardening ranges from distinct spaces for gathering NUS to mixed crop gardening, interspersed with both wild plants and domesticated crop varieties. Wild gardening uses all spatial plant niches via the cultivation of a variety of plant types, including trees, shrubs, vines, and groundcovers. NUS maximize potential space use for optimal nutritional and economic benefits while also providing environmental services, such as creating favorable microclimates, improving hydrology, and increasing soil quality (Friday, Drilling, & Gamty, 1999).

Temporal dimension

Wild gardens are particularly important for the livelihood benefits yielded during times of stress or food scarcity (Cruz-Garcia & Price, 2014a; Cruz-Garcia & Struik, 2015; Moreno-Black & Somnasang, 2000). NUS are essential components of rural diets, as they are readily accessible and do not incur time or financial investments to maintain or use (Moreno-Black & Somnasang, 2000). They therefore provide a low-maintenance alternative, as NUS are amenable to varying levels of management intensity and can be assembled based upon the households' goals. In rural Cambodia, NUS are usually harvested by women in varying quantities and utilized at specific times of the year for many purposes, including but not limited to consumption, sale, traditional medicine, and others. Often, NUS harvesting requires minimal labor or time inputs, which is favorable given women's existing time burdens (Asian Development Bank [ABD], 2015; Sachs, 2018; Thorng et al., 2015).

Figure 2 highlights wild gardening's role in sustainably intensifying smallholder Cambodian systems across seasons. Cambodia annually experiences one major wet season (between June and November) and one dry season (December to May). Wild gardening has the potential to provide

Figure 1. Optimizing Tropical Plant 'Layers' with Perennial NUS

Adapted from Friday et al., 1999.

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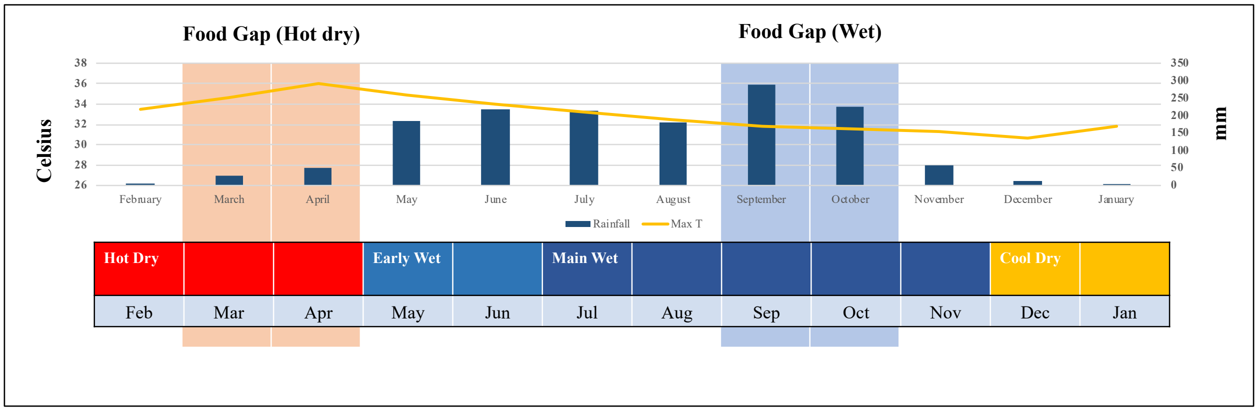
Figure 2. Potential for Optimizing Across Temporal Food Gaps [a]



[a] Figure presents rainfall and temperature data from Siem Reap Province, 1998–2010.
Image Author: Stuart Brown, World Vegetable Center.

critical sources of nutrition or products for sale outside of traditional times of harvest, such as the annual rice harvest in November-December. It also has the potential to supplement household and animal diets during ‘food gaps,’ when other food and forage sources may be reduced in availability or accessibility. Many wild garden species, such as banana (*Musa spp.*), are perennial in production, allowing for year-round harvests. Some species, such as sweet potato (*Ipomoea batatas*), can be left in the ground and harvested over multiple months without imminent risk of loss due to biotic or abiotic stressors. Furthermore, whereas certain NUS, such as pigeon pea (*Cajanus cajan*) and chaya (*Cnidoscolus aconitifolius*), are generally well-adapted to the difficult growing conditions encountered during the two ‘food gaps’, other species such as moringa (*Moringa oleifera*) can be selectively pruned by farmers to maximize biomass production during the ‘hot-dry food gap.’

Conceptual Framework: Wild Gardening for SI

Our research on wild gardening is based on the Sustainable Intensification Assessment Framework developed by the Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification (SIIL) at Kansas State University (Musumba et al., 2017). This framework presents a rigorous and comprehensive mechanism to conceptualize and measure the impact of SI packages. It was developed through a systematic process with participants across eight institutions with diverse disciplinary perspectives. The framework also considers indicators for assessing SI across spatial scales (plot or field, household, landscape) as well as the following five domains (Musumba et al., 2017). The five broad domains include productivity, economic, environmental, human, and social. We selected this framework as a tool to assess the efficacy of new ideas and technologies in agriculture for SI because it goes beyond traditionally narrow-focused assessment indicators (such as yield per crop) by providing a holistic approach that can be expanded and refined over time (Musumba et al., 2017).

We used this framework (Musumba et al., 2017) to guide the development of the qualitative data collection tools and the qualitative analysis to evaluate wild gardening as a potential sustainable intensification strategy through a case study conducted in northwest Cambodia from December 2017 to July 2018. We purposively sampled participants in each respective data collection activity if they had managed or used NUS in the previous year around their homestead or from nearby sources. This study asked four main research questions:

- How do rural Cambodian households conceptualize and define wild gardening?
- What are the benefits to the current use and

management of NUS in rural Cambodian households?

- What are the challenges to the current use and management of NUS in rural Cambodian households?
- What is the potential of wild gardening as an SI strategy following the SI assessment framework developed by Musumba et al. (2017)?

Materials and Methods

Methods and Sampling

This study employed multiple qualitative methods to answer the four research questions. These methods included two types of semi-structured interviews (SSI) and sex-disaggregated focus group discussions (FGD). A total of 65 men and women participated in SSIs, and 38 men and women participated in four FGDs (Table 1). This research study is part of a large research program under the SIIL that works in various rural Cambodian villages to identify and test SI technologies in the Cambodian context.

The villages selected for this particular study had been previously identified to participate in the broader SIIL research program. Participants for this study were purposively sampled from these previously identified rural villages in Battambang and Siem Reap provinces based on if they had experience with NUS (Teddlie & Yu, 2007). Participants included households that maintained or used NUS. Wild gardening was defined to participants as using or managing plant species other than those found in vegetable gardens (or another cropping field). Both men and women within households who met these criteria were invited to participate in this study to understand the intrahousehold dynamics of the maintenance and use of these wild plant species. Households were first selected; then, an able and willing adult was invited to participate in the respective data collection activity.

Table 1. Total Number of Participants by Sex and Activity

Activity	Male	Female	Total
SSI 1	6	13	19
SSI 2	16	30	46
FGD	18	20	38
Total	40	63	103

The FGDs were sex disaggregated. Men and women were invited to participate if they had managed or used NUS around their homestead or other nearby sources. The FGD protocols asked participants about their use and management of 27 specific NUS commonly found in Cambodia.

Two types of SSIs were conducted. The first type of SSI ('SSI 1') (*n*=19) asked detailed questions about specific NUS use, management, availability, and relevant benefits and challenges. These questions were open-ended; participants were asked to describe the specific NUS they utilized or maintained in their daily life. The second type of SSI ('SSI 2') (*n*=46) asked questions about how participants defined or conceptualized NUS, NUS maintenance and use, household gender dynamics of NUS maintenance, challenges and barriers to NUS maintenance and use, and benefits or motivations for using NUS. Table 1 presents the total sample by data collection activity and sex.

Data Analysis

The interviews were conducted in Khmer by trained Cambodian research assistants along with four authors. Data were recorded using structured note-taking sheets in the field and were then transcribed and recorded in Microsoft Excel. Native Khmer speakers fluent in English facilitated the interviews, took detailed notes of the interviews, and translated the notes into English.

The SSI data were analyzed through thematic analysis using a mix of deductive and inductive codes, guided by the five domains (economic, productivity, environmental, human condition, and social) of the Sustainable Intensification Assessment Framework (Musumba et al., 2017). Deductive codes were developed to align with indicators of each domain (presented in Table 2). Inductive codes were added to the coding framework after reviewing the qualitative data to select consistently emergent themes, such as certain types of benefits or challenges to managing and using NUS. Qualitative results are presented using direct quotes or summaries of aggregated findings.

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Table 2. Measurement Indicators Used to Assess SI Potential

Domain	Measurement Indicators Used
Productivity	• Ability to improve household consumption • Ability to increase crop production • Ability to diversify production
Economic	• Ability to increase income • Ability to increase diversified income • Ability to save on investments • Ability to save time for labor
Environmental	• Ability to increase species diversity [biodiversity] • Reduce needs for chemical inputs • Promote use of natural composts
Human Condition	• Ability to improve access to nutrition and nutritional diversity • Ability to improve food security • Ability to improve health [medicinal]
Social	• Gender • Social cohesion • Collective Action

SSI and FGD data were analyzed to identify the frequency of benefit types reported by participants of wild gardening. Results from the frequency analysis are presented in Figure 3. Given the multiple methods used to collect data over the time period, the total number (n) of participants asked about a specific benefit or challenge in general vary. For example, all participants (*n*=103) were asked the question, "*How do you use NUS or wild gardening for household consumption*?" Only a portion of the total participants (*n*=49) were asked, "*In general, what are the benefits to managing or using a wild garden or NUS*?" For each benefit listed, the total number of participants that had an opportunity to answer or discuss the possible benefit is weighted against the total number of participants who reported that benefit. This analysis was run for reported benefits of maintaining or using NUS in wild gardens and presents only descriptive figures of reported benefits.

This study is not representative and cannot draw statistical generalizations. Further, the results of this study shed light on wild gardening management and use in two areas of Cambodia. As an exploratory qualitative case study, the results from this research cannot be generalized to other contexts; this remains an important area of further inquiry.

Research Ethics

This study design and qualitative protocols were approved by The Pennsylvania State University's Office of Research Protection's Institutional Review Board. All participants gave verbal consent to participate in this research study voluntarily and to be audio-recorded.

Results

Local Conceptualizations of Wild Gardening

Consistent with the literature (Harris, 1989; Thorng, 2012), participants conceptualized wild gardening along a management continuum rather than discrete spatial locations. Generally, participants described NUS under three main categories: cultivated (*ដំណាំ/ បន្លែដាំ*), self-growing (*ដំណាំ/ បន្លែដុះខ្លួនឯង*), and wild or forest plants (*ដំណាំ/ បន្លែព្រៃ*). The discourse around NUS ascribed these labels. For example, one man explained that NUS are those that grow by themselves, often along homestead boundaries (the 'fringe areas'), such as along fences, roadsides, or in the rice fields or the forest, "*For example, gooseberry grows by itself in the forest/bush. And the people know that those plants are edible, but with little economic value, so they do not grow them in large amount for business*" [SSI, man, participant 1, 56 years old].

Some participants argued that NUS become cultivated plants once they are transplanted around the homestead. For example, a woman claimed that "*galangal* [Alpinia galanga] *is not a wild plant. It is a transplanted plant, so it has become a cultivated plant*" [SSI, woman, participant 2, 47 years old]. Similarly, another respondent pointed out that plants grown or transplanted around the home compound lose their 'wild' label, thus becoming cultivated plants. However, others maintained that these plants can still be considered wild, even if transplanted around the homestead. For example, one respondent clarified the difference between wild plants and cultivated plants,

> Some wild plants have been collected/conserved [transplanted to the home compound] quite a long time back, but some others we haven't collected/conserved. They are still at the forest or bush. So, they are all still wild plants although they have been collected a long time ago. [SSI, man, participant 3, 36 years old]

Although participants slightly disagreed over the categorization of wild versus cultivated plants, they categorically agreed that NUS are those grown in fringe areas (of the household or rice paddy) or those gathered from the forest.

Benefits of Wild Gardening

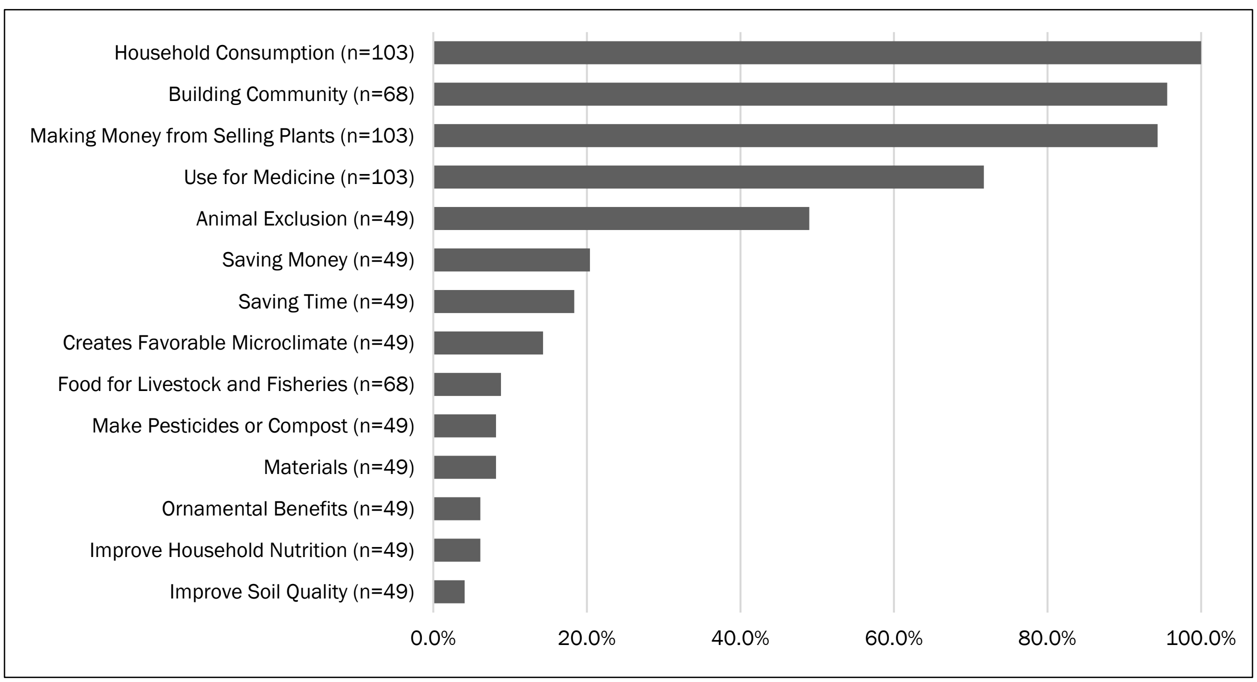
Participants across our sample reported a range of benefits from using and maintaining NUS, presented in Figure 3.

The most commonly reported benefit of wild gardening is its use in providing sources for household consumption. One man explained,

> It is important to have these wild plants around the house because when [we] need to cook some particular food that need those wild plants, especially Samlor Kakou (mixed vegetable soup). It is the traditional Khmer food that need most of wild plants. We can find them around our house. We don't need to go very far, or we don't need to spend money to buy them. And most importantly, wild food plants are chemical-free, unlike commercial vegetables and plants. [SSI, man, participant 1]

NUS are important components of rural diets in Cambodia. Traditional Khmer meals incorporate common NUS, such as ivy gourd leaf, star gooseberry, or galangal. Samlor Kakoo (សម្លកកូរ), mentioned by participant 1, is a common Khmer dish, prepared as a soup that combines a variety of vegetables, herbs, and fresh fish, making it rich in nutritional diversity. Participants highlighted that wild gardening is a beneficial cost-saving strategy, as it saves them time (18% of sample reported) and money (20% of sample reported) by not having to travel to either purchase or forage for food sources. Additionally, 14% of the sample indicated that NUS are used as food for livestock and fisher-

Figure 3. Reported Benefits of Wild Gardening



ies, providing a similar cost-saving benefit to households for their livestock rearing activities. However, while all participants cited using NUS for consumption, only 6% of the sample identified improving household nutrition as a major benefit. This difference suggests a knowledge gap for how NUS can be utilized for maximum benefits.

A majority of the participants (96% of the sample) cited that wild gardening facilitates community building as a major benefit. For example, 85% of participants noted that they always share NUS amongst neighbors, providing an opportunity to build social capital and cohesion. Other participants reported using the benefit that NUS can yield favorable microclimates (14%), ornamental aesthetics (6%), or delicious fruits (1 participant) as a way to intentionally entice neighbors, family, and friends to visit their homestead.

Participants cited the income-generating opportunity from managing and using NUS as a major benefit. Ninety-four percent (94%) of the sample cited selling NUS to traders or at the local market, generating additional and diversified income streams to support their livelihoods. Participants in the FGD agreed that they are willing to sell any of the NUS; however, there is not always market demand for certain species. Participants also indicated that the cost-saving benefits of managing and using NUS enable households to redirect cash previously reserved for food items or pesticides to other important purchases.

Some NUS are used as a means of physical protection, such as a living fence around the homestead to protect against roaming livestock or wildlife. Indeed, 49% of the sample indicated that NUS serve as a physical protection of the homestead, which not only saves the household from having to purchase materials to build a fence, but also saves the loss potential of harvest and income from grazing animals.

Barriers to Wild Gardening

All participants were asked open-ended questions about the challenges or barriers to wild gardening. Participants cited three major barriers and challenges to using, managing, and maximizing different NUS species near their homestead: lack of knowledge for how to maximize NUS potential, lack of available space and suitable soil quality to expand wild gardening areas, and lack of capital to invest in certain management practices or species.

A lack of knowledge for how to maximize benefits from wild gardening presented as a primary limitation. A majority of participants were not aware of the variety of benefits available to them via wild gardening. First, a majority of participants were not aware of the nutritional potential of NUS. For example, a majority of participants in this sample either had no knowledge of NUS nutritional potential or were aware of this potential but did not know how to harness it. One woman highlighted the latter point, explaining she knew "*the plants could be used for something, like cooking for health*" because she saw her neighbors cooking it, "*but [she] just didn't know how*" [SSI, woman, participant 4, 32]. As exceptions, two women had attended trainings at a local community health center about using NUS to increase household nutritional diversity. These women maintained a diverse wild garden and had in-depth knowledge of how to use which plants for optimal nutritional or medicinal benefits. Both women encouraged others in their community to attend trainings to improve their household nutrition and learn how to best use NUS for household nutrition.

NUS have long been a part of indigenous and traditional medicinal practices in Cambodia, and it is important to highlight the wealth of indigenous knowledge regarding the use and management of NUS. For example, these plants have been used in traditional medicines to cure some common diseases, such as stomach disorders (diarrhea and dysentery), fever and headache, skin diseases, stomach worms, snake and scorpion bites, colds, and others (Aryal et al., 2018). Much of this knowledge is passed generationally, but such knowledge transfers have been hindered by out-migration and a general erosion of cultural practices in rural communities (Inta et al., 2013; Wester & Chuensanguansat, 1994). Seventy-two percent of participants pointed to over 30 different uses of certain NUS to cure or ameliorate certain ailments. For example, one woman shared that papaya root was used to ameliorate kidney issues; another cited using neem to treat fevers. Those who had knowledge of the medicinal benefits of NUS indicated learning these benefits from a training at the health center, a neighbor, or from a village medicine man (a village expert in using plants for traditional medicine). More participants (72%) reported knowledge of the medicinal benefits of NUS than did those of potential nutritional benefits (6%).

Secondly, 34.8% of participants cited a lack of space with suitable soil around their homestead as a major barrier to increasing the number of species incorporated around their homestead. Some participants (*n*=8) reported not having any additional space to plant certain species around their homes. Soil quality was also considered an issue, as available soil around the homestead was of too poor quality to support additional or new NUS. For example, one woman wanted to grow *Sesbania grandiflora* and galangal in her wild garden, but cited having "*no space available to grow* [*it*]," and poor soil quality as inhibiting factors [SSI, woman, participant 4].

Participants cited an overall lack of capital to invest in securing seeds or cuttings. While a majority of participants (85%) indicated that they sourced NUS (cuttings, seeds, or via other techniques like grafting) from their neighbors, some participants (*n*=18) purchased seeds, cuttings, or plant materials at the local market, highlighting a potential lack of knowledge of the available methods to transplant NUS. Although some participants said that most plant species are shared between neighbors, others reported little sharing of germplasm between neighbors. The social dynamics of informal seed systems and sharing of germplasm require further inquiry. This finding suggests a need for greater NUS germplasm availability and perhaps an opportunity for the expanded presence of NUS in Cambodia's retail nursery industry.

Wild Gardening and Sustainable Intensification

We applied the SI Assessment Framework developed by Musumba et al. (2017) to explore wild gardening as a potential SI strategy. The framework suggests several indicators to assess each of the five domains, but also accommodates flexibility for new, applicable indicators under each (Musumba et al., 2017). Table 2 presents the indicators used in this study to qualitatively assess the potential of wild gardening as an SI strategy.

Productivity

We examined how households were able to use wild gardening to increase production yields, diversify production sources, and increase sources for household consumption (Table 2). Across the sample, wild gardening directly enabled households to produce more plants for household consumption, sale (income), materials, and other uses. Wild gardening also indirectly contributed to an increase in overall household production, as households could use NUS and income generated from its production to reinvest into other crop production or multipurpose reasons, saving time and money. Twenty percent of our sample indicated a major benefit of wild gardening was saving money by using NUS to replace items (pesticides, fish and livestock feed, food products) that they otherwise would have to purchase.

Importantly, wild gardening enabled women, specifically, who generally were responsible for its maintenance, to increase production under their control. Our data do not indicate if women were then in control over the incomes generated from the sale of NUS, making this an area requiring further research. However, wild gardening enabled women, who are responsible for preparing meals, to access a variety of food plants close to home, saving time and money from having to travel to the market and purchase these items. All participants indicated using NUS, such as morning glory (*Ipomoea aquatic*)*,* bamboo shoot (*Bambusoideae spp.*), amaranth (*Amaranthus spp.*)*,* and turmeric (*Curcuma longa*) for household consumption.

Economic

We examined wild gardening's ability to increase household profits, diversify income streams, save capital on investments, and save time needed for labor activities (Table 2).

Over 90% of our sample indicated that they sold NUS from their wild gardens for additional sources of household income (Figure 3). One woman described the profits she gained from selling *sa'oum* (*Acacia pennata*), making upwards of US$12/day for her harvest, in addition to other NUS she sold, representing a lucrative market opportunity.

Wild gardening, which can sustain and incorporate a diversified assemblage of NUS, yields the potential to diversify household sources of income, as NUS provide households with diversified market options to sell their harvests. For some species, like kaffir lime (*Citrus hystrix*), papaya (*Carica papaya*), and wax gourd (*Benincasa hispida*), traders travel through villages to each household, pick their own harvest, and then pay the representative household member for their take. Women often manage these sales, as they typically are home when traders arrive. For other species, like water hyacinth flower (*Eichhornia crassipes*), water mimosa (*Neptunia oleracea*), and wild morning glory (*Ipomoea spp.*), women and children pick the harvest. Then women sell it at either a local village market or a central market closer to a city, depending on market saturation. One woman explained that *sa'oum* has to be sold in central markets because "*everyone in the village has the* [sa'oum] *plants, so no one will buy at [the local market]*" [SSI, woman, participant 5, 45]. Other plants such as amaranth, kaffir lime, and water hyacinth flower may be sold in the village market, where sellers gain higher profits.

Additionally, wild gardening can reduce household expenditure—both time and financial—on otherwise necessary items. Approximately 20% of the sample cited saving money as a major benefit of wild gardening (Figure 3). For example, wild gardening provides food sources that complement diets, saving the household money from having to purchase these food sources at the local market. Other sources of savings cited across our sample include using NUS in mixtures as natural pesticides or organic composts (8%), as raw materials for a fence or construction (8%), or as fish or livestock feed (9%). The Cambodian diet heavily relies on fish, which constitutes 80% of the country's animal protein intake, and is considered a secondary staple food to rice (McNamara, 2016). One woman explained that growing *chaya* (*Cnidoscolus aconitifolius*) enabled her to not only feed her family, but also feed her fishpond. Growing *chaya* saves her money from buying alternative fish feed, saves her time from having to travel to the market to purchase fish feed, and maintains healthy fish, increasing their market value and thus providing additional income to be reinvested into household needs.

Eighteen percent of participants cited that wild gardening saves households time searching for and securing necessary household products and highlighted the minimal labor investment required to maintain wild gardening. Some species naturally grew around households, while others were purposively planted. Once planted, the plants require little to no additional maintenance activities, except sometimes watering during the dry season, which took anywhere from five minutes to one hour every few days, depending on the variety and volume of species maintained around the homestead. None of the participants cited sourcing or securing water for wild gardening activities as a challenge.

Environment

We examined how wild gardening in Cambodia increased species biodiversity as well as reduced the use of chemical inputs (Table 2). Overall, the intensification of homestead wild gardening can accommodate a wide diversity of plant species across three spatial scales. For example, over 20 species were identified as used and/or maintained by participants in this case study. One man maintained a particularly biodiverse wild garden, with over 12 different species, maximizing spatial capacity around his homestead to purposively yield benefits such as increased and diversified income sources, household food and fuel sources, improved household nutrition, and positive environmental effects.

Wild gardening offers the potential to reduce the need for chemical inputs due to the increased biodiversity and natural protection (Isbell et al., 2017), as well as the raw materials it provides to make natural pesticide mixtures. For example, one woman preferred wild gardening specifically for its environmental benefits due to its biodiversity. She explained that a high level of biodiversity reduced her need to rely on chemical pesticides and helped increase available soil nutrients. She also made natural pesticides from galangal *[Alpinia galanga]* and lemongrass *[Cymbopogon citratus]* and preferred this mixture to purchasing chemicals as it "*saves* [*her*] *money and is healthier for* [*her*] *family because* [*she*] *does not like using chemicals but needs to reduce the pests on* [*her*] *trees*" [SSI, woman, participant 6, 42]. Around 8% of our sample cited using materials from WFP grown in their garden to make natural composts for their vegetable crops and rice paddies.

Human condition

We examined whether wild gardening led to improved household nutrition, increased nutritional diversity, and improved household food security and health (Table 2).

The wide variety of plants that can be cultivated through wild gardening provides diversified and accessible sources of important nutrients for household consumption. This variety also supplements household food sources. For example, Cambodian women of reproductive age and children suffer from high rates of vitamin A deficiency, and certain common NUS, such as *Moringa oleifera* and *Basella alba,* are rich sources of vitamin A (Wieringa et al., 2016). One woman described the health and nutritional benefits of each plant maintained in her wild garden, indicating that wild plants are an *"easy and beneficial way to improve [her family's] health"* [SSI, woman, participant 7, 35]. As a result, she encouraged other women to grow wild plants and use them to increase their family's nutrition. Some women perceived this activity as time-consuming, sharing that they "*do not have time to maintain them and would rather buy food using money from construction jobs*" [SSI, woman, participant 7]. However, to this participant, keeping a wild garden was a surmountable barrier, as wild plants take "*no time"* to maintain but do require small time investments upfront to learn how to use and maintain various NUS [SSI, woman, participant 7]. She found value in investing the time up front, as she improved her family's nutritional diversity and supplemented her household consumption with a variety of wild plants grown in her garden.

Second, wild gardens provide households with accessible, nutritious food plants that are particularly important during seasonal food gaps or at times of hunger when most crops are unavailable or insufficient (e.g., during times of conflict). Consuming NUS was an important survival strategy for Cambodian people during the time of the Khmer Rouge in the 1970s, when citizens were forced out of cities into the countryside. One man, a farmer and survivor of the regime, explained that,

> during [the regime of] Pol Pot [the leader of the Khmer Rouge], we were provided very little rice soup. … We were able to survive because of these wild plants. We were provided one big spoon of rice soup with only few grains of rice. These wild plants provided energy … we had morning glory, water hyacinth, water lily. We cooked dioscorea hispida and banana root as rice and with rice. We also cooked bamboo shoot as rice and soup. We survived because of these wild plants; otherwise, we would have died. [SSI, man, participant 8, 87 years old]

Wild gardening promotes household food security, as it yields accessible, diverse, and nutritious options for household consumption, particularly during acute or seasonal periods when other staple food crops are unavailable or scarce. It also promotes household health via traditional medicinal properties that NUS may yield. Over 70% of our sample cited using NUS as medicine to treat ailments such as stomachache, nausea, fever, for during and post-pregnancy support, liver and kidney problems, and as an anti-venom, among others. For example, one woman described,

> Moringa is used to digest or help dissolve food…. I use it once. It has rich vitamins. … If we don't know about a plant, we can do an experiment. I cooked and ate one portion of moringa; I found it very effective. … It is good for those who are having difficulty in digesting. [SSI, woman, participant 9, 49 years old]

Participants also preferred NUS to products purchased in the market because NUS are perceived to be organic and safe for household consumption. Participants, in general, expressed an overall lack of trust for the perceived safety of plants sold in the market, particularly those from Thailand or Vietnam, where pesticide and chemical use is abundant (Hoi, Mol, Oosterveer, van den Brink, & Huong, 2016). In this way, NUS are perceived to promote human health through the consumption of chemical-free plants.

Wild gardening also provides the potential for households to experiment with different techniques in intercropping, grafting, soil improvement, and others, with much lower risk than a traditional vegetable garden or cropping field. For example, one young farmer, who worked as a construction laborer, maintained an abundance of NUS around his homestead as a hobby for consumption and experimentation. He gave most of his surplus to his sister to sell at the market and sold little harvest to traders. He would research and experiment with NUS around his home, utilizing social media, such as Facebook and YouTube, as well as Google to generate new ideas on how to cultivate new assemblages of plants. He then would share this knowledge with other community members. He indicated that while social media was a powerful tool for increasing his knowledge, he did not feel that others knew how to maximize its potential to gain knowledge.

Social

We examined social considerations related to how NUS provided a venue for community building and social cohesion and promoted gender equality (Table 2). A majority of participants (85%) indicated relying on neighbors for knowledge, cuttings, or seeds of NUS for their own garden. Many participants (*n*=58) described sharing their NUS harvest with neighbors. One woman explained that "*It is always good to build relationships with neighbors and share [the plants]*" [SSI, woman, participant 12, 43]. Another described, "*[Sharing wild plants] is also good for neighbor interaction and building relationships with neighbors*" [SSI, woman, participant 10, 32]. A man explained how he uses NUS harvests to build social capital, sharing harvests with neighbors *"to gain favor"* with them [SSI, man, participant 11, 38].

While 85% of participants shared seeds, seedlings, and cuttings for certain NUS species, not all participants relied on neighbors or community members to access NUS or knowledge about their management or use. For example, some (*n*=10) indicated sourcing several species from the road or rice paddy fields, either transplanting these at their home or traveling periodically to pick them. Others (*n*=18) relied on purchasing certain species from the local market. Only four participants solely sourced their NUS from the market or stores. Additionally, not all participants cited asking their neighbors for help or knowledge about best practices for the management or use of NUS. In total, six participants trusted and relied on local agricultural store owners for information about NUS. While the intergenerational transfer of knowledge was the main source of information on the use and management of NUS, some participants indicated learning from neighbors or social media. For example, one woman explained that she uses Facebook or other social media groups to learn about new NUS.

Several participants cited the favorable microclimate and ornamental benefits as attributes they would leverage from the NUS to encourage visitors to their homes. Six percent (6%) of participants said some NUS are beautiful and increase the attractiveness of their homestead, while 15% of the sample said certain NUS encouraged family and friends to visit because of the shade and cooling they provided or fruits they yielded. For example, one man specifically maintained *sapodilla [Manilkara zapota]* around his house because, although it took a long time to grow, the fruits enticed family and neighbors to visit his home.

We examined the extent to which wild gardening contributed to gender equality. Consistent with the literature (Oakley & Momsen, 2007; Sachs, 2018), wild gardening was discussed as the women's responsibility. Women make decisions about which plants to grow in the wild gardens, and importantly, which plants to use in food preparation. Women are also primarily responsible for selling NUS harvests, if they are sold, and making decisions around where and how much of these species to sell. For example, one participant indicated that selling is "*women's work…only women go to the market"* [SSI, man, participant 13, 29]. Wild gardening often occurs around the household and requires minimal time and labor investment to maintain, yet it provides accessible food, nutrition, and potential income sources. As such, there is potential for wild gardening to save women from having to travel to markets to purchase food or materials while providing an additional source of income, thus preventing exacerbation of women's existing time burdens (ABD, 2015). However, further research dedicated to the gender dynamics of wild gardening is required to understand this potential better.

Discussion

Wild gardening as a viable, sustainable intensification strategy?

Wild gardening is an important component of rural livelihoods in northwest Cambodia. NUS are conceptualized along a management continuum, rather than spatially, highlighting the need to understand local perspectives when proposing which specific NUS should be included in an intensification package. Participants cited a wide range of functional benefits to wild gardening, particularly pertaining to its role in household diets, building community, and increasing income. Wild gardening is used to complement staple diets of rice, providing an array of sources of nutritional and dietary diversity, and traditional medicine for rural households. NUS are important and accessible components of rural diets, particularly during seasonal food gaps, and they simultaneously offer additional beneficial livelihood uses. The variety of livelihood uses of NUS highlight the functional diversity wild gardening offers for households to improve livelihoods and overall well-being.

Importantly, wild gardening can be an option for the rural landless who often do not have access to additional land for expansion but can maximize existing land or space to accommodate perennial NUS. Wild gardening functions as a suitable and useful SI technology that brings otherwise wasted land into purposeful production. When incorporated into marginal land, fencerows, or vacant plots, NUS, particularly perennial trees, shrubs, and vines, become a low maintenance and time-efficient technique to supplement existing food systems. Wild gardening also provides households with access to improved and diverse sources of nutrition and traditional medicine, biodiversity, favorable microclimates, and sources of necessary materials (such as wood, fish or livestock feed).

While wild gardening offers a multitude of benefits, challenges nevertheless persist with promoting its intensification and scalability. The results presented in this study suggest a general lack of knowledge regarding the multitude of benefits of wild gardening and how to intensify the practice. For example, respondents overwhelmingly cited using NUS in daily food consumption, but do not necessarily seek out NUS for their nutritional value. Approximately 32.4% of children under five years of age are stunted, and approximately 46.8% of reproductive age women in Cambodia are anemic (USAID, 2018). Considering such high rates of mal- and undernutrition in Cambodia, the need to increase nutritional knowledge and diversity is important (Fiorentino et al., 2016).

The intensification of NUS via knowledge sharing between neighbors within a community offers a promising alternative to addressing this need, as these NUS are already readily consumed. Additionally, while the physical ownership of horizontal space around a homestead may pose a potentially limiting factor for increasing diversification of wild gardens, vertical levels of space (Figure 1) can be further intensified to include different varieties of NUS. Thus, knowledge gaps hinder the use of NUS for their maximum potential; strategies to intensify wild gardening should focus on addressing these gaps.

Aligned with Musumba et al.'s (2017) assessment framework, we used several indicators to explore the potential of wild gardening under each respective domain for smallholder systems in northwest Cambodia (Table 2). Cultivating NUS increases household food production (productivity), provides the potential for diverse incomes streams (economic), reduces the need for purchasing and using chemical inputs (environment and economic), provides an accessible source of diverse nutrition (human condition), and facilitates community building and social cohesion (social). The functional diversity of NUS and wild gardening enables benefits to cut across several domains. For example, using NUS for making natural composts contributes to both environmental and economic domains as it saves households money and time from procuring inputs, and reduces the overall need for use of chemical inputs.

In rural Cambodian households, wild gardening is an existing, albeit uncommon, practice that merits greater attention. Wild gardening holds the potential to provide a high level of sustainability and greater resilience to a low-input food system, complementing home vegetable gardens with a much less resource-intensive food production strategy. NUS and wild gardening yield several positive impacts for rural households, from increasing access to nutritional sources and income streams to saving money. Thus, there is ample opportunity to scale this strategy in Cambodia and in other regions where wild gardening is already practiced. Whereas results of this study demonstrate that Cambodian smallholder farmers value these various aspects of wild gardening and NUS, a number of significant challenges remain if this SI technology is to see a wider regional impact. For one, NUS are part of an informal seed system with limited access to germplasm for some perennial species.

We also find that the cultivation and use of NUS are embedded in indigenous knowledge, such as their use in traditional medicines (Aryal et al., 2018). With less intergenerational transfer of knowledge and rural and youth out-migration from agriculture, these knowledge systems are eroding. Furthermore, NUS knowledge is not included as part of the Cambodian formal Agricultural Education and Training curriculum. These constraints may pose limitations to the efficacy of scaling a wild gardening SI strategy across Cambodia and therefore require further research to understand how they can be overcome.

Considering Gender when Assessing Strategies for SI Potential

We find that certain indicators of the SI assessment framework cross-cut domains, which we present as a critique. Most notably, the social domain includes an indicator on gender; however, there are important gendered aspects to be considered across all five domains that hold implications for the viability of a successful SI strategy. For example, women play important roles in gathering and transplanting NUS to diversify family food sources (productivity) as well as in managing household food security and nutrition (human condition). Transplanting and domesticating NUS with the annual vegetables creates biodiverse and multifunctional ecosystems, which may reduce the need for chemical substances while increasing climate resilience (environment). Moreover, women may generate their own income sources by selling NUS products (economic).

In the framework, we argue that gender should be considered across and within each domain rather than as a sole indicator. Incorporating gender-sensitive indicators across domains allows for more in-depth analysis and enables broader impacts to be captured. For one illustrative example, under ‘productivity,’ this study corroborates the literature in that women are predominately responsible for managing household production, management, and use of NUS (Freedman, 2015; Sachs, 2018). It would be essential to understand if and how such a SI strategy aimed at scaling up NUS production would shift women’s time allocation and, if so, what tradeoffs women and men would need to make to accommodate such a shift (ABD, 2015). Therefore, under the ‘productivity’ domain, it would be important to include an indicator on gender to understand how the SI strategy’s attempt at increasing production affects current and future demands on women’s and men’s current and future labor and time allocation. This framework, and those similar, should ensure to incorporate gender-sensitive indicators across all domains measuring a potential SI strategy.

This approach also allows for gender considerations to be integrated into the design and delivery of SI packages (Komatsu et al., 2018; Kristjanson et al., 2017; Theriault et al., 2017). Feminist literature has long documented how men and women experience and shape social norms that form gendered opportunities and barriers, and how these may vary across geographic contexts and social identities (Alkire et al., 2013; Boserup, 1970; Meinzen-Dick et al., 2011). For example, Theriault et al. (2017) found that women plot managers were less likely to adopt an SI technology aimed to improve cereal productivity because they had significantly less access to adequate resources, such as credit, equipment, labor, and extension services, than did men, who were more likely to adopt and benefit from the technology.

Given women’s role in ensuring household food security (Quisumbing et al., 2014), it is important that developers of SI packages integrate gender considerations into the design and delivery and engage with gender specialists in this process. When designing strategy packages, these gendered opportunities and barriers must be thoughtfully considered to understand those that exist for men and women in adopting, employing, and benefiting from such a package. We suggest that further research explore and examine the manner in which gender should be incorporated into the frameworks assessing SI strategy potential, package development, and scaling approaches.

Further Research

This study presents findings from qualitative research on how rural households in Cambodia currently use NUS, but further research is required to quantify these attributes to best package NUS suggestions for sustainably intensifying wild gardening. For example, nutritional analyses can point to which NUS are appropriate for combating acute vitamin deficiencies prevalent in certain parts of rural Cambodia (Fiorentino et al., 2016). Additional research should examine the market potential of certain NUS to target better those with higher market potential in certain contexts over others. Further effort is also needed to assess the value of wild gardening and the value-added products prepared using the harvest. Determining the influence of NUS cultivation, harvest, storage, preparation, and processing methods will enable appropriate recommendations to be made on how to gain maximum value to ensure delivery of food and nutritional security. Current efforts to understand, improve, and disseminate an intensified wild gardening system in Cambodia are limited (Thorng, 2012).

Furthermore, all future research should be situated in terms of gender relations within the household and the community to identify men's and women's roles related to NUS management and use. This will be useful for understanding decision-making and negotiating roles for NUS management and use, and in understanding who controls benefits from various NUS usages (see Alkire et al., 2013, and Meinzen-Dick et al., 2012, as frameworks to guide such future research).

The work presented here documents the wide-ranging value of wild gardens to Cambodian farmers. However, additional research is needed to illustrate how NUS integrate with and complement other components of home and community food production. This research should include documentation of quantifiable nutritional, medicinal, and economic contributions of wild gardens to rural Cambodian households as well as to other contexts. Questions worthy of attention in the context of an era of sustainable intensification include:

- What are the quantifiable potential nutritional, medicinal, and economic contributions of wild gardens to rural households?
- What role do women play in managing and maintaining NUS within wild gardens, and how would a wild garden intensification package present tradeoffs to women's time and control over resources?
- Would over-management of NUS result in a reduction of the natural biological capacity of these spaces to regenerate?

Conclusion

SI and food security remain a major development concern and an important area for research and conceptual development. While NUS are given some recognition, especially as famine foods and crises-relief foods, their role and contribution have largely remained undervalued in the food security discussion. Conservation of horticultural genetic resources has been cited as a global research priority (USAID, 2005); however, characterization of how these diverse species integrate (both individually and as wild gardens) with local food systems in specific geographic regions has been lacking.

The research presented here shows a wide range of values associated with NUS that compose wild gardens. Wild gardens mimic natural ecosystems and provide a high level of sustainability and climate change resilience as a low-input food system that complements home vegetable gardens. They are far less resource-intensive and pose less risk to farmers and can positively impact household nutrition and additional income streams. NUS are generally not traded commercially in formal markets, and as such, are insulated from regional competition compared to traditional vegetables that are cheaply imported from neighboring countries. And as such, wild gardening presents a potential positive strategy to improve rural livelihoods and overall well-being.

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Indicators of readiness and capacity for implementation of healthy food retail interventions

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Abstract

Healthy food retail (HFR) interventions are a recommended strategy to improve the dietary behaviors of low-income residents with limited access to healthy food; however, tools are needed to assess, tailor, and implement HFR plans to local contexts. The present study identifies factors influencing HFR implementation and presents findings related to identifying, operationalizing, and prioritizing facilitators of and barriers to implementing HFR interventions within low-resource rural and urban contexts. Practitioners and community residents, recruited from nine counties in Ohio, participated in semistructured interviews and focus groups. Grounded theory methodology was used

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to develop themes and indicators of readiness and capacity for successful HFR implementation. Consensus conference feedback from an expert panel prioritized themes and indicators based on their perceived relevance and importance for successfully implementing HFR interventions. Five themes were identified as influential factors: (1) corner store awareness and perception, (2) organizational and practitioner capacity, (3) community attitudes and perceptions, (4) logistical factors, and (5) networks and relationships. Additionally, 18 indicators within the five themes were identified to further illustrate influential factors to HFR implementation. The themes and indicators presented in this research have been synthesized into the PSE READI tool[1] (developed outside of this research). The PSE READI tool uniquely provides an opportunity to assess, tailor, and implement HFR plans to the local contexts by considering the key themes and influential factors that emerged from this community-level, qualitative research.

Keywords
Healthy Food Retail; Dietary Behavior; Policy, System, and Environmental Interventions; Program Implementation

Introduction

The influence of the food environment on dietary behaviors and health outcomes has been of keen interest to academia and the public health community (Centers for Disease Prevention and Control, 2011; Larson et al., 2009; Treuhaft & Karpyn, 2015). Retail food outlets such as supermarkets and convenience stores make up a large part of the community food environment (Glanz et al., 2005), and studies have shown that these outlets may contribute to obesity (T. A. Farley et al., 2009; Morland et al., 2006). Living in an area with many convenience stores, which tend to carry a larger proportion of energy-dense foods compared to healthy foods (T. A. Farley et al., 2009), versus an area with multiple supermarkets may influence obesity risk (Morland et al., 2006). Research demonstrates that one's proximity to retail food outlets with high availability of healthy foods is associated with better dietary habits and a decreased risk for diet-related chronic diseases, including obesity (Glanz & Yaroch, 2004; Story et al., 2008; Treuhaft & Karpyn, 2015).

Policy, system, and environmental (PSE) interventions encompass multilevel approaches to alter environments such as community and consumer food environments (Frieden, 2010). Community and consumer nutrition interventions to improve these environments are often referred to as healthy food retail (HFR) interventions. These interventions are gaining momentum as a means to create healthier food environments, especially for people living in underserved areas designated as so-called 'food deserts' (Adam & Jensen, 2016; Gittelsohn et al., 2012; Walker et al., 2010a). The design and implementation of HFR interventions vary based on store type and size, geographic location, and access to community resources needed to support change (Centers for Disease Prevention and Control, 2011; Glanz & Yaroch, 2004). The popularity of implementation of HFR interventions has increased over recent years in various geographic areas (Pinard et al., 2016), and in multiple types of retail food outlets, including tiendas (Ayala et al., 2013), bodegas (Dannefer et al., 2012), green carts (S. M. Farley et al., 2015), corner stores (Gittelsohn et al., 2012; Langellier et al., 2013), convenience stores, including gas-marts, pharmacies, and dollar stores (Gittelsohn et al., 2012), and supermarkets (Adam & Jensen, 2016; Hartmann-Boyce et al., 2018). These interventions are more likely to be implemented in urban areas compared to rural areas (Gittelsohn et al., 2012). Examples of the types of HFR interventions that have been implemented previously include increasing the number of healthy food options in corner stores, placement strategies (e.g., placing healthy food items near cash registers), and marketing and promoting healthy food items (e.g., pricing strategies, healthy food advertisements), among others (Adam & Jensen, 2016; Dannefer et al., 2012; Gittelsohn et al., 2012; Hartmann-Boyce et al., 2018).

Given the range of locations for HFR interventions and differences in these programs' size

[1] The PSE READI website is https://PSEREADI.org

and scope, there is an opportunity to streamline technical assistance around program implementation to suit one's local context. Toolkits have been created to assist practitioners in developing, implementing, and disseminating multifaceted HFR interventions; however, none of them explicitly address how to tailor implementation within diverse community settings (Building Capacity for Obesity Prevention, 2016). Tools to systematically assess community readiness and capacity to tailor HFR interventions to local contexts' realities help practitioners effectively implement HFR interventions within and across diverse community settings.

The goal of this research was to identify factors perceived to influence the implementation of HFR interventions. This study presents findings related to identifying, operationalizing, and prioritizing facilitators of and barriers to implementing HFR interventions within low-resource rural and urban contexts. Interview and focus group data were collected from two groups: (1) frontline practitioners working with the Ohio Supplemental Nutrition Assistance Program Education (SNAP-Ed) or the Ohio Department of Health's Creating Healthy Communities (CHC) and (2) community members, to identify factors perceived to influence the implementation of healthy eating PSEs in retail food outlets. We believe our study is the first of its kind in that it not only contributes to the existing literature by identifying facilitators of and barriers to implementation of HFR interventions from the perspectives of experienced stakeholders but also extends research by operationalizing them into measurable indicators resulting in the creation of PSE READI (Readiness Assessment and Decision Instrument tool) (Building Capacity for Obesity Prevention, 2016).

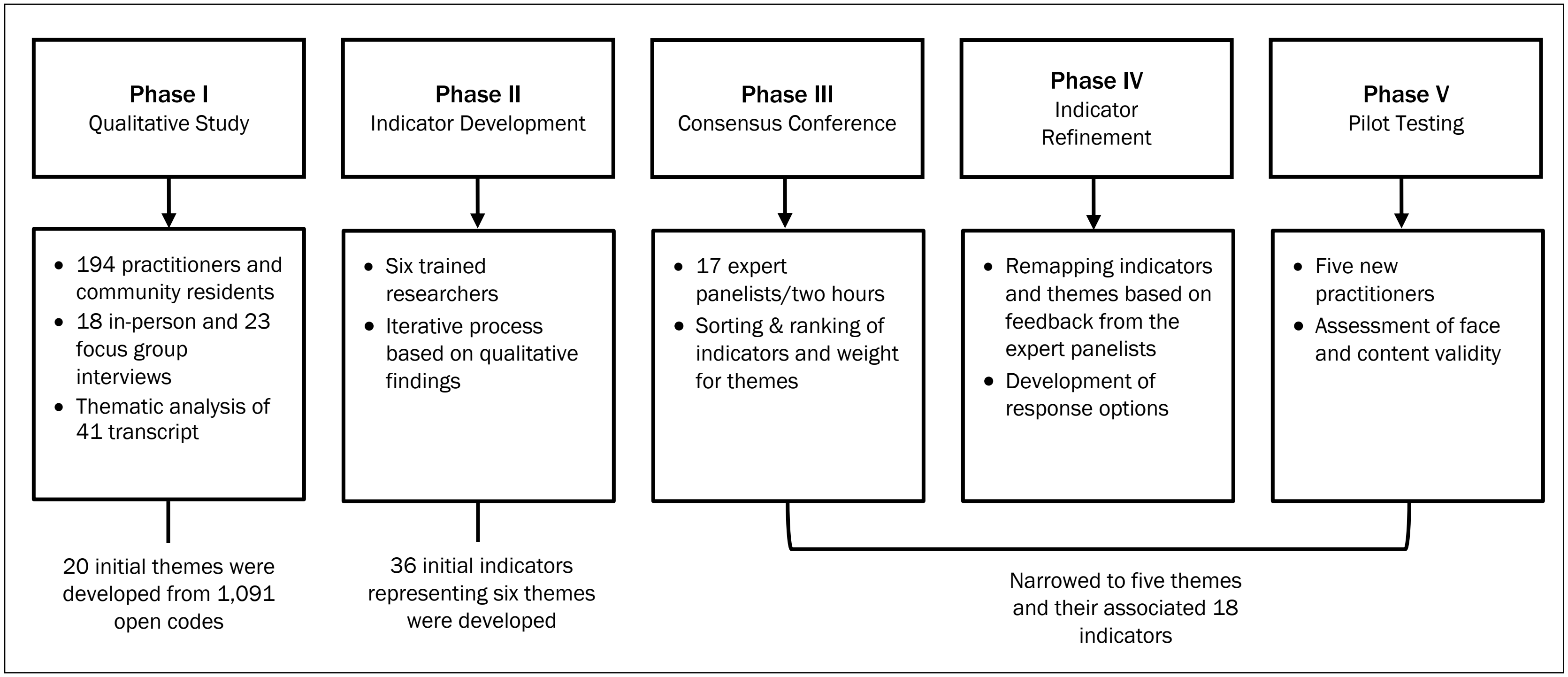
Applied Research Methods

This study is derived from the Building Capacity for Obesity Prevention (BCOP) project, a university-community partnership aimed at developing web-based community readiness and capacity assessment tools to optimize implementation of four nutrition-related PSE interventions ([1] farmers markets, [2] healthy eating in childcare settings, [3] HFR, and [4] farm to school) (Lee et al., 2017, 2019; Parsons et al., 2019). Details about the overall study methods were previously published (Lee et al., 2017). Figure 1 displays the five-phase consensus modeling process to develop the PSE READI tool for implementing HFR projects. Briefly, Phase I consisted of data collection (interviews with SNAP-Ed and CHC practitioners and focus groups with SNAP-eligible community members and CHC coalition members) and thematic analysis of transcripts. Phase 2 consisted of indicator development, where an iterative process of discussion and refinement to operationalize indicators among the research team took place. Phase III consisted of a consensus conference where an expert panel reviewed indicators. Phase IV consisted of indicator refinement where similar indicators and themes were refined and merged by the research team. Lastly, Phase V consisted of developing the PSE READI tool for pilot testing with external expert panelists who might be potential end-users of this tool. Community partners included representatives from countywide coalitions supported through the Ohio Department of Health's Creating Healthy Communities (CHC) program. Coalition membership varied by county but included a range of local stakeholders involved with healthy eating and active living initiatives, such as health care and public health practitioners, cooperative extension agents, grassroots and faith-based leaders, educators, and stakeholders from government, nonprofit, and business sectors.

Sampling and Recruitment

Before data collection, we selected targeted geographic areas to recruit diverse study participants. Specifically, nine counties in Ohio were purposively selected given their representativeness in terms of county health rankings, geographic location, adult obesity rates, and SNAP participation. Additionally, they had on-the-ground SNAP-Ed and CHC staff to support HFR project implementation. Inclusion of on-the-ground SNAP-Ed and CHC staff was warranted as they bridged the knowledge gap of HFR intervention readiness and could support findings suggesting that having boots on the ground is an essential and crucial element in HFR intervention implementation. Within these counties, two distinct groups of participants were recruited for data collection

Figure 1. Five-Phase Consensus Modeling Process to Develop The Policy, Systems, and Environmental Strategies
Readiness Assessment and Decision Instrument (READI) for implementing healthy food retail project.



First, public health and community nutrition practitioners from SNAP-Ed or CHC were recruited by email. If interested, practitioners participated in one-on-one interviews. Second, community members receiving or eligible to receive federal food assistance benefits and members of CHC coalitions were recruited via flyers. Interested community members called the study phone line to learn about the study and sign up for a focus group. Informed consent was obtained from all participants. The institutional review board of Case Western Reserve University approved the study.

Data Collection and Analysis

The interview and focus group guides (Supplementary Materials 1 and 2, uploaded as separate files) were developed by the research team based on a review of the extant literature on conceptual models focused on factors associated with implementing nutrition-related PSE interventions (Blanck & Kim, 2012; Frieden, 2010; Wandersman et al., 2008). Interview and focus group questions were developed to identify participants' perceptions of factors that may influence the implementation of healthy eating PSEs, including community readiness, organizational readiness, practitioner capacity, the local burden of obesity, and sociopolitical context. The interview and focus group guides used, and their objectives, were the same for all practitioners and community members. Researchers, county- and state-level public health and community nutrition practitioners, and cooperative

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extension professionals reviewed and provided feedback on the interview and focus group guides as they were developed. Examples of healthy eating PSEs in retail food outlets were provided to develop a standard definition among participants during data collection. Between April and June 2015, semi-structured and open-ended in-person interviews and focus groups were conducted. These took place in various locations, such as community centers and practitioner offices. Interviews and focus groups were led by two trained researchers and lasted one- to two hours. They were digitally recorded and transcribed verbatim by a third-party transcriptionist. All transcripts (*N*=41) were checked for accuracy against original recordings by the research team members.

A grounded theory approach (Charmaz, 2002) was used to analyze the transcripts in Atlas.ti (version 7) (Scientific Software Development GmbH, 2015). Details regarding the coding structure hierarchy are described elsewhere (Cascio et al., 2019). Briefly, first, trained researchers developed "open codes" grounded in participants' real words and captured the emerging concepts through a line-by-line reading of the transcripts. All open codes were co-coded with an associated PSE code to facilitate data analysis relevant to HFR projects. Second, each open code was assigned to a subtheme and then to a higher-level theme code to develop the coding structure. These processes guided the development of a codebook with themes, subthemes, and definitions used by the team to analyze the remaining transcripts. Third, the most salient themes and subthemes were prioritized. The selected subthemes were then operationalized into measurable indicators along with operational definitions of each theme.

The sample consisted of 194 participants, with 18 taking part in an interview and 176 participants taking part in one of 23 focus groups. Of these 194 participants, 20 were practitioners, 11 were CHC practitioners, and nine were SNAP-Ed practitioners. The remaining participants (*n*=174) were community members who were current recipients or were eligible to receive SNAP (*n*=127) or were CHC coalition members (*n*=47). Most focus group participants were female (69%) and self-reported current receipt of federal assistance benefits such as SNAP (65%). More than half identified as white (60%), and the remaining focus group participants identified as African American (40%). Demographic characteristics were not recorded for practitioners who participated in the in-person interview because of the small sample size and the risk of losing confidentiality.

Consensus Conference

An expert panel reviewed indicators derived from the qualitative data analysis during a face-to-face consensus conference. A consensus conference's primary goal is to determine the extent to which a select sample of stakeholders agree with potential causes and solutions to targeted issues through iterative discussion and reflection (Lee et al., 2017). To improve validity, consensus conference participants consist of experts in the field who have credibility with the target audience (Murphy et al., 1998). According to the literature, the optimal number of expert panelists in a consensus conference is at least six participants to be more reliable (Kea & Sun, 2015). Our consensus conference consisted of a panel of 17 experts, which is well above the recommended sample size. The expert panelists were recruited based on their expertise in HFR intervention design and management, experience in community nutrition practice, and/or experience working with low-income populations. The goal of this panel was to generate ideas, discuss disputed options, and ultimately synthesize stakeholder opinions to understand the value of the indicators for HFR implementation. The expert panelists (*N*=17) participated in three activities to prioritize the themes and indicators based on their perceived relevance and importance for successful HFR implementation. First, two or three panelists worked together to sort indicators into thematic piles. Second, the same groups selected the top three indicators within each theme pile based on their perceived importance to successfully implementing HFR projects. These rankings were used to develop a standardized indicator weight ranging from *not at all* (coded as 0) to *extremely* (coded as 5). Lastly, panelists individually assigned a weight to each theme by manually distributing 25 tokens, with more tokens indicating greater perceived theme relevance for HFR implementation. These theme weights were used to develop standardized theme weights (range: 0–1). After the consensus conference, the research team refined and/or merged themes and indicators representing similar concepts. Indicators within each theme that accounted for 80% of the total indicator weight (range: 0–1) were selected for a final set of indicators to develop a parsimonious assessment tool (see Lee et al., 2017, for details).

Through an iterative process using a consensus conference with an expert panel, results were further refined. The themes presented came from the 1,091 codes produced through qualitative data analysis. These codes were then refined into five themes and 18 indicators through the consensus conference process. The panel of experts selected the final five themes as being the most critical factors related to implementing HFR projects. These final themes included corner store awareness and perception; organizational and practitioner capacity; logistical factors; community attitudes and perceptions; and networks and relationships. The corresponding indicators and standardized weights for both the theme and indicators are presented in Table 1. These standardized weights resulted from ranking exercises conducted with the expert panel and research team.

Table 1. Final Themes and Indicators for HFR Interventions Based on Indicator and Theme Ranking Exercises Conducted with the Expert Panel and Refinement by the Research Team

Theme	Theme description	Standardized Theme Weight	Indicator	Standardized Indicator Weight
Corner store awareness and perception	Perceptions of profitability and motivators to use healthy food retail PSE projects.	0.24	To what extent do the owners of corner stores, convenience stores, or gas stations in your service area have positive perceptions about increasing healthy food options for sale in their stores?	0.41
			To what extent do the owners of corner stores, convenience stores, or gas stations in your service area perceive that healthy food retail programs would increase their profits?	0.33
			To what extent are the owners of corner stores, convenience stores, or gas stations in your service area interested in implementing healthy food retail PSE projects?	0.26
Organizational and practitioner capacity	Capacity to maintain budgets, staffing, and resources to implement and evaluate healthy food retail PSE projects in corner stores.	0.22	To what extent does your current organizational or program budget have funds to support implementation of healthy food retail PSE projects in your service area?	0.43
			To what extent does your organization have staff who are available to support implementation of healthy food retail PSE projects in your service area?	0.25
			To what extent does your current work plan include healthy food retail PSE projects?	0.20
			In the past year, to what extent did you assess the number of corner stores, convenience stores, or gas stations in your service area that have healthy food choices available for purchase?	0.13
Logistical factors	Transportation, location, and distribution and sourcing systems that are associated with implementing healthy food	0.19	To what extent is it easier for people receiving SNAP benefits and other low-income populations in your service area to access a corner store, a convenience store, or gas station by public transportation or walking compared to a grocery store?	0.39

	retail PSE projects in corner stores.		To what extent are there corner stores, convenience stores, or gas stations available in low-income neighborhoods in your service area?	0.32
			To what extent is there a distribution and sourcing system in your service area to provide corner stores, convenience stores, or gas stations with access to produce and other healthy food items?	0.30
Community attitudes and perceptions	The perceptions, awareness, and motivations in a community that affect implementation of healthy food retail projects in corner stores.	0.18	To what extent do people receiving SNAP benefits and other low-income populations in your service area have positive views of corner stores, convenience stores, or gas stations as places to buy fresh produce or other healthy food options?	0.41
			To what extent do people receiving SNAP benefits and other low-income populations in your service area have positive perceptions about the quality of produce or other healthy food options available in corner stores, convenience stores, or gas stations?	0.27
			To what extent are people receiving SNAP benefits and other low-income populations in your service area aware of healthy food retail projects taking place in your service area?	0.18
			To what extent are people receiving SNAP benefits and other low-income populations in your service area willing to use corner stores, convenience stores, or gas stations to purchase fresh produce and other healthy food options?	0.14
Networks and relationships	Social capital from which practitioners and community members can draw upon to help implement and support healthy food retail PSE projects	0.17	To what extent are you involved with or connected to other practitioners who are currently working on, or have worked on, healthy food retail PSE projects?	0.37
			To what extent are there community engagement programs available in your service area to mobilize low-income residents to become engaged in efforts to increase the amount of healthy foods for sale at corner stores, convenience stores, or gas stations?	0.26
			To what extent have you been successful at partnering with a food store owner either by yourself or through a partnership to increase their supply of healthy foods?	0.20
			In the past year, to what extent did you collaborate with food retailers to develop marketing tools (e.g., signs, point-of-purchase labels) to raise awareness about healthy food choices available in the stores?	0.17

Results

Corner Store Awareness and Perception

The corner store awareness and perception theme received the highest standardized weight (0.24). This theme refers to perceptions of profitability and motivators among corner store staff to conduct HFR projects. Within this theme are three indicators arranged from highest to lowest weights received. The first indicator refers to store owners' perceptions of increasing healthy food within their stores (weight=0.41). Overall, participants discussed concerns about store owners' ability to maintain healthy food options. One participant said, "One of the barriers that we've heard … is that … store owners were worried that the produce would go bad or … wouldn't be used" (Interview, urban).

Additionally, there is a belief that corner store owners lack time to engage in new initiatives like HFR that require an effort to rework their business model. An interviewee from a rural community expressed that corner store owners often work "double- or triple-duty" because they "have other full-time jobs and do other things." Store owners' lack of time created challenges for HFR implementation. The second indicator is the extent store owners perceive that HFR programs would increase profits (weight=0.33). Participants often discussed how store owners were "hesitant about bringing produce in because … they [weren't] sure it would sell" (Interview, urban).

The final indicator refers to the extent to which store owners are motivated to act on their interests related to implementing HFR projects (weight=0.26). While store owners may be interested in "entertaining" the idea of HFR projects, participants suggested store owners may not have a strong motivation to act on these interests. Further, there were other store-level factors identified as key to motivating engagement in HFR projects. One participant stated store owners might be inspired by "chain-wide implementation" of HFR versus a "store-by-store" approach,

> [Store owners have] been pretty adamant that they don't wanna do a store-by-store implementation type process … if they're gonna do anything [in] altering the infrastructure of their store, they wanna do it … [chain]-wide. (Interview, urban)

Organizational and Practitioner Capacity

The theme of organizational and practitioner capacity received the second highest standardized theme weight (0.22). This theme focused on organizations' and practitioners' capacity to maintain funding, staffing, and resources to implement and evaluate corner store HFR projects. Of the four indicators within this theme, the first indicator is the availability of funds within organizations to support the implementation of HFR interventions (weight=0.43). There was agreement that HFR projects required financial capital to initiate. An urban community member shared that HFR projects that were "taking off" had "additional funding and staff." Another participant discussed the use of grant funds to expand HFR projects,

> We started this [corner store] project here in 2012 with one store in the [neighborhood] . . . expanded to two more stores in 2013 and we are up to 11 stores since and we are expanding with another grant that we applied for … our goal is to help them and to do 50 stores by the end of 2017. (Interview, urban)

The second indicator is the extent to which organizations have staff available to support HFR implementation (weight=0.25). In general, participants discussed this in terms of limited staff time available to provide technical assistance to stores. One participant stated,

> I think … it's important to combine as much technical assistance as possible and . . . have that relationship with that store owner. (Interview, urban)

Another participant stated,

> We have the curriculum, we have the information, it's all research … and evidence-based, and it's not biased. We have all that. We have the expertise of how to make it work … but I guess the real problem is the time. (Interview, urban)

The third indicator is the extent to which organizations' current work plans include HFR projects (weight=0.20). A challenge identified was the balance between HFR and other nutrition-related PSE work. As a focus group participant from an urban community stated, "We have a lot going on" as they described the challenges related to concurrently supporting HFR projects and implementing other nutrition programs as well as fostering broader policy change "to make healthy foods more available and affordable and accessible in our communities." Participants also reported different phases of activity related to HFR projects. An early-stage activity may focus on ensuring a store is approved to accept food assistance benefits:

> If the stores aren't SNAP and WIC accepted … then we're gonna work to try to get them on board and get them the equipment that they need to become SNAP and WIC accepted. (Focus group, rural)

The final indicator refers to the extent to which organizations assessed the availability of healthy foods for purchase in corner stores within the past year (weight=0.13). Most participants discussed evaluating the availability of healthy foods at the community level via "health impact assessments," a survey tool to help communities, decision-makers, and practitioners make choices to improve public health through community design, or, as one participant stated,

> (We collected surveys) where we looked at the whole county related to … income levels, and looking at where the … grocery stores were located. (Interview, urban)

The same participant also discussed collecting data via community surveys,

> We looked at food access there [name of community] … and we did a community survey … and it showed that people [in] the [neighborhood] of [city] [were in] great need for … food access. (Interview, urban)

Logistical Factors

The theme of logistical factors received the third highest standardized (weight=0.19). This theme refers to transportation, location, distribution, and sourcing systems associated with implementing corner store HFR projects. Within this theme were three indicators. The first indicator refers to the extent to which it is easier to access a corner store by public transportation or walking versus a supermarket (weight=0.39). Overall, participants perceived it is easier for people receiving SNAP benefits and other low-income populations without a car to access a corner store than a supermarket. One participant stated that lack of transportation made it difficult to get to the supermarket, so people with SNAP go "to the … gas station or something where non-healthier stuff is" (Focus group, rural).

The second indicator refers to the lack of balance regarding access to supermarkets versus corner stores (weight=0.32). One participant stated,

> There's no grocery stores, so a lot of people rely on those gas stations … I have a gas station near my house, and I'm never going to find skim milk in that place. (Focus group, rural)

Another focus group participant from an urban community discussed the overabundance of convenience stores by stating, "There [are] a lot of convenience stores. No major [supermarkets]."

The final indicator refers to the existing distribution and sourcing systems that provide corner stores with access to healthy food items (weight=0.30).

> I think the biggest barrier continues to be there is not a good system of procurement for any type of food, let alone healthy food for corner stores. It is not unusual for the corner stores to … go to Costco or Sam's Club and Aldi and purchase products and bring it back and mark it up because they are going to go through 10 gallons of milk in a week and . . . the distributors … do 100 gallons or whatever it might be. (Focus group, urban)

Community Attitudes and Perceptions

The theme of community attitudes and perceptions received the fourth highest rating from the expert panel (0.18). This theme refers to the perceptions, awareness, and motivations in a community that affect implementation of HFR corner store interventions. Within this theme were four indicators. The indicator with the highest weight (0.41) refers to the extent to which people receiving SNAP benefits and other low-income individuals have favorable views of corner stores as places to buy healthy foods. Overall, the consensus was that these outlets are not the right place to purchase healthy foods. Additionally, participants discussed the challenge of changing perceptions of these stores as healthy food outlets. As one participant stated,

> Changing that perception … I think it's going to be a challenge …but I think … we can assist with marketing … and holding different community events for people. Getting the residents used to … being in the store and coming to the store [to buy healthy food], and getting to know the owner themselves [and building] rapport with the … store owner … but then also, the store owner seeing that people want to see [their] store and showing the store owner that [HFR] is not going to go to waste, and, educating him … more about food handling, and proper ways to store food [to help change perception]. (Interview, urban)

The second indicator is the extent to which people receiving SNAP benefits and other low-income individuals have positive perceptions of the quality of healthy foods in corner stores (weight= 0.27). Like the previous indicator, overall perceptions regarding quality were generally negative. As one participant stated,

> Most … corner stores, if you try to get healthier food … fruits and all that … they're not gonna take care of it better than if you had a farmer market … because … most of [their] stuff [are] rotten, no good … mushy cause they don't care. [Store owners] just don't. I don't see it'd be the best place to put healthy foods because it ain't gonna be worth it when you pay your money for it. You're not gonna get top quality. (Focus group, urban)

The third indicator is the extent people receiving SNAP benefits and other low-income populations are aware of HFR projects (weight= 0.18). Participants generally agreed that organization-level individuals were aware, but community members were not. As one participant said,

> I think the stakeholders in the communities where it is active most [are] aware, but I think the community as a whole … if you don't see fresh foods here or stores in your neighborhood, you probably aren't aware of it. (Focus group, urban)

Overall, most participants agreed that community members needed to become aware of HFR projects.

The final indicator relates to the extent to which people receiving SNAP benefits and other low-income populations are willing to use corner stores to purchase healthy food (weight=0.14). Overall, perceptions of buying healthy food from these food outlets were negative. One participant stated,

> I am not goin' to no gas station buyin' no fruit, I don't care how pretty it looks, it's goin' to be too much … the idea of sending my son down to the gas station for a basket of apples, nah, it's not for that. (Focus group, urban)

Networks and Relationships

The final theme with the lowest standardized rating (0.17) is networks and relationships, which refers to relationships and support systems that help practitioners implement HFR projects in corner stores. Within this theme were four indicators. The first refers to the extent to which practitioners are involved with or connected to other practitioners currently working on or have worked on HFR projects (weight=0.37). One participant stated,

> [We] connected with other [public health] coordinators around the state through the online list by the local organization … [to learn what] they doing and what works for them … what doesn't work. (Interview, urban)

Additionally, participants discussed the importance of connecting with community organizations or essential players in the food systems field to be successful in implementing an HFR project,

> You have to build those relationships with stores … and [with the] community … from big grocers all the way down to the corner stores … building relationships with the farmers … and distributors that you can … hopefully get healthy food into those retail outlets. (Focus group, urban)

The second indicator refers to the extent to which community engagement programs are available to mobilize low-income residents to engage in efforts to increase healthy foods in corner stores (weight=0.26). Most participants discussed engagement programs by discussing relationships with community members. One participant discussed multiple community organization partnerships in the hopes that it would increase community awareness of HFR efforts:

> It's getting … more people at the table cause we have a monthly [coalition] meeting that encompasses people from like [university], including [name of county early childcare programs] and [name of funders] and … the [name of hospital system] … and [name of coalition members] … I mean, there's a lot of different organizations. The county commissioners know about it, the city council … knows about it … family services know about it, but how do all the people in the community know about it? (Interview, urban)

The third indicator within the theme of networks and relationships refers to the extent practitioners were successful in partnering with store owners to increase HFR options (weight=0.20). Most participants stated the positive aspects of partnering with store owners as demonstrating both the success in building relationships with store owners and owners' willingness to work on HFR. One participant stated that when they have questions about selling healthy foods within smaller food outlets, they turn to store owners. Another participant discussed how their success extended beyond increasing access to healthy foods. Some were able to use the store environment for community events as well,

> There's been quite a few … active store[s] [and] owners that …helped the community … with assistance of the development corporation …they've … held different community events in their stores. (Interview, urban)

The final indicator within this theme refers to the extent practitioners collaborate with food retailers to develop marketing tools to raise awareness about healthy food within stores (weight= 0.17). Overall, participants discussed their current efforts to market not only the healthy food within corner stores but also their efforts to market these food outlets as Healthy Food Retailers:

> We can … assist with marketing … and holding different community events for people, the residents who get used to seeing, being in the store, and coming to the store, and getting to know the owner themselves. (Interview, urban)

The same participant continued to discuss how they hope to help with the marketing of healthy foods,

> We're hoping to put better signage around healthy foods in the windows and … around the healthy food areas. [Help] to make the, um … displays greater [for healthy foods]. (Interview, urban)

Discussion

This study reveals five themes considered the most critical factors related to implementing HFR projects. These themes were: corner store awareness and perception; organizational and practitioner capacity; community attitudes and perceptions; logistical factors; and networks and relationships. Additionally, 18 indicators were identified within the five themes that illustrate influential factors related to the implementation of HFR projects. The highest-rated indicator(s) for each domain included organizational budget for HFR projects and store owners' perceptions of increasing healthy food options for sale in their stores; availability of staff to implement HFR projects; community members' perceptions of corner stores as HFR settings; community members' ability to travel to a corner store compared to a supermarket; and connections to other practitioners who are currently working on or have previously worked on HFR projects.

PSE strategies for HFR interventions have become increasingly recognized as a potential solution to reduce overweight and obesity trends (Adam & Jensen, 2016; Gittelsohn et al., 2012). In practice, HFR interventions are more likely to be successful when there is funding to provide adequate technical assistance to retail food outlets, in addition to funding tailored intervention strategies (Caspi et al., 2016; Greco et al., 2020; Laska et al., 2009; Rushakoff et al., 2017). With this, there needs to be buy-in from retail food outlets and community members (Haynes-Maslow et al., n.d.; Houghtaling et al., 2019; Martinez, Rodriguez et al., 2018). Study findings demonstrate that organizations are receiving funding for HFR, demonstrating their value to practitioners, organizations, and the broader community. However, the findings highlight that funding should be used to develop and implement HFR interventions and build store owners' relationships. By building relationships with owners, program staff can identify intervention methods to stock and/or promote healthy foods that align with an owner's goals, business model, and resources (Houghtaling et al., 2019).

Like previous research, another significant finding from this research is community members' perceptions (Blitstein et al., 2012). Community support is essential to HFR interventions' success, given that retail food outlets are primarily driven by consumer demand and profits (Bodor et al., 2010). If healthy foods are not selling, store owners may choose to replace those foods with unhealthy products. Participants in this study perceived healthy foods in corner stores to be of low quality. This perception is consistent with previous research examining the quality of healthy foods in small stores and nontraditional retail food outlets, which found these foods low quality than supermarkets (Block & Kouba, 2006; Cummins et al., 2008). The low quality of healthy foods in small stores and nontraditional retail food outlets demonstrates the need to train corner store owners to select, stock, and maintain healthy foods (Karpyn et al., 2018). After this skill is attained and mastered, PSE and in-store promotional strategies, such as choice architecture strategies (Bucher et al., 2016; Thorndike & Sunstein, 2017), can occur to promote these foods.

Utilizing corner stores as settings for HFR is essential, given that a significant barrier to shopping at a supermarket for community members is a lack of transportation. Lack of transportation has been cited as a barrier in previous community food environment research (Walker et al., 2010b). Utilizing existing retail food outlets versus opening a supermarket may be a more realistic and cost-effective approach to improving a community's food environment (Cameron et al., 2016). Previous research has demonstrated that opening a supermarket in a food desert did not improve healthy food purchasing, potentially showing the importance of PSE and in-store strategies within existing retail food outlet spaces to encourage healthy food purchasing (Cummins et al., 2014).

Other significant findings from this study relate to organizational capacity to implement HFR interventions. Like the need for HFR funding, participants stated the need to focus on HFR and the need for connections to other practitioners who are currently working on or have previously worked on HFR projects. Making such connections may help to build strategic partnerships with academic and/or community partners who are savvy in the topic of HFR to support development and implementation (Holden et al., 2016). Strategic partnerships can help identify areas of need and provide implementation support. Still, such partnerships can also mean tapping into others' expertise and gaining insight into their lessons learned to develop evidence-based HFR interventions successfully. As found in previous research, the provision of resources and skill development training is needed to identify, build, maintain and strengthen strategic partnerships (Shah et al., 2019).

Implementation of HFR interventions involves a balancing act of improving the overall food environment (e.g., the increased supply of healthy foods) within retail food outlets as well as creating consumer demand for healthy foods (Karpyn & Hannah, 2013; Pitt et al., 2017). Recent research has identified multiple points of intervention that affect the environment within retail food outlets, ranging from the managerial-level (e.g., lack of knowledge among store owners to source and maintain healthy foods) to the infrastructure-level (e.g., limited in-store space to stock healthy foods) (Houghtaling et al., 2019; Karpyn & Hannah, 2013). Parallel efforts should occur to encourage healthy food purchasing among consumers to increase demand. Actions could include improving customer service to build stronger relationships between retail food outlet staff and consumers (Sanchez-Flack et al., 2016; Webber et al., 2010), marketing mix strategies (e.g., strategic placement) to nudge consumers to purchase healthy foods (Castro et al., 2018), and assisting retail food outlets with becoming certified nutrition assistance program vendors (DeWeese et al., 2016).

Findings from the present study highlight the need to provide technical assistance to practitioners and store owners to implement HFR interventions. Practitioners reported barriers to building relationships with store owners and building relationships with other practitioners with HFR intervention experience. Providing practitioners with the skills to build relationships with store owners means assisting them first in connecting with other practitioners. Practitioners with HFR intervention experience have critical insight into how to reach and engage store owners. Potential strategies to connect practitioners may be through networking events or roundtable discussions at conferences or organizing a national meeting where practitioners awarded an HFR grant can meet one another and discuss their work.

Efforts should also be conducted to get successful support and buy-in from store owners. Gaining their support may assist in the relationship-building process. Referring store owners to publicly available tools and resources about HFR may help them understand these programs and what it means for their business. It may also encourage highly motivated owners to independently implement suggested strategies to promote healthy foods within their stores. Supporting store owners in HFR through publicly available resources, providing technical assistance, and strategic partnerships can lead to changes within the consumer food environment, changing the community's perspective towards corner stores, convenience stores, gas stations, and the like HFR outlets.

There were limitations to the present study. Participants represented different geographic areas of Ohio, which may reduce generalizability to other regions of the U.S. The expert panel's views may not reflect the full range of perspectives and experiences, as we did not interview food store owners and managers, about HFR interventions, which would impact the weights assigned to indicators and themes. Additional research may replicate methods with different stakeholders, including food store owners and managers, to gain consensus on the theme and indicator weights. Our interview and focus group guides solely focused on fresh fruit and vegetables for HFR interventions and neglected to consider other viable, healthy food options such as no- or low-sodium canned or frozen fruit and vegetables, thereby potentially limiting our findings in terms of HFR interventions targeting other forms of healthy foods.

Furthermore, the psychometric properties of indicators were not assessed and may be a potential avenue of future research. Facilitators of and barriers to implementation of HFR from the perspectives of experienced stakeholders have been operationalized into measurable indicators, resulting in the creation of PSE READI (Readiness Assessment and Decision Instrument tool (Building Capacity for Obesity Prevention, 2016). The online tool for practitioners helps assess community readiness and capacity to implement HFRs suiting the local context.

Conclusions

Designing, deploying, and evaluating HFR interventions is complex, detailed work. It requires understanding needs, fostering relationships, and building trust among stakeholders ranging from store owners, residents, and distributors at the community level, to funders, local health departments, and universities at the institutional level. Conducting informed groundwork for the effective launch of HFR strategies may be a resource-intensive and nonlinear work process but is crucial to success. The themes and indicators presented in this research have been synthesized into the PSE READI tool. Unlike many currently available HFR toolkits that offer a generalized approach to HFR interventions, the PSE READI tool provides an opportunity to assess, tailor, and implement HFR plans for local contexts by considering the key themes and influential factors that emerged from our research.

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Access to foods using Grand Rapids, Michigan, as a case study: Objective versus subjective issues

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Abstract

Low access and low income are two of the primary factors used in determining the food desert designation by the U.S. Department of Agriculture. Low access is defined as a geographical area where 33% or more people are living beyond one mile from a supermarket in an urban region, and a low-income area is defined as one with a poverty rate of either 20% or more, or median family income falling below 80% of statewide or metropolitan area family income. These criteria have been in place for several years now. This study aims to assess the adequacy of these criteria for food desert designation and further investigate perceptions of barriers to fresh and healthy foods and measure physical 'access' for those reliant on the public transportation in the city of Grand Rapids, Michigan. The study includes a preliminary price comparative analysis of selected fresh foods in local grocery stores, spatial mapping using GIS to measure accessibility, and interviews with families at three schools located in food desert census tracts. Results of this study indicate that, first, there are other factors to consider when designating areas as food deserts such as public transit availability and inclusion of alternate food retail stores where fresh and healthy foods may be purchased, and secondly, perceptions of barriers to access fresh and healthy foods for families depend on mobility and cost preferences. Implications include a greater awareness of transit availability, alternate venues, acceptance of federal benefits such as SNAP-EBT, and incentivizing existing stores to sell healthier produce in disadvantaged areas.

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Keywords
Food Deserts, Food Access, Alternative Grocery, Public Transit, Perception of Barriers

Background and Introduction

The U.S. Department of Agriculture (USDA) defines a food desert as an area composed of predominantly low-income neighborhoods and limited access to affordable and nutritional foods measured at a census-tract level (Liese et al., 2014; USDA Economic Research Service [USDA ERS], 2009). It further specifies metrics for defining low access in an urban region as a geographical area where 33% or more of residents are living more than one mile (1.6 km) from a grocery store or supermarket. It defines low income as a poverty rate of either 20% or more, or median family income falling below 80% statewide or metropolitan area family income (Ploeg et al., 2011; USDA ERS, 2009). Therefore, physical access to healthier food and affordability primarily are considered as benchmarks for identifying an area as a food desert (Liese et al., 2014; Walker et al., 2010). In 2017, the USDA reported that one in eight people in America, or 11.8% of American households, had 'low' food security, and 4.5% of households had 'very low' food security; that is, they lacked adequate financial resources and access to purchase affordable food at a grocery or supermarket (Coleman-Jensen et al., 2018; Hunger + Health, Feeding America, n.d.). The USDA differentiates between 'low' and 'very low' food security by considering quality, variety, or desirability of healthy foods and multiple other factors such as disrupted eating patterns and decreased food consumption (USDA ERS, 2009).

Access to foods is researched as a function of distance to grocery stores (Apparicio et al., 2007; Michimi & Wimberly, 2010), cost, and quality of food (Wolf et al., 2005; Wetherill & Gray, 2015). Research by Hilbert et al. (2014) included costs of both travel and products to get at the "true" expenditure on access to fresh and healthy foods. Overall, the physical distance measured is either from a census tract or block group's centroid or from the center of a supermarket or a grocery store (Jiao et al., 2012; Apparicio et al., 2007). Moreover, a straight-line (Euclidean) or street network distance is used to measure distance between a selected area and a supermarket (Jiao et al., 2012; Sharkey & Horel, 2008). Studies utilize socio-economic characteristics such as race, income, educational attainment, and employment to assess food insecurity and access to fresh produce (Njai et al., 2017 ; Walker et al., 2010). Poorer neighborhoods have almost half the access to fruits and vegetables and nearly 30% fewer supermarkets than higher-income neighborhoods (Wetherill & Gray, 2015; Walker et al., 2010). Respondents with more than four years of college education are more food-secure than high-school graduates, and the least food-secure are those who do not have a high-school degree (Njai et al., 2017). White populations have perceived higher food security than other groups, including non-Hispanic whites, Blacks, and Hispanics (Block et al., 2004; Bower et al., 2013). However, Morland, Wing, and Roux (2002) found that with every unit increase in supermarkets, Blacks improved their fruit and vegetable intake by 32%, and whites improved by a mere 11%. Therefore, the notion of access to foods requires further investigation on the type of access and perceptions of barriers to access for a community.

Solutions to improve access to healthy foods have been linked to encouraging farmers markets, farm stands, food hubs, corner stores, and community gardens in neighborhoods in food deserts. However, some researchers have argued that the results of including alternate food retail in a neighborhood are inconsistent as it tends to depend on the context and the type of community (Alkon, 2012; Wetherill & Gray, 2015; Njai et al., 2017). Farmers markets have a higher quality produce that offer good value for money, especially for regular patrons who are commonly females, 45 or older, affluent, with at least some college education, married, and identify as white (Alkon, 2012; Wetherill & Gray, 2015; Wolf et al., 2005). Urban gardens are perceived as a nutrition intervention for urban residents facing barriers to achieve healthier diets by addressing limited availability to fresh produce and improving their long-term eating and consumption habits (Alaimo et al., 2008; Hoover, 2013). A farmers market in a low-income and racially segregated community is perceived to have lower acceptability by minorities stemming from the concept discussed by Julie Guthman (2008) as "whiteness," in addition to barriers of cost, convenience, and safety (Wetherill & Gray, 2015). Small grocery and corner stores face poor demand to stock fresh produce at prices that are comparable to supermarkets (Pothukuchi, 2016; Raja et al., 2008). Some research has also found that studying a neighborhood food environment (within walking distance of a consumer) is insufficient to understanding the grocery shopping behavior and consumption of the low-income household's supermarket shopping pattern, as they often go outside their environment in search of 'maximizing their food dollars' (Gittelsohn et al., 2008; LeDoux & Vojnovic, 2013). Therefore, racial segregation and cultural differences may influence the purchasing habits of people living in the same food desert area (Ver Ploeg et al., 2009).

Government programs in the U.S. such as the Supplemental Nutrition Assistance Program (SNAP) have close to 30 million people dependent on the subsidized benefits to purchase healthier nutritious food. Michigan is ranked first in the Midwest and tenth in the nation with the highest number of enrolled SNAP recipients at 615,000 (Statistical Atlas, 2018). Michigan also provides 'double-up' benefits for SNAP recipients, who can purchase fresh produce at farmers markets and other participating local food retailers to get double the amount of produce with the same amount of money (Goddeeris et al., 2017). The community-scale interventions, such as alternative payment options at local farmers markets and convenience stores, incentivize residents to purchase affordable, healthy, and nutritious foods by reducing the transportation cost and by bringing the retail source closer (Njai et al., 2017). Limited awareness about such benefits in low-income neighborhoods is a deterrent for purchasing from local farmers markets. Affordability, convenience, and safety are the other reasons recorded during focus group discussions about the benefits of these nutrition assistance programs (Wetherill & Gray, 2015).

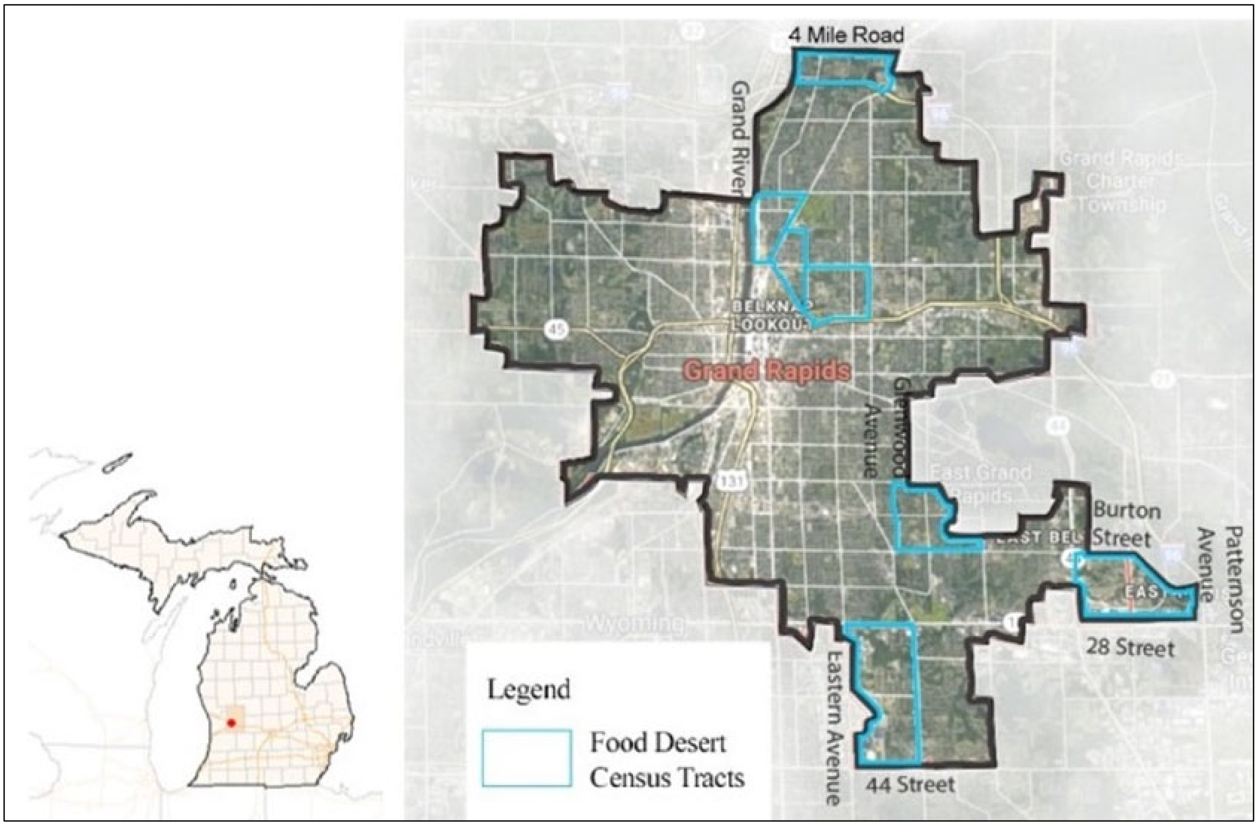
The aim of this study is to systematically combine multiple facets of food deserts research that have been studied by various researchers separately and get a sense of the perception of barriers to accessing fresh and healthy foods in the midwestern city of Grand Rapids, Michigan. As the second-largest city in the state, it is ranked sixteenth in the number of SNAP enrollees and has the highest number of SNAP recipients located in southwest Michigan, with just over 20,000 married families with children (Statistical Atlas, 2018; U.S. Census Bureau, 2019). The city also introduced a free bus service called Downtown Area Shuttle (DASH) that connects key downtown nodes and runs on all days except Sunday at a frequency of 8 minutes (The Rapid, n.d.). Furthermore, the research dives into the socio-economic factors contributing to the identification of census tracts as food deserts in 2010 and 2015 and conduct interviews to determine the purchasing behavior and expenditure for families living in and around food deserts. This research also discusses policy interventions to improve the local food environment by improving access to fresh and healthy foods. Conducting this research in Grand Rapids helped explore barriers to accessing fresh and healthy foods using mixed methods and discuss opportunity to improve the perceptions of inaccessibility to parallel the efforts of community residents to improve their food environment.

Materials and Methods

Data

This project uses data from the 22 census tracts that make up the city of Grand Rapids, with 13 supermarkets with full-service grocery section and household items within the city limits. A preliminary retail price analysis was conducted on selected produce items at 11 food retail stores that were operating at the time of the study. Then, the study investigated the percentage change in socio-economic characteristics with food desert status of the census tracts that were low income and had low access to foods. Food desert data on low income and low access census tract-level information was retrieved from the USDA Economic Research Service (ERS) online portal, Food Environment Atlas (see Figure 1) (Bao, 2017; Wadlington, 2017). The census-tract–level socio-economic information for Grand Rapids was accessed from the U.S. Census Bureau for 2010

Figure 1. Map of Grand Rapids, Michigan; Inset Shows Designated Food Desert Census Tracts in 2015



and the American Community Survey (ACS) for 2015/2016. For the spatial analyses, we obtained the transit route, bus stops, and streets layers from the Grand Rapids Open Data portal, while a complete list of mailing addresses for all residential locations in all the food desert census tracts was acquired from a private mailing list company called Melissa Data. Additionally, the information on alternate retail stores, including farmers markets, community farms, and grocery stores, was retrieved from the MSU extension office database in order to conduct the spatial analysis for the year 2015. This data for 2010 could not be verified and therefore have not been used. The study excluded convenience stores and gas stations as alternate retail stores as these have limited fresh and healthy foods

This information was imported into ArcGIS to map onto the 2010 and 2015 food deserts recorded from the Food Environment Atlas. Analyses included mapping the socio-economic characteristics by block groups in the food desert-designated census tracts for a more nuanced understanding of the residential make-up of the tracts, as well as determining whether residents were within a walking distance (quarter mile) from a bus stop to analyze their access to grocery stores, especially if they did not own a vehicle. We also mapped one mile buffers (radius) around all grocery stores (including alternate stores where fresh produce can be purchased) to see how much of the food desert census tracts were included in these buffers.

After identifying food deserts based on secondary data, the research team conducted interviews at three schools located in the food desert area using a convenience sampling method. After being granted permission from school authorities to be present on family nights and parent-teacher conference nights, the parents were interviewed on their perception of barriers to access fresh and healthy foods (Gustafsson & Sidenvall, 2002; MacNell et al., 2017). This allowed the research team to reach families who could be living in the food desert–designated census tracts and get their opinions on perceived barriers to accessing healthy foods and assessing expenditure on fresh and healthy foods in stores located in food desert census tracts versus those outside (Dubowitz et al., 2015; Hendrickson et al., 2006; Walker et al., 2010). Additionally, the team canvassed some of the census tracts designated as food deserts to conduct interviews with residents. To understand the difference in the responses collected, participants who were residing in the food desert census tract were referred to as the "selected group" and the results were compared to the entire study sample, which also included residents from non–food desert designated census tracts (especially those families that lived elsewhere but whose children attend the selected schools in the food desert tracts).

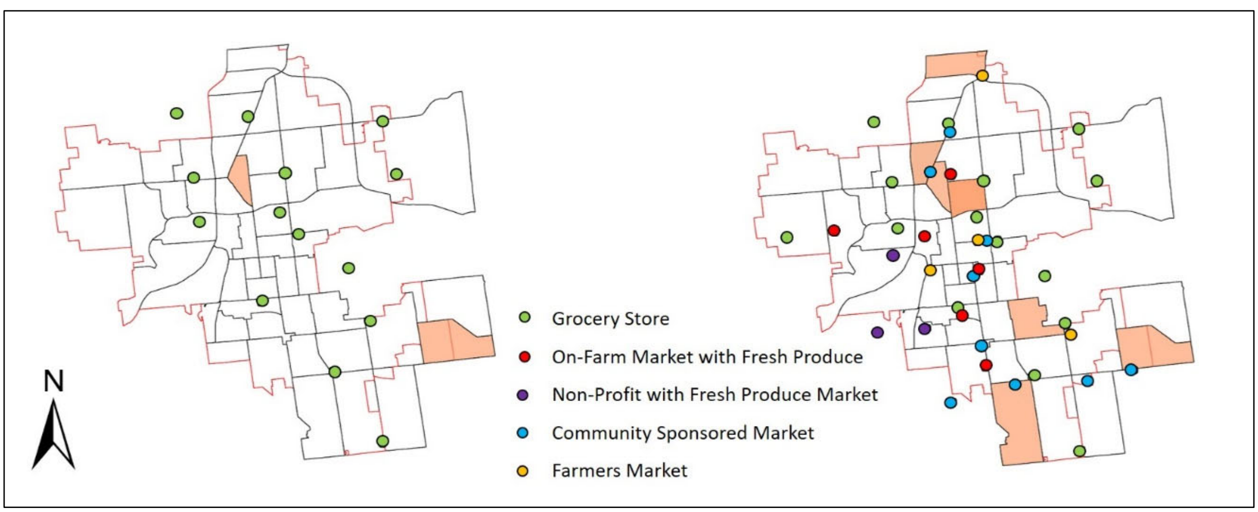
The survey instrument questions such as "how often do you go grocery shopping?" "how much do you spend at the grocery store on average per trip?" and "what, in your opinion, prevents you from accessing and purchasing healthy fresh foods?" were posed after looking at similar published food access surveys (Evans et al., 2015; Mushi-Brunt et al., 2007). Respondents were also asked to list up to five stores where they regularly shopped for groceries and food products, and their address or the intersection closest to where they resided. This information was mapped in ArcGIS, and the distance traveled to access the grocery store was evaluated. This survey was also translated in Spanish and Arabic in order to engage members of ethnic minority groups who may live in the food desert–designated tracts but who did not read or understand English. The interview questionnaire was made available on Qualtrics for those who could not take part in the study at the venue. The research team also used Qualtrics to compile all the responses online. The respondents at schools received some fruit as a thank-you for participating, and interviewees reached in the food desert census tract received a US$5 gift card to a local grocery store in the area. This study is approved and determined to be exempt by the Michigan State University Institutional Review Board, STUDY00001539.

Results

Food Desert Identification

Figure 2 is a combination of USDA-identified food deserts and author-identified grocery stores or supermarkets for 2010 and 2015. The 2010 map of Grand Rapids shows two census tracts as food deserts and 11 supermarkets or grocery stores. The 2015 map shows seven census tracts as food deserts and 13 supermarket or grocery stores. The city underwent an increase in food desert area by 2.5 times from 2010 to 2015. Additionally, alternate retail stores were also marked on the 2015 map of

Figure 2. Grand Rapids 2010 (left) and 2015 (right), USDA Defined Food Deserts with Existing Supermarkets and Alternative Food Retail Stores



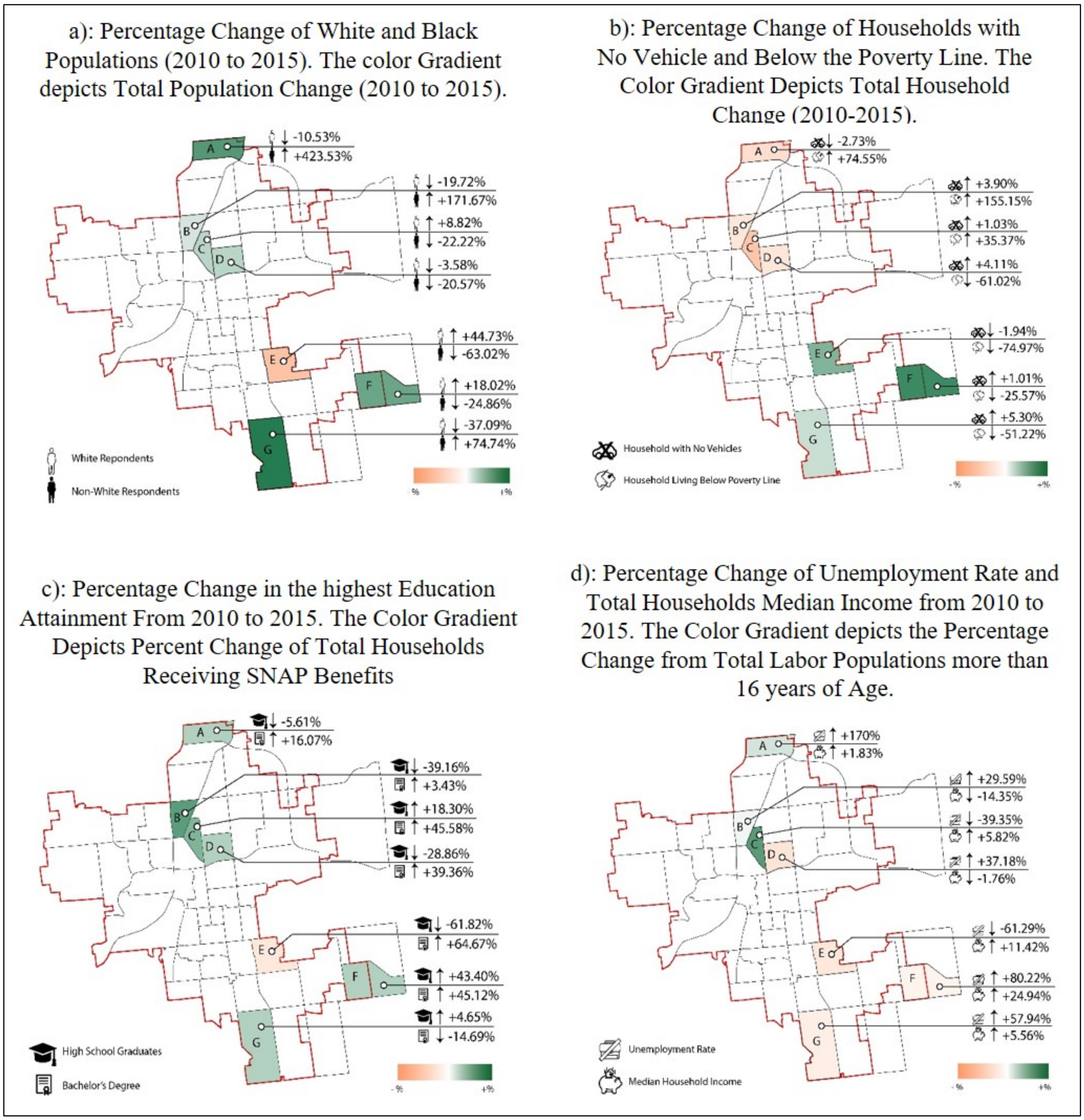
Grand Rapids. Figure 2 shows that the alternative retail stores are concentrated mainly in the middle and western edge of Grand Rapids.

Role of Socio-Economic Variables

The data for each census tract were assessed based on percentage change for each socio-economic variable from 2010 to 2015. The results of the socio-economic analysis are visually represented in Figure 3.

Seven census tracts were designated as food deserts in 2015 as per the USDA parameters of low income and low-access. Out of these, only two were designated as food deserts in 2010. In 2010,

Figure 3. Change in Socio-demographic Characteristics from 2010 to 2015*



* The red outline shows the city of Grand Rapids and the black dotted lines show the census tract boundaries

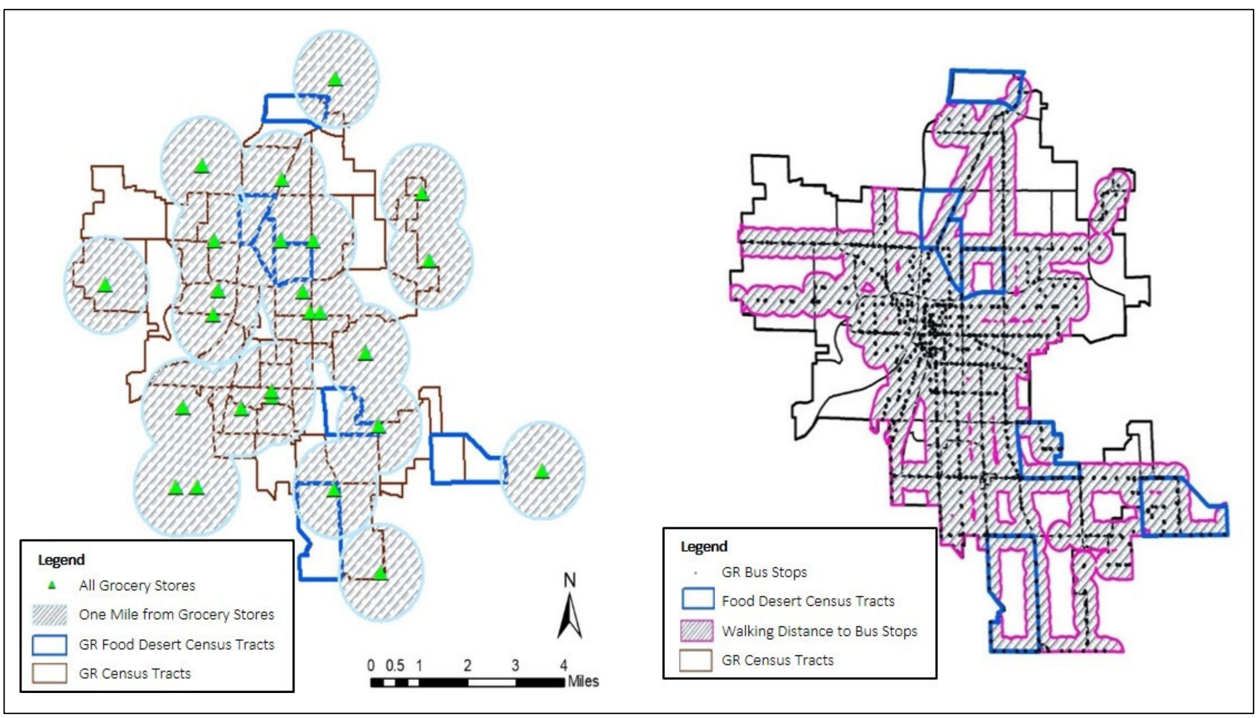
Tract C could have been a food desert because of the number of persons living below the poverty line (35.37%) and households receiving SNAP benefits (9.58%). Tract F also showed a higher unemployment rate compared to other census tracts and comparative median income and total labor numbers, which could have been the reason for its food desert status. However, further spatial analyses are necessitated to include alternate fresh produce stores to see if more than 33% of the population according to the parameter defined by USDA was residing more than one mile from a grocery store (USDA ERS, 2009).

The five new census tracts that became food deserts in 2015 are Tracts A, B, D, E, and G. Since unemployment rate is directly related to the median income of an area, the increase in the unemployment rate in Tract A could explain its designation as a food desert. Tracts B and D could be explained as food deserts due to their increased unemployment rates and decreased median income. In Tract G, an increased unemployment rate with only a marginal increase in median income could have still classified it as a food desert in 2015. Therefore, an increased unemployment rate could be a vital socio-economic indicator to underscore the emergence or existence of a food desert for future research. However, Tract E became a food desert in 2015 even with overall improving statistics. This is the only tract where the total population decreased between 2010 and 2015. Therefore, corroborating the food desert identification for this tract was similar to a myth for the researchers from socio-economic standpoint. One way to substantiate the food desert status for Tract E could be to understand market decline in the neighborhoods, possibly due to other alternate retail stores opening outside the neighborhoods, and the probability of the population living more than one mile away increasing. There is only one grocery store on the low-density southeast side. Therefore, the majority of the population could be concentrated away from the store. Hence, we conducted spatial analysis to investigate barriers to access fresh and healthy foods for this community.

Spatial Analyses

Figure 4 shows a more detailed look at race and income for the city and the food desert–designated census tracts (outlined in blue). In general, the

Figure 4. Areas within 1 Mile of a Grocery Store(Left) and 5 Minutes of a Bus Stop (Right)



northern half of the city has a greater proportion of white and wealthier residents than the southern half of the city. The areas that have higher percentages of Black residents also have lower household incomes.

Alternative food retail stores, grocery stores, or stores that sell fresh and healthy produce were also added to our maps for spatial analyses. The addition of these show that more of the food desert–designated census tracts are covered within a one-mile radius of these stores, so including more food retail points makes sense when assessing whether people can get to fresh and healthy produce. Accessibility to a grocery store and the designation of an area as a food desert if there is no grocery store within a one-mile radius seems less practical when residents may not have access to a vehicle and accessing a grocery store while commuting to or from work is also not feasible for them. Therefore, we assume that residents in food desert tracts who do not have access to a vehicle are critically reliant on public transit. Figure 5 shows that once other grocery stores are added to the map, many parts of food deserts get incorporated into that one-mile radius from the grocery store. This is beneficial when the residents in those food desert areas that get covered in this buffer do not have issues with access to a vehicle. A comfortable walking distance that people are willing to undertake is a quarter mile, which translates to a five-minute walk (Atash, 1994; Steuteville, 2017; Yang & Diez-Roux, 2012). When public transit routes and bus stops are added to the map, Figure 5 shows that this five-minute walking distance to a bus stop area includes most of the food desert tracts. We infer that someone with a lower income and no access to a vehicle would be willing to walk five minutes to get to a bus stop that would then take them to a grocery store nearby. Grand Rapids has introduced DASH, which are fare-free bus routes that connect downtown residents to multiple destinations in the center of the city, but these routes are not useful for the food desert census tracts as these are far from the city center. Therefore, the fare-free routes do not contribute to the solution of access to healthy foods for affected residents. A comparison of retail prices of randomly selected grocery items such as apples, bananas, spinach, beans, and carrots was done at all the stores in the study and we found no one store that consistently had higher or lower prices (refer to Table 1). The range of prices varied but at small rates, indicating that no one area was at

Table 1. Supermarket Prices of Common Produce Items Selected

Comparative average prices not noted if more than 3 unavailable items. Pink shading denotes highest prices, while blue shading denotes lowest prices by product.

Supermarkets	Apples (per pound)	Bananas (per pound)	Spinach (per 8 ounces)	Green Beans (per pound)	Raw Carrots (per pound)	Average Price
Diamond Place GFS Grocery Store	$1.89	$0.39	$3.99	$2.59	$0.89	$1.95
Family Fare Supermarket	$1.49	$0.49	$2.75	$3.49	$0.99	$1.84
Fresh Thyme Farmers Market	$0.99	$0.79	$2.00	$2.49	$0.89	$1.43
Fulton Street Farmer's Market	$1.50	N/A	N/A	N/A	$3.00	N/A
Great Giant	$2.99	$0.59	$2.49	$4.00	$0.96	$2.21
Harvest Health Foods	$1.79	$0.49	N/A	$1.99	$1.99	$1.57
Horrocks Market	$0.99	$0.54	$2.99	$1.99	$0.90	$1.48
Ken's Fruit Market	$0.79	$0.39	$2.69	N/A	$0.79	$1.17
Kingma's	$0.99	$0.59	$2.99	$2.49	$0.66	$1.54
Our Family	$1.49	$0.54	$2.69	$2.99	$0.99	$1.74
Urban Roots	$1.50	N/A	N/A	N/A	$1.50/$1.75*	N/A

* Residents/outside.

a greater disadvantage where access to fresh and healthy produce was concerned, when taking cost of produce into account.

Lastly, spatial proximity analyses show that while almost 59% (6,602) of the 11,173 residents who live in the seven food desert–designated census tracts fall within the one-mile buffer from the nearest grocery store, almost 75% (8,275) of these fall within a quarter mile radius of a bus stop. However, those residents living in tracts identified as having low access to a vehicle would not be able to get to the grocery store even if they lived within a mile of it. Therefore, accessibility should be understood as not only being dependent on a personal vehicle but also being afforded through public transit availability. Of the 26 routes in the Grand Rapids public transit system (The Rapids), 21 offer access to a grocery store. Thus, those residents who live in tracts designated as having low access to a vehicle need to be close to bus stops, rather than being within a mile from the grocery store. Results indicate that about 17% (1,900) of residents (out of a total of 11,173 living with food deserts) are disadvantaged, as they live in areas with low access to a vehicle and further than a five-minute walk from the nearest bus stop (so only vehicle and transit availability is taken into consideration here). However, just under 9% (964) of the residents living in the food desert–designated census tracts (designated by the USDA based on their low income and the fact that they live further than one mile from the nearest supermarket) live further than both metrics: one mile from a grocery store and a five-minute walk to a bus stop. Thus proximity to a grocery store and transit is taken into consideration here. These objective means of assessing access to fresh and healthy produce stress the notion that there needs to be some other inquiry into food deserts and the systemic problems with accessing fresh and healthy foods. This study took to interviews with residents as the next step in identifying perceived barriers to accessing foods.

Interview Results

From a total of 65 study participants, 13 were living in food desert census tracts (refer to Figure 2 for the location of these food desert census tracts and refer to Table 2 for some descriptive data on these participants). In all, over half (53%) of study participants living in the food desert–designated census tracts said they did not face any barriers to accessing fresh and healthy produce, compared to 62% of all those interviewed. Twenty-five percent of the participants reported having an annual household income less than US$25,000, whereas less than 8% reported having the same income range in the food desert tracts. More than 95% of the study participants had access to a car. Thirty-six percent of respondents who travel by car for their grocery shopping (n=61) said they faced barriers to accessing fresh and healthy foods, and 75% of respondents who use other modes of travel (n=4) reported facing barriers to access fresh and healthy foods. With the city of Grand Rapids' efforts in improving accessibility for all, this city has been able to address the transportation barrier for some members of minority populations; however, this remains to be further studied to analyze its use and efficacy.

Respondents from the group of participants who lived within the food deserts spent more on average per week for groceries, prepared meals, and eating out compared to all respondents, although this difference was not statistically significant. Fifty percent of white respondents who perceived barriers (n=8) spent more than US$100 on average per week on groceries while only 17% of Black respondents who faced barriers (n=12) spent greater than US$100 on average per week on groceries. Even with nutrition assistance, people living in food deserts tend to spend more on groceries than those who are not living in food deserts.

Overall, of those who reported facing barriers to accessing fresh and healthy foods (n=25), two-thirds were non-white respondents and one-third were white respondents. Affordability was the main perceived barrier for the majority of the households on SNAP or some food and nutrition assistance and by non-white respondents. Additionally, access to seasonal produce and awareness about local food retail entities were also identified as barriers to consuming fresh and healthy produce. The average travel distance for the overall group was 3.9 miles (6.3 km), whereas for the group living in the food deserts, it was 4.1 miles (6.6 km). The distance was marginally longer (0.2 miles or 0.3 km);

however, this difference is not statistically significant. This part of the study indicates that even with access to fresh and healthy produce being identified through the spatial analyses, some residents still perceive that there are barriers that prevent them from acquiring produce, and costs and lack of awareness of produce availability were the main barriers identified.

Table 1. Interviewees' Socio-demographic Data and Expenditures on Groceries, Prepared Meals, and Eating Out

Some figures have been rounded

Socio-Demographic Variable	Survey Participants	Selected Group
Population (*n*)	65	13
Gender		
Male	18%	23%
Female	82%	77%
Race		
White	45%	70%
Black	43%	23%
Others	12%	7%
Number of Household Members		
0 to 2	23.5%	31%
3 to 5	62.5%	46%
More than 6	14%	23%
Children at home		
0	19%	31%
1	28.5%	23%
2	28.5%	23%
3	13%	8%
4 or more	11%	15%
SNAP-EBT Users	16%	8%
Perceive Barriers to Access Fresh and Healthy Foods	39%	46%
Vehicles at home		
0	3%	0%
1 or more	97%	100%
Education		
High school graduate or less	30%	31%
Some college credit/no degree	34.5%	54%
Bachelors	17%	8%
Graduate degree	18.5%	8%
Employment		
Employed for wages	66%	61.5%
Self-employed	14%	15.5%
Others	20%	23%
Number of Grocery Trips per week		
Less than twice	79%	85%
Three to five times	18%	15%
Six or more times	3%	0%
Average Expenditure on Groceries per trip	$106	$112
Expenditure on Prepared Meals per week	$29	$33
Expenditure on Eating Out per week	$35	$42

Discussion

This study brings out a few things. First, the objective measures used to designate food deserts need to be revisited. The designation comes from a federal agency—the USDA—and so their designation is an important first step in many research endeavors related to food access. If this first step is revised or improved, research starts off on a better note and we get to the underlying structural issues directly. Access to supermarkets is a good starting point for fresh and healthy produce; however, residents usually frequent stores based on many other factors as well (Bailey, 2010; Caspi, Sorensen, et al., 2012; Gittelsohn et al., 2008; Ledoux & Vojnovic, 2013; National Research Council, 2009). Access to alternate food retail markets, including farmers markets, should be considered apart from supermarkets when designating census tracts as food deserts (Evans et al., 2012; Kwate, 2008). Our results show that with the addition of alternate food retail stores, about 59% of residents fall within the one-mile radius of grocery stores. That still leaves about 40% of residents as being disadvantaged. In this study, some of the new alternate retail stores were found to be on the geographical edges of the food desert census tracts and not located in the food desert area except in a limited number of cases. Presently, there is a greater percentage of alternate food retail stores in comparatively more affluent neighborhoods than the ones which were identified as food desert in 2015, which is consistent with the food market tendency of setting up in economically stronger neighborhoods (Zenk et al., 2006). This strategic location for the alternate food retailers suggests that the efforts to bring these food retailers in close proximity to areas of low income and low access to healthy foods still fail to capture the entire census tract where their need is most vital (Kwate, 2008).

Apart from including alternate food retail stores, we must also consider travel modes other than the personal vehicle. Those with no access to a vehicle inherently will be reliant on public transportation. Results of this study showed that once we included the transit routes and bus stops into the spatial analyses, 75% percent of the residents in the food desert–designated census tracts had access to a grocery store. Combining the alternate stores and public transit, 91% of residents in food desert census tracts had access to a grocery store with fresh and healthy produce.

Second, this research brings forward the structural imbalances in resident classes and racial groups, since minority groups reported a greater barrier to accessing fresh and healthy foods than white residents living in the same food desert–designated census tracts, echoing research findings from Kwate (2008). Interviewees living in the food deserts areas reported fewer trips to the grocery store per week and higher expenses per trip compared to interviewees living outside the food desert tracts. These interviewees also reported higher expenditures on prepared meals and eating out, supporting findings by other researchers on the topic (Alwitt & Donley, 1997; Chung & Myers, 1999). Affordability and awareness of alternative venues for accessing fresh and healthy foods were the greatest barriers reported. Since most respondents reported having access to a private vehicle and being five minutes from public transit, the objective measures of access do not seem to be the issue as much as the subjective measures of access, more specifically cost and awareness of availability and acceptance of SNAP benefits, echoing the findings by Caspi, Kawachi, et al. (2012). Research often proposes objective measures of access, such as distance to stores, time spent in travel to stores, costs associated with travel to stores (whether they be personal costs for using a car or costs associated with public transit), and costs associated with buying a set of products from stores (Hendrickson et al., 2006; Walker et al., 2010). As reflected by Ver Ploeg et al. (2009) as to the importance of race and cultural differences in food purchasing habits of residents, this research adds knowledge on the topic by asking residents about their perception, as urged by Usher (2015), of barriers to accessing fresh and healthy produce after analyzing the objective measures of access.

This study has a few limitations. First, the study could not access data on supermarkets and grocery stores that closed or opened between 2010 and 2015 to analyze whether that played a role in the change of food desert designation. Second, the sample size for interviews in this study is comparatively small, and therefore cannot be generalized for the entire city. Third, ethnic minorities may have not been fully represented in the selected group due to language limitations and respondents with children may have been overrepresented during the interviews that were conducted in primary schools. Lastly, the distances used in the spatial analyses were radii from the point of interest (grocery store or bus stop) rather than network-based travel distances. However, similar patterns of food desert characteristics such as income, employment, education, and race are visible in its urban fabric.

Conclusions

This research delves into the nuances involved when assessing access to fresh and healthy foods. Grand Rapids, Michigan, with its geographic divide created by the Grand River and industrial complexes, has long-standing racial and ethnic segregation. The results of the qualitative analyses in this study show that minority groups perceived a greater barrier to accessing fresh and healthy food than whites, even when living in the same census tracts. This research also showed that that access to food involves more than just supermarkets and driving distances to such supermarkets. It involves, perhaps more importantly, inclusion of alternative grocery stores that offer fresh and healthy produce at affordable prices, and the presence of a public transportation system that can grant access to such destinations for those lower-income residents who do not have access to a private vehicle. This study thus proposes that the inclusion of alternate retail stores with fresh and healthy produce be encouraged and in-place corner stores be incentivized to carry and sell healthier produce items. Another take-away from this study is that location within a mile of a grocery store is misleading if the residents do not have a car to get there. However, being able to access another mode of public transit to get to a grocery store is also an important and practical aspect to consider when mitigating barriers to access fresh and healthy foods. Home delivery of grocery items that is developing rapidly from local food retail stores could contribute to the last-mile connectivity to healthy foods for those who do not own a vehicle. Current conditions due to the COVID-19 pandemic have fueled the practice of groceries being delivered to the consumers. This form of access to fresh produce addresses the physical distance and mode of travel to obtain fresh produce. However, this does not address the equity issue with access, as being able to get groceries delivered home involves a subscription to a delivery service or payment of a delivery charge, perpetuating the disadvantage and burden that food-insecure families face.

One of the important findings of this research is that even with a presence of alternate grocery stores and the availability of transit which, in general, would lift a vast majority of the residents in food desert areas out of the "inaccessible to grocery stores" category, the residents still perceive barriers to accessing fresh and healthy foods. Cost was reported as the main perceived barrier to accessing healthy foods by the residents in the food desert census tracts. Awareness of alternative retail stores that accept federal program dollars was a close second and therefore an increase in the awareness would enable access for residents on income support and food assistance programs to a large extent. Similarly, retail stores frequented by consumers living in food deserts should be incentivized to include fresh and healthy foods to promote a healthier environment for residents, as people tend to patronize sellers with a selling history or similar cultural backgrounds in their neighborhood. With more digital interventions, targeted and subsidized delivery for EBT beneficiaries may be explored to promote convenience of purchasing fresh and healthy foods.

Knowing the divide in perceived barriers by race and class of residents in the same built environment, the questions that need further research are: what are the residents trying to purchase, what is "affordable" as far as costs go? Further research is recommended to include information on customer purchasing patterns and market trends including delivery schemes offered for grocery retail when there are increasing numbers of food deserts in Grand Rapids and in similar cities. Regarding racial diversity, the food assistance programs should be assessed with respect to the race and ethnicity of the minority populations so that it is easier for the communities to adapt and achieve a better quality of life with access to a healthier diet for themselves and their families. Maybe it is time to move away from the "food desert" designation to something that is more representative of a phenomenon that is in no way "natural" like a desert, but the result of longstanding and persistent economic and structural actions that have led to poor access to fresh and healthy produce for many underrepresented residents.

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Cost-benefit analysis as a tool for measuring economic impacts of local food systems: Case study of an institutional sourcing change

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Abstract

Universities continue to expand their local food sourcing, but the impacts of these sourcing changes are ambiguous. Some academics have measured these impacts using input-output analysis methods to track economic indicators that may be of interest to local communities. However, these studies do not capture nonmarket benefits of local food system investments or answer the broader question of whether local sourcing benefits society as a whole, both of which can be addressed using cost-benefit analysis. This paper explores cost-benefit analysis as an additional tool for measuring the economic impacts of local food investments, using a sourcing change by The Ohio State University as a case study. It builds on recent theoretical applied economics literature on the welfare impacts of local food sourcing and sheds light on important trade-offs of local sourcing that institutions and other buyers may want to consider. Employing data provided by Ohio State University Dining Services and the U.S. Department of Agriculture, I use a Monte Carlo simulation approach that accounts for uncertainty and allows for exploration of many scenarios. In more than half of the scenarios, local sourcing yields a net *loss* to society. However, additional research is needed by economists and others to enable local food system stakeholders to more easily and accurately conduct this work and add cost-benefit analysis to their project evaluation toolkit.

Keywords

Local Food, Local Sourcing, Farm-to-Institution, Welfare Analysis, Cost-Benefit Analysis, Input-Output Analysis, Economic Impact Analysis, Higher Education

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Disclosures

I am a faculty member in an academic unit in The Ohio State University to which this paper refers, and the data used in this paper were obtained from Ohio State University Dining Services, another unit of the university. Also, I am a resident of the geographic area discussed in the paper.

Introduction

While still a relatively small portion of total food sales, total local (or direct) food sales appear to be increasing in the U.S. In 2017, farmers earned US$11.8 billion in revenue from direct sales to consumers, retailers, institutions, and intermediaries with regional and local marketing (U.S. Department of Agriculture, National Agricultural Statistics Service [USDA NASS], 2019). Although not directly comparable to prior estimates due to differences in data sources, this number represents an increase from prior revenue estimates of US$8.7 billion in 2015 and US$6.1 billion in 2012 (Low et al., 2015; USDA NASS, 2016). As local food sales increase, a significant effort is being undertaken by researchers across disciplines to rigorously measure and account for the impacts of these sales. Much of this research is occurring on university campuses. But that is not the only activity related to local food systems taking place on campus—universities increasingly recognize the roles that they play as buyers and investing in local food systems directly.

Thinking and writing about the role of large institutions in local food systems is not new. Many agricultural economists and researchers in other disciplines have explored the barriers and opportunities associated with farm-to-institution sales for universities in particular (e.g., Feenstra et al., 2011; Hardesty, 2008; Leib et al., 2012; Ng et al., 2010). In addition, some agricultural economists are developing tools to help communities, institutions, and other food system stakeholders better understand the economic impacts of their decisions and investments related to local food systems. For example, the *Economics of Local Food Systems* toolkit—developed by academic and government economists and published by the USDA Agricultural Marketing Service (AMS)—provides food system stakeholders with a step-by-step process for measuring the economic impacts of their food system projects using the common input-output methodology (Thilmany McFadden et al., 2017). However, some scholars suggest a need remains for more rigorous assessment of the impacts of local food investments than the existing method of input-output analysis (Deller et al., 2017; Goldenberg & Meter, 2019).

In this paper, I discuss an alternative economic project evaluation method—cost-benefit analysis. Economic impact analyses using input-output models provide estimates of the impacts of local food system investments on key economic indicators like employment and household income. In contrast, cost-benefit analysis allows us to answer the broader question—do local food system investments benefit society as a whole—by allowing for the inclusion of nonmarket impacts of local food systems and expansion of the community of interest to all of society. To explore how the process of cost-benefit analysis can be used by institutions and others, I consider Ohio State University (OSU) Dining Services' decision to source a local product, sweet potatoes, for its dining halls in lieu of sourcing entirely from nonlocal producers. Specifically, the research question addressed in this article is: What is the net benefit to society of OSU Dining Services changing from a nonlocal to a local supplier for sweet potatoes? This work explores how cost-benefit analysis can be used to give food service managers and other food system stakeholders a better understanding of the trade-offs inherent in their local food system investments and suggests important areas for future research to enable more comprehensive and accurate cost-benefit analyses going forward.

To my knowledge, this work is the first published cost-benefit analysis of an institutional investment in local food systems. Lack of prior literature is not surprising, as presumably maximizing welfare—an economic term for societal benefit—is not the primary goal of many local food system stakeholders. In addition, as discovered in the course of this work, there are substantial gaps in data availability that may limit the usefulness of cost-benefit analysis at present. Nevertheless, in order to build capacity to employ this type of analysis in the future it is useful to explore this approach and identify specific strengths, weaknesses, and areas for future study.

This work also builds on recent theoretical work on local foods. In their 2017 paper in the *American Journal of Agricultural Economics*, Winfree and Watson explored the welfare impacts of "Buy Local" programs using a theoretical approach, building a two-region theoretical economic model to demonstrate the welfare impacts of local food investments and to determine under what conditions local food system investments would be welfare-enhancing for society as a whole. With this model, they demonstrated that in the presence of externalities (external costs or benefits incurred by third parties) or market power (the ability of buyers or sellers to set price) "Buy Local" programs could be welfare-enhancing. However, in other situations the net impact on society was unequivocally negative. This paper complements Winfree and Watson's work by considering how the type of welfare analysis they considered might be conducted for a *specific* local food system investment. Cost-benefit analysis is the methodology of conducting applied welfare analysis in a specific empirical setting.

The particular setting considered—with the university as a single buyer—is one possible setting in which to use cost-benefit analysis, and as with any setting has both its advantages and disadvantages. One advantage is that the opportunity cost of purchasing the local product (i.e., what product the buyer switches away from) is quite clear in the university setting; in contrast, it can be difficult to know what a consumer at a farmers market or similar venue would have purchased instead of a local product (O'Hara & Pirog, 2013). On the other hand, understanding the benefits accruing to students in an all-you-can-eat dining hall setting presents a challenge relative to settings where consumers face more price variation (as in most market environments). While the specific setting examined quite obviously lacks external validity, an important insight of Winfree and Watson's work—and a component of local food systems understood widely by food system stakeholders—is that each setting is different.[1] Thus, while the quantitative results should not be assumed to hold for other products and/or regions, the contribution of this work is to explore the process of conducting applied welfare analysis in the context of a specific local food system investment and provide an example for others.

The cost-benefit analysis conducted in this paper consists of several steps. First, the groups impacted by the sourcing change are defined. Second, the welfare impacts on each of these groups are described and measured using estimates from prior literature and data provided by OSU Dining Services and its vendors. Then these data are used to parameterize a Monte Carlo simulation model and develop a range of estimates for the net benefits of this sourcing change in its first year. I find that the net benefits to society of this sourcing change are positive in less than 50% (of 10,000) cases and highlight some excluded impacts (e.g., environmental and social) which could affect these results. These results emphasize the importance of understanding the specific ways that local and nonlocal markets may be impacted in a particular setting and the large role that nonmarket benefits must play in order to offset the cost of producing output less efficiently (as is often the case when shifting from nonlocal to local production). The results also highlight the challenges associated with valuing nonmarket benefits in this setting and indicate paths forward for researchers and practitioners in this area.

Measuring the Economic Impacts of Local Foods

As discussed by O'Hara and Pirog (2013), most existing studies considering the economic impacts of local food use input-output models, such as IMPLAN.[2] Input-output models provide estimates of the impacts of local food system investment on key indicators like employment and household income.[3] Some recent examples include Christensen et al. (2019), Conner et al. (2017), Jablonski et al.

[1] Specifically, placing my setting within Winfree and Watson's framework, I assume competitive markets and remain agnostic about the motivations of both OSU Dining Services (the intermediate buyer) and OSU students.

[2] Computable general equilibrium (CGE) models are also sometimes used to examine economic impacts and have the distinct advantage of allowing for more flexibility than input-output models, but they are also very technically challenging to implement and thus are used less frequently.

[3] Input-output analysis and cost-benefit analysis are not the only two approaches to understanding the economic impacts of local food systems. Goldenberg and Meter (2019) suggest that the "black box" of input-output analysis can give numbers that are dubious and suggest instead measuring connectivity via social network analysis, which would help to show how spending may be transferred between food system stakeholders. However, without incorporating opportunity cost, it is unclear that connectivity leads necessarily

(2016), and Miller et al. (2015). In addition, Bauman and Thilmany McFadden (2017) describe the evolution of economic impact analysis using input-output methods in local food settings.

Input-output models describe a regional economy in terms of transactions between firms (who sell outputs, earn revenue, and purchase labor and other firms' outputs) and households (who sell their labor, earn income, purchase outputs, and save for the future), as well as imports into and exports out of the region of interest. These transactions can be expressed as a series of linear equations (a matrix). The key to solving this model is that everything has to go somewhere; for example, all revenue earned by a firm must go to households (in the form of wages/income), other firms (in the form of expenditures on inputs), or other entities outside the economy (in the form of payments for imports). For example, if you increase the amount that a firm earns in revenue, more money must go to households, other firms, or the providers of imports.

Observed data about a regional economy are used to characterize and estimate the relationships between all these different stakeholders. This process then generates an input-output model that can be used to simulate the impacts of various shocks or investments within the economy; *IMPLAN* is an example of such a model. A user will input a change—such as a shift from nonlocal to local purchasing by a firm—and then see what happens to this investment given the relationships between firms and households in the economy. The impacts of such an investment could be changes in employment, revenue for firms, or income for households, as these are all aspects of the economy that are captured by the model. Input-output models can also be used to generate multipliers, numbers that indicate how much of the initial dollar amount invested stays in the local economy, which in turn is determined by the relationship between industries, households, and outside regions in the model.

The key strengths of the input-output methodology of economic impact analysis are its ability to provide tangible economic indicators that are desired by decision-makers and its ability to disaggregate these impacts across stakeholders. However, without modification, standard input-output models like *IMPLAN* make highly simplistic assumptions that do not match most local food settings, such as that resources used for local food production were previously idle (as opposed to being used in an alternative productive activity), and that consumers do not decrease other local purchases when they increase local food consumption.[4] Furthermore, while the outputs of this analysis are very useful, and it can be tempting to see input-output analysis as the only decision-making tool needed, the outputs only capture the flow of goods, services, and money in markets. They do not capture nonmarket impacts of local food systems, which are commonly among the motivations for local food system investments. In addition, as we consider the future of the food system more broadly, there is a bigger question—do local food system investments benefit society as a whole once we expand our analysis beyond the local region? While this seems like a simple enough question at first glance, "benefiting society as a whole" is vague. What does this phrase mean? How do we measure it?

Within the field of economics, these benefits are often expressed using the economic concept of welfare, another term for benefit or well-being. Individuals make choices as to what to buy by maximizing their well-being subject to constraints (time, income, etc.). Based on this optimization, consumers will have a willingness to purchase a good or service that is expressed as a function of price (commonly referred to as a demand curve). Similarly, businesses make choices as to what to sell by maximizing their profit (revenue they earn from sales minus cost of production). The functions which indicate the quantities of goods and services at each price that buyers are willing and able to buy and sellers are willing and able to sell

to more societal welfare, as this depends on what stakeholders were doing in the absence of connectivity. Nevertheless, it poses a promising and interesting tool that increases transparency.

[4] Thilmany McFadden et al. (2017) provide detailed instructions for adjusting the standard model to more accurately represent local food settings.

are referred to as demand and supply curves, respectively. In a competitive market, it is the intersection of demand and supply curves—when the quantity produced/sold is exactly equal to the quantity purchased/consumed—that determines the market price of a good or service. As individuals, we will purchase a good or service if our willingness and ability to buy (often referred to simply as willingness to pay) is higher than the price. If our willingness to pay is exactly equal to the price of a good, and we purchase that good, then we exchange money for the good of equal value and we don't gain any welfare as consumers (called consumer surplus). If we have a willingness to pay that is *greater* than the price, then we gain consumer surplus from this purchase because we have traded some amount of money for a good that we value at *more* than that amount of money. Similarly, sellers will produce and sell a good if the cost to produce that particular unit of their good or service is less than the price. If a seller's cost is exactly equal to the price of the good, and they sell that unit of the good, then all the money they earn on that sale will be used to cover the cost of producing that good, and they gain no welfare as sellers (called producer surplus). If sellers have a cost of production that is less than the price of the good, then they gain producer surplus from this sale because they have earned more from the sale than the good cost to produce.[5]

The goal of cost-benefit analysis is to capture these changes in welfare to understand what Watson et al. (2007) call *economic benefits* of an activity, program, or investment to society. Cost-benefit analysis allows for the inclusion not just of economic activities, but of impacts on society from changes in nonmarket outcomes (environmental, community, etc.). Cost-benefit analysis can also provide a transparent view of the categories of welfare impacts and demonstrate the particular benefits and costs that make up the largest components of welfare changes, providing insight about which levers are most important to pull in order to make sourcing decisions that yield the greatest benefit to society. The weaknesses of this approach are that it involves converting things into monetary terms that are felt by some should not or cannot be measured in dollars (e.g., community well-being), it does not as easily disaggregate some stakeholders, and it says nothing about the *distribution* of welfare across various stakeholders, which may well be of interest.

Despite these weaknesses, cost-benefit analysis is a powerful and valuable tool, and importantly, the most appropriate tool for answering a crucial question frequently asked: will this project we're pursuing benefit society? If the analysis finds that local sourcing yields a net benefit to society, it can be used by local food system advocates to better support their case for decision-makers to support local food investments. However, if the study suggests a project will yield a net loss to society, it can help redirect food system efforts to more beneficial activities. In addition, it can be useful in decision-making for those who wish to make decisions that benefit society as a whole while also supporting their local communities. More broadly, it can be a helpful tool for anyone trying to better understand the trade-offs of local sourcing.

Institutional Setting

Institutions, including colleges and universities, K-12 schools, early childhood care and education settings, hospitals, elder care settings, corporate cafeterias, faith-based organizations, and prisons are increasingly seen as important players in local and regional food systems (Benson & Fleury, 2017; Harris et al., 2012). Not only do they offer a more stable source of local food demand than some direct-to-consumer settings, like farmers markets and online direct sales, due to the nature of institutional food service planning, but many also have a specific interest in the health and/or nutrition education of their users, patients, or residents due to the nature of their work, and embeddedness within their communities drives interest in supporting local farmers (Conner et al., 2014; Harris et al., 2012). Indeed, a number of studies have found evidence that supply-chain stakeholders in these farm-to-institution settings are motivated by values *other than*

[5] This topic is covered in most introductory economics textbooks; see, for example, *The Economy,* developed by the CORE Project, which is available free online at https://www.core-econ.org/the-economy. The topic is covered in Chapter 7.

profit. However, many challenges remain, including logistical, administrative, and aggregation challenges that come from the interactions of large bureaucracies with individual local farmer vendors (Feenstra et al., 2011; Heiss et al., 2015; Matts et al., 2015). These motivations increase the importance of determining if these institutional relationships are meeting the values-oriented goals of the participating stakeholders, goals that cannot be captured in input-output models.

As a public, land-grant university, OSU is engaged in food systems through research and innovation, teaching and learning, outreach and engagement, and resource stewardship (Fox, 2017). One way that OSU has engaged in resource stewardship is by setting a goal to source 40% of food served at the university from local and sustainable sources by 2025 (OSU, 2016). To meet this goal, OSU Dining Services, which in its traditional dining hall locations alone serves approximately 11,000 meals per day to students, faculty, and staff, must find new sources for some of their products (L. Holford, personal communication, May 19, 2017).

Prior to the 2016-2017 academic year, OSU Dining Services purchased sweet potatoes from a distributor based in Ohio that sourced from another Ohio distributor. The latter distributor sourced from a sweet potato packer in North Carolina (personal communication with vendor, May 22, 2017). North Carolina produced more than half of U.S.-produced sweet potatoes in 2016, making it a likely source for major distributors based in the eastern United States (USDA NASS, 2020). (The supplier in North Carolina will be denoted the "nonlocal supplier" and the sourcing policy the "status quo policy.") In 2016, OSU Dining Services began sourcing approximately 25% of their sweet potatoes from a local, cooperatively owned supplier that aggregated from farmers and delivered directly to the university, denoted the "local" supplier. Sweet potatoes produced by this supplier are not only local to OSU (all farms are less than 100 miles from OSU, and most are less than 25 miles away), but also organic.[6,7] A schematic of these two supply chains is provided in Figure 1.

Once purchased by OSU, the sweet potatoes considered in this analysis are served as whole, baked sweet potatoes. Sweet potato fries, which are sourced from the same regional distributor, go through a different supply chain and are not considered in this analysis. The whole, baked sweet potatoes are offered in three *Traditions* dining locations on OSU's main campus in Columbus. These dining halls use an all-you-care-to-eat model. Student meal plans include a combination of meals at *Traditions* dining locations as well as other more liquid forms of payment that can be used at a variety of dining locations across campus (OSU, 2021a).

Methods

The method employed to answer the research question is a retrospective cost-benefit analysis of OSU Dining Service's first year of local sourcing of this product. The organization of the approach draws from the conceptual framework for cost-benefit analysis outlined in Boardman et al. (2011). Incremental net benefits are reported. In other words, the analysis compares the local sourcing decision to the *status quo* policy of sourcing all sweet potatoes from the nonlocal supplier rather than reporting the full costs and benefits of both sourcing policies. To calculate net benefits, first the impacted stakeholders are defined. Then the welfare impacts of the change on each stakeholder group are cataloged and estimated using a combination of economic theory and data provided by OSU Dining Services and their vendors, as well as publicly available data and estimates from the literature.

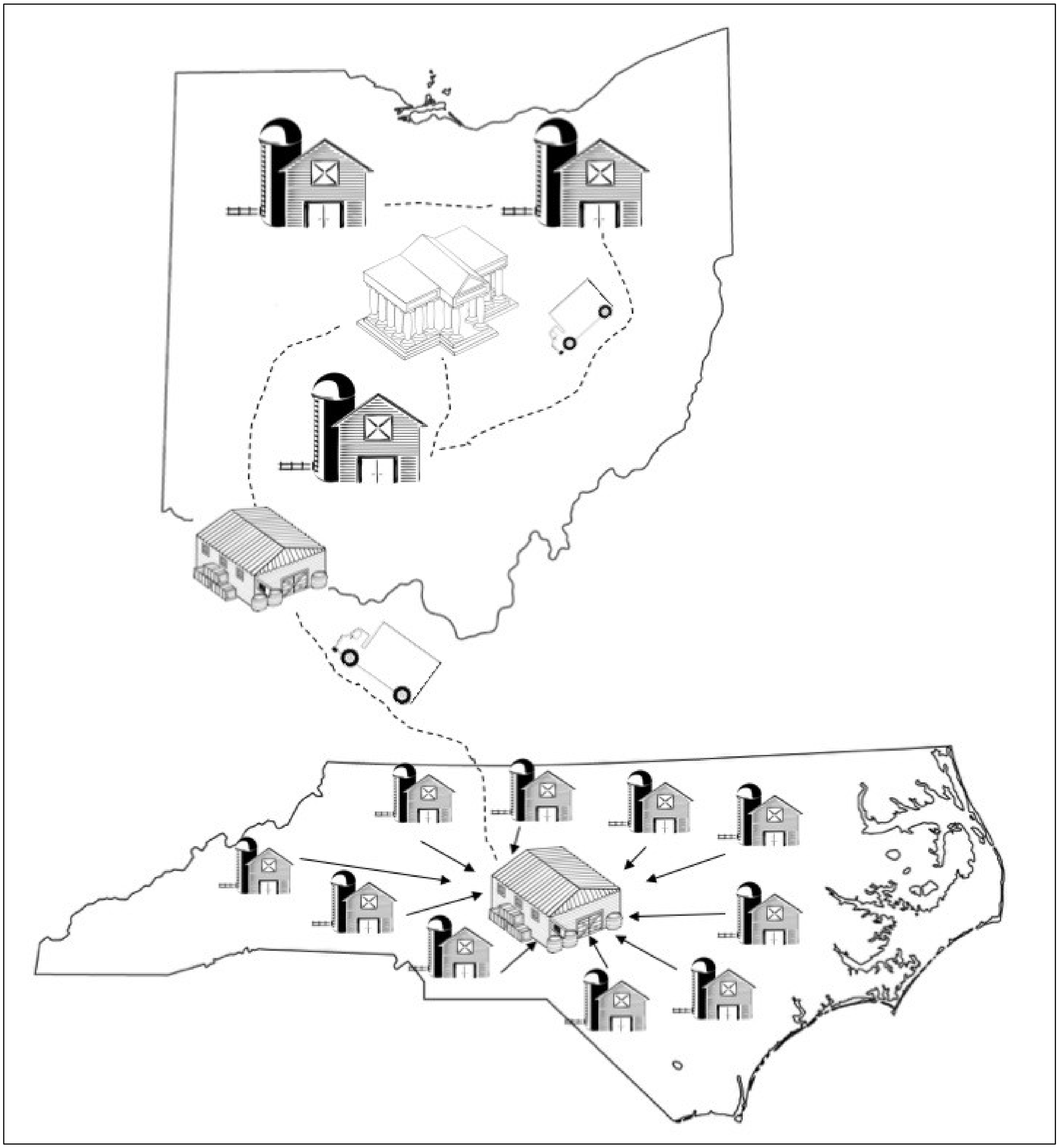
These data and values are then used to param-

[6] The definition of local used in procurement varies considerably across institutions. The OSU Food Sustainability Panel in its fall 2018 final report defined local based on zones: ultralocal (within 50 miles of OSU serving location), Ohio-produced (produced within the state), regional (produced within 275 miles), North America (produced within the U.S., Canada, Central America, and the Caribbean), and beyond or unknown (produced outside North America or in unknown location) (OSU, 2018).

[7] These sourcing changes were chosen by OSU Dining Services, as was the product considered in this cost-benefit analysis. Based on conversations with Dining Services staff, I have no reason to believe this product was picked strategically to lead to a particular result of the cost-benefit analysis. Rather, local sourcing for the product was just beginning and the Dining Services team was eager to better understand the impacts of this sourcing choice.

eterize a Monte Carlo simulation model. Monte Carlo simulation is a method for accounting for uncertainty of key parameters in the analysis (e.g., the maximum willingness to pay for sweet potatoes or the responsiveness of consumers to price) by simulating a large number of scenarios using a range of possible parameter values and using information about these scenarios (rather than a single

Figure 1. Local (Ohio) and Nonlocal (North Carolina) Supply Chains



Note: Drawings are not to scale. Positions of states in the figure are not intended to represent relative positions of states geographically, and locations of farms and warehouses in the states are not intended to represent geographic locations of specific business entities.

estimated value) to answer the research question. Because many of the parameter values in this study are drawn from other settings rather than from observational OSU data, acknowledging and accounting for this uncertainty is particularly important. To conduct the simulation, I assume a distribution for all key parameters based on literature or expert knowledge of the setting. Then I take random draws from the distribution for each of the key parameters and use them to calculate the net benefit. I then repeat the process 9,999 times, to yield 10,000 unique net benefit calculations. This procedure is conducted with the computer program Matlab. If the net benefits from the sourcing change are greater than zero, then the local sourcing policy provides a net welfare gain to society; alternatively, a negative net benefit indicates a net loss to society. With the information from the 10,000 simulations, I can examine the *distribution* of the net benefit estimates, given uncertainty in these key parameters. For example, I can see the share of the 10,000 scenarios that yield a net benefit greater than zero and the share of the scenarios that yield highly negative or highly positive values. As in Jeuland and Pattanayak (2012), given no prior knowledge of the distributional form of these parameters I assume a uniform distribution for all parameters I allow to vary, so that the probability of choosing any particular value within the range that I set is equal for all values within the range.

Impacted Stakeholder Groups

First, it is important to consider those individuals or groups who have standing, i.e., those stakeholders who are likely to be affected by the change. Inclusion of particular groups can be controversial in cost-benefit analysis, particularly in the case of local food investment, as the endeavor in itself emphasizes the importance of local businesses and residents relative to businesses and residents elsewhere. In economic impact analysis using input-output methods, the focus is on individuals and firms in a particular region, with imports and exports serving as the only connections outside the region. In contrast, because cost-benefit analysis does not involve structural modeling of the economy, it is generally more difficult to disaggregate welfare accruing to local and nonlocal firms and individuals, and it is not necessarily a goal of the analysis. Given the setting, OSU and OSU students clearly have standing, as do local residents and local farmers. If the goal is to understand the impacts of the local sourcing decision on society as a whole, actors in the nonlocal supply chain must also be given standing, as they may potentially be impacted by the sourcing change. However, this choice may be controversial.[8] Another possible group with standing is the global population. While it might seem unnecessarily expansive to consider all people, it is important to consider the global population when valuing the impacts of environmental externalities from food production, processing, and transport. For example, the social cost of carbon, often used in cost-benefit analyses to value the impact of carbon emissions, is based on global costs.

Impacts

University

The university is likely to be impacted in several ways. First is the change in the cost of the product due to switching to the local supplier. Based on records provided by OSU Dining Services, the average prices per pound paid by OSU Dining Services during the 2016-2017 academic year were US$0.55 and US$1.25 for nonlocal sweet potatoes and local sweet potatoes, respectively (L. Holford, personal communication, March 27, 2017). The expenditure by OSU on local sweet potatoes represents one component of the opportunity cost of local sourcing; other components are discussed in the section on local farmers. In the 2016-2017 academic year, OSU Dining Services purchased 37,173 pounds of sweet potatoes.[9] Of these, 9,060 (24.4%)

[8] Although not within the scope of this paper, the importance of local producers would suggest a role for distributionally weighted cost-benefit analysis, with a higher weight given to local producers. However, determining the appropriate weight to give to local producers in such an analysis would no doubt be controversial. It will become apparent later in the paper that in the case under examination, the question of standing for nonlocal producers may well be irrelevant.

[9] This quantity is based on data made available in March. For this analysis, April and May purchasing are assumed to be equal to the

came from the local supplier (L. Holford, personal communication, March 27, 2017). Since these quantities are known values, they are not allowed to vary in the simulations.

Another impact to consider is the cost of establishing the relationship between OSU Dining Services staff and the new local vendor, as social relationships between supply-chain actors are understood to be an important aspect of farm-to-institution programs (Buckley et al., 2013). OSU Dining Services staff indicate they do not negotiate prices with suppliers, so OSU Dining Services labor costs are unlikely to be incorporated in the price paid to the new local vendor through a lower price. OSU Dining Services staff did not track their time establishing this vendor relationship separately from their other activities, so these labor costs incurred by OSU are based on data from the publicly available OSU salary database (Buchanan, 2017). It is assumed that the executive chef and receiving manager both have spent time developing this relationship.[10] These staff had difficulty estimating the time involved in developing the relationship, so I assume the number of hours spent by each in the first year is uniformly distributed between 0 and 10 hours.

These employees' effective hourly wages are then calculated based on the salary information and multiplied by the unclassified staff benefit rate of 37% to get the cost to OSU per hour of work (OSU, 2021b). Beyond the cost of establishing the relationship, OSU Dining Services staff indicated no difference in receiving or preparing cost between the sweet potatoes sourced from the local and nonlocal suppliers (L. Holford, personal communication, May 19, 2017). Thus, the only cost differences for OSU Dining Services are the cost of establishing the relationship with the vendor and difference in price for the local sweet potatoes.

Although OSU Dining Services did not raise the price of the student meal plan due to these increased costs, the long-term effects of any increase in food costs due to additional local and sustainable sourcing could very well be an increase in the price students pay.[11] If students remained on the meal plan after a plan price increase, the increase would serve simply as a transfer from students to OSU Dining Services and therefore would not affect the results of the cost-benefit analysis. However, to the extent that students no longer purchased the meal plan due to this change, the change could affect the net benefits of local sourcing. These kinds of long-term impacts are important for universities to consider.

Yet another possible consideration is the set of alternative policies facing the university.
One challenge of cost-benefit analysis is how best to restrict the set of policy alternatives. Although the choice set considered in this analysis is very narrow, in fact, the set of policies could be broadened for a follow-up analysis exploring possible alternatives. Given the ample evidence of returns to education, would the money used to purchase local foods yield a greater benefit to society if employed in the form of something entirely different, like a scholarship? A wide variety of options could potentially be considered. For the purposes of this paper, it is assumed that OSU Dining Services is allocated an annual budget, and once this budget is allocated OSU Dining Services must spend that money on activities within its budgetary control, ruling out such policy alternatives.

An anonymous reviewer has noted additional benefits that could accrue to the university, including connections to alumni and enhanced university image within the community. Conceivably the university advancement office could track the importance of these benefits (at least qualitatively) through their various data collections, which may be a useful strategy moving forward for universities investing in local food systems. Producer or alumni local food donations are also a possibility, although

academic year monthly average up to that point and that June and July purchases are 25% of the monthly average for the academic year.

[10] The title of the executive chef in the salary database is assistant director, Residence & Dining, Food Service.

[11] This is solely my prediction, based on simple economic principles and was never mentioned or suggested during conversations with OSU Dining Services staff in the course of this project.

it should be noted that donations may not yield a net benefit. A donation of produce could benefit the university and may benefit the producer or alumnus/a through psychological impacts of altruism, but the producer is giving up the revenue that they would have received from selling this product (the opportunity cost). Thus, the distribution of welfare would change, but the net benefit is not likely to be considerably different from the scenario in which the producer sells their product to the university.

Students

Students are the consumers of the product. Some evidence suggests that students are unwilling to pay the same kinds of premiums that grocery store shoppers would pay for a local or organic product. Bruno and Campbell (2016) found that only 50% of students they surveyed at the University of Connecticut in 2015 were willing to pay a premium for more local food options and only 50% of students were willing to pay a premium for more organic options.[12] The average willingness to pay (WTP) for more local options for students with a meal plan in the study was US$17.14, or approximately 1–2% of their meal plan cost, while the average WTP for more organic was slightly larger, at US$20.69.[13,14] Porter et al. (2017) surveyed students at the University of Vermont and found a somewhat higher willingness to pay for a combination of these attributes relative to Bruno and Campbell (2016): 70.8% indicated they would be willing to pay a positive premium. However, this premium was for 20% of their food to be produced locally using ecologically sound, fair, and humane practices, which differs from the attribute set considered by Bruno and Campbell (2016). For those willing to pay a premium for this combination of attributes, the median premium represented a 3% meal plan price increase, and the mean premium represented a 3.4% price increase.

As these studies are focused on large changes in sourcing and not changes in sourcing of particular products—as is the focus of this paper—it is important to consider other literature that looks at price premiums for specific relevant products. Estimates in the literature range considerably, including a local premium of 10% (Loureiro & Hine, 2002), 18% (Nalley et al., 2006), 16–31% (Darby et al., 2008) and 27% (Carpio & Isengildina-Massa, 2009). This evidence would suggest students may put a premium of anywhere from 1% to 31% on local sweet potatoes.

However, in order to calculate the premium students place on local sweet potatoes, it is necessary to understand students' current demand. Student demand for foods in a dining hall are particularly complex; at *Traditions* dining halls, students on a meal plan and other visitors pay a fixed fee to enter.[15] Furthermore, *Traditions* locations are all-you-care-to-eat. Therefore, once inside, the additional (or marginal) cost of any specific food items, including sweet potatoes, will be zero. Consumer surplus from the consumption of sweet potatoes will be the entire area under the demand curve for sweet potatoes by *Traditions* diners minus the fixed cost of entry.[16] Thus, to calculate the difference in the consumer surplus that students (and potentially faculty, staff, and other visitors) receive, an estimate for the demand for sweet potatoes is needed.

A stylized description of the market for sweet potatoes for OSU students is provided in Figure 2.

[12] The study is not clear about whether or not these are the same 50%.

[13] It is not clear from the article if the survey asked students about a specific quantity increase. If no specific quantity was given in the survey, uncertainty about the quantity of local food to be provided could have biased students' WTP downward, so this percentage is likely a lower bound for the premium these students would place on local food.

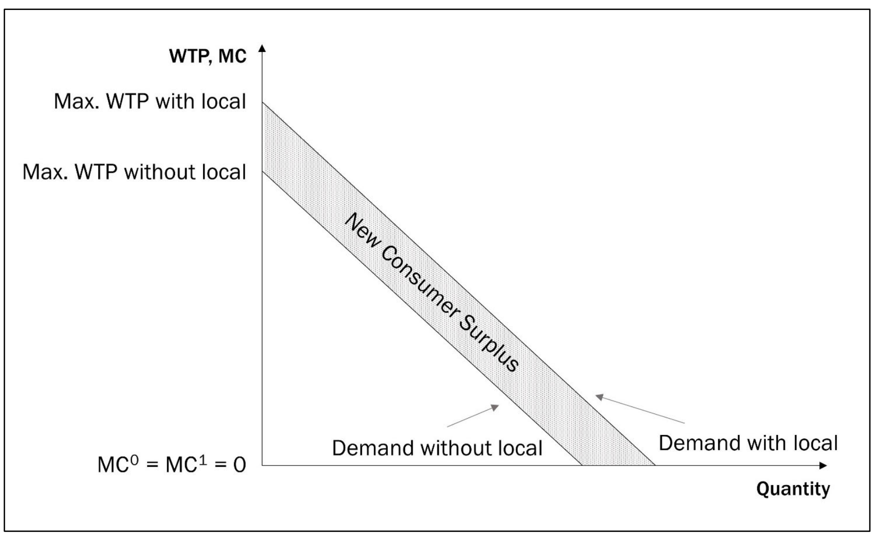
[14] Interestingly, Bruno and Campbell (2016) found that students who regularly purchased fruits and vegetables were willing to pay a smaller premium for local than other students. The authors speculated that this might be because students expected transportation costs for local foods to be lower and therefore thought local foods should be cheaper.

[15] Students pay with one "visit" or anyone can pay a fixed price in either "Dining Dollars" or cash.

[16] The fixed cost of entry in and of itself is rather complex. Student meal plans offer a fixed number of visits per week, and visits do not roll over to the next week. However, some meal plans allow students to exchange "visits," which can only be used in *Traditions* dining locations, for more flexible forms of payment that can be used elsewhere on campus and can be rolled over from week to week. A visit is worth considerably less in this more liquid form (OSU, 2021a).

The demand for whole baked sweet potatoes is assumed to be linear. I assume the maximum WTP by students without the local product is uniformly distributed between one and four dollars per pound. This range is based on the maximum willingness to pay found in Nalley et al.'s (2006) experiment for sweet potatoes. The marginal cost to students for both local and nonlocal sweet potatoes is zero, as they pay a two-part tariff at the dining hall: a fixed fee equal to the meal plan per-meal price and a per-unit price equal to zero for the sweet potatoes themselves. Thus, I can approximate the total consumer surplus (before subtracting the fixed fee for *Traditions* visits) as the area under the demand curve before the introduction of local purchasing. I assume that student diners receive new consumer surplus from the introduction of local, which I allow to vary from 0% to 30% of the total consumer surplus from sweet potatoes in the absence of local sourcing, based on the variability in estimates, described in the literature above.[17] The area representing this new consumer surplus from local sourcing accruing to students is shown in Figure 2.

Figure 2. Stylized Demand for Sweet Potatoes by Ohio State Students



Note: MC indicates marginal cost and WTP indicates willingness to pay.

Local Farmers and Community

As cited in previous studies of institutional buyers of local food, lack of availability of local food both in adequate quantities and year-round can be a significant barrier to local sourcing by large institutions (see, for example, Hardesty, 2008). In the present study, in the first year of sourcing (2016–2017), the local supplier was able to provide from October through early March. Throughout the year the buyers at OSU Dining Services purchased from the nonlocal supplier as well. Although production numbers are unavailable from 2016 for direct comparison to North Carolina, in 2012 producers in Ohio harvested 39 acres of sweet potatoes, and in 2015 they harvested just five acres of National Organic Program–certified organic sweet potatoes (USDA NASS, 2020). Based on 2015 yield estimates (4,980 pounds/acre), OSU's demand from local sources (9,060 pounds) would represent approximately two acres of production.

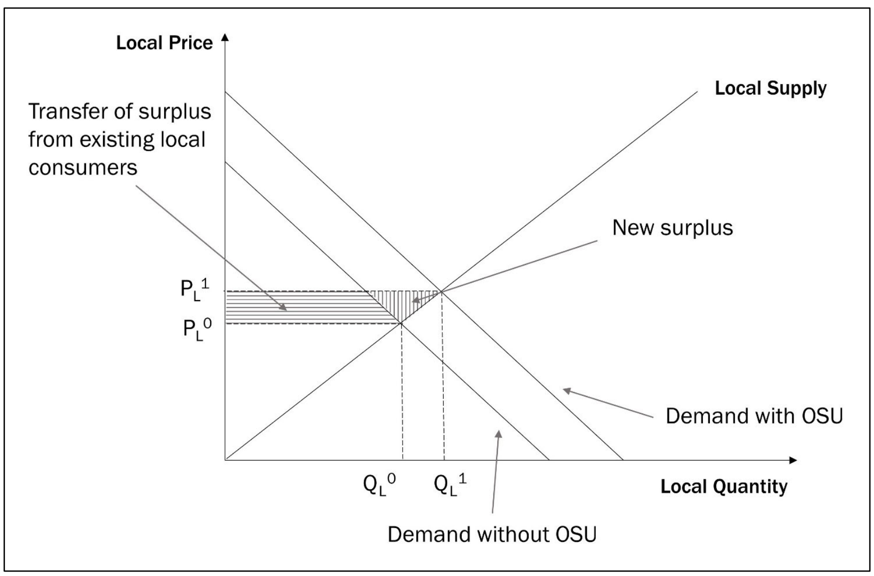
Given the small size of the market for local, organic sweet potatoes in Ohio, it is reasonable to assume that the market for local sweet potatoes is affected by the OSU

[17] One complication for this analysis is that during the 2016–2017 academic year, sweet potatoes were not in fact labeled as local or organic in *Traditions* dining halls when they were purchased, which suggests that the demand by students in that academic year was actually the demand for sweet potatoes with an unknown location of origin rather than local sweet potatoes. Thus, it is not clear that the calculation of additional willingness to pay here is even appropriate if local, organic sweet potatoes are assumed to be a credence good (i.e., having attributes valued by consumers that cannot be deduced through consumption) rather than an experience good (e.g., due to freshness). The calculation used here also does not include the possibility that some students may choose to eat sweet potatoes instead of other goods if the sweet potatoes are local and/or organic. In addition, the literature provides ample evidence that localness can be confounded with other attributes consumers value, including organic certification (e.g., Hu et al., 2012 and Meas et al., 2015). If students place additional value on organic certification when products are already local, my estimate for the welfare impacts of local food could be biased downward.

sourcing change. Demand for sweet potatoes in the local market will shift outward, and assuming an upward sloping supply curve for local, organic sweet potatoes (in other words, that supply is not perfectly elastic), then local producers will gain from the shift. Figure 3 presents a stylized rendering of this shift. Farmers in fact will receive *two* types of surplus (benefit) from this shift. The rise in price from OSU participation in the market will result in a transfer of surplus from existing (i.e., non-OSU) local consumers to local farmers, and it will allow for additional production of sweet potatoes, leading farmers to gain *new* surplus. The opportunity cost of producing the local, organic sweet potatoes is then OSU's expenditure minus the new surplus benefits accruing to the local producers.[18] This opportunity cost is likely to be quite high, as OSU's average price paid per pound more than doubled, from US$0.55 to US$1.25, with the move from nonlocal to local sourcing. This increase in price is likely due to lower technical efficiency in production (i.e., fewer units of output produced given the same amounts of inputs) by Ohio sweet potato producers relative to those in North Carolina. This lower technical efficiency is generally viewed as one of the downsides of local sourcing and suggests that additional benefits must accrue to Ohioans from local production and consumption to offset this efficiency loss if a switch to local production is to increase welfare. However, as I will discuss later in the paper, the impacts of the change are not that simple, as they depend on how the particular inputs used in production in Ohio were used previously.

For the purposes of this study, it is assumed that demand for local, organic sweet potatoes is linear and that all organic production in Ohio is consumed locally (within the state of Ohio). The demand and supply functions for 2016 are assumed to be linear and are parameterized using 2016 Ohio organic production and sales data available from the USDA NASS (2020). I assume that both demand for and supply of sweet potatoes are elastic relative to nonlocal production and consumption, and both are assumed to be uniformly distributed and range in magnitude from 0 to 6 (Andreyeva et al., 2010; Okrent & Alston, 2012b).[19] Evidence in

Figure 3. Stylized Market for Local, Organic Sweet Potatoes



Note: PL indicates equilibrium local price, and QL indicates equilibrium local quantity.

[18] It should be noted that this approach to considering opportunity costs is markedly different from the way that opportunity costs are considered in many input-output models. In particular, as Thilmany McFadden et al. (2017) show, the default input-output model assumption is that all demand is new and that the resources being employed in the local food system were previously idle, so input-output model assumptions must be adjusted by users in order to incorporate the more realistic assumption that some local resources (e.g., land and labor) were being used in other ways prior to the increase in local spending.

[19] Elasticity (specifically price elasticity of demand or supply) is a measure of price sensitivity. Elastic demand or supply is signified by a number greater than one in magnitude and denotes that the quantity demanded or supplied is very sensitive to changes in price. Inelastic demand or supply denotes that the quantity demanded or supplied is *not* very sensitive to changes in price, and is signified by a number between zero and one in magnitude. Although price elasticity of demand is negative when calculated, I use the economic convention of reporting the magnitude of the value only.

the literature suggests that demand for specific fruits and vegetables is relatively insensitive to changes in price (i.e., inelastic), although some estimates range up to 3 (with any value above 1 being elastic). Price elasticity of supply has been less researched for specialty crops than for commodity crops, but existing evidence suggests a similar range is appropriate (Okrent & Alston, 2012a). I assume a larger range of price elasticities of demand and supply relative to the nonorganic, nonlocal market (discussed in the next section) because buyers have many close substitutes, including nonorganic local sweet potatoes and organic nonlocal sweet potatoes (in contrast, most existing studies examine one common category of goods like apples or potatoes), and sellers are substantially diversified and thus are likely to able to switch relatively easily between crops. The assumption of elastic supply is also supported by the observation that 2016 production of sweet potatoes in Ohio represented an increase in production over 2015 that was approximately the size of the quantity purchased by OSU in 2016, suggesting that this demand represented all new demand for producers. However, it should be noted that when supply is highly elastic, new demand will not cause a change in price, and local farmers will gain no additional surplus.

Whenever there is an increase in local demand, farmers will be using additional inputs. The use of these inputs is included in the opportunity cost of purchasing this product. Any additional surplus in input markets is not captured as a benefit in this cost-benefit analysis. It is possible that the new demand will yield indirect impacts in input markets if the inputs were previously idle. However, by assuming that the cost of production for local farmers is the opportunity cost of using these inputs, although production is now local and entirely new, there are in fact no gains to the local economy beyond local farmers' new producer surplus.

It is unclear whether or not it makes sense to incorporate the cost of establishing the relationship with OSU as a separate category. For the local producer, it would seem reasonable to include labor costs associated with establishing the relationship in the cost of production, so this cost is not considered explicitly, in contrast to the university. Furthermore, the distributor is a cooperative in this particular case, so the entirety of the price paid by OSU Dining Services is assumed to go to producers (in contrast to the nonlocal case, as described in the next section).

Finally, it may be important to consider the additional nonmarket benefits that local farmers may receive from selling to OSU. For example, Conner et al. (2012) conducted a cluster analysis based on a survey of Vermont farmers engaged in farm-to-school sales to better understand the different characteristics of these farmers. One cluster (of three they identified) consisted of farmers who were primarily motivated by profits, and another included farmers with strong social motivations. This and other studies suggest a question, how much more satisfying is it to be a farmer producing for local markets than to engage in some other kind of work? While broad concepts such as job satisfaction might be difficult to monetize, there is no conceptual reason they could not be included in a cost-benefit analysis. Although they are not included here due to data constraints, these benefits could conceivably be estimated by measuring the pay cut individuals would be willing to take to in order to be farmers who produce for local markets, relative to other jobs they could hold. This number should be a good estimate of the lower bound of the value to them of being local food producers, as it represents the tradeoff they make between a monetary reward and the intangible benefits of being a local farmer.

Nonlocal Farmers, Distributors, and Community

Some may debate whether it makes sense to include nonlocal growers in this analysis. Although estimates of welfare changes based on 2016 sales are likely to be very small, our desire to consider total societal welfare and not just local societal welfare necessitates their inclusion in the model, and a number of other studies emphasize the importance of measuring the *net* impacts of local food system investment, requiring its impacts outside the local food system itself (Miller & Mann, 2020).

Assuming a yield of 19,000 pounds of sweet potatoes per acre, the average yield for North Carolina producers in 2015, it would take 1.97 acres to grow OSU Dining Services' *total* annual supply of whole sweet potatoes; this acreage represents 0.002% of the total acreage of sweet potatoes harvested in North Carolina in 2016, which was 86,000 acres (USDA NASS, 2020).[20] Due to this very small share of production, prices for sweet potatoes in North Carolina are unlikely to be affected by the small decrease in demand represented by OSU's sourcing change. The process to confirm this hypothesis and calculate the magnitude of this impact is the same used to calculate the impact on local farmers. Demand is assumed to be linear, and it is parameterized using 2016 prices and quantities from USDA NASS (2020). Following the literature discussed in the previous section (Andreyeva et al., 2010; Okrent &and Alston, 2012a 2012b), elasticities of demand and supply are assumed to be uniformly distributed between 0 and 3 in magnitude. This parameter range differs from that for the local market. While it can reasonably be assumed that there are many close substitutes for local, organic sweet potatoes and thus that demand would be relatively responsive to price, demand for North Carolina sweet potatoes is unlikely to be as responsive due to its important national role as a sweet potato supplier. Supply is also likely to be less responsive to changes in price given the specialization of producers in sweet potato production in this region. This also means that North Carolina consumers of sweet potatoes are unlikely to be affected by the change, as they will see little to no change in the price of sweet potatoes.[21] For this reason, they are not currently included in this analysis.[22] However, in the case of a more substantial decrease in demand by nonlocal buyers like OSU that did affect the equilibrium price in the North Carolina market, the price of local sweet potatoes for North Carolina consumers would *decrease*, making them better off.

One interesting aspect of the supply chain for the nonlocal sweet potatoes is that two of the three intermediaries between the farm and OSU are located in Ohio. It is assumed that the supply of marketing and distribution services is completely elastic. Thus, when the quantity of product they are distributing is affected due to the change in demand, the distributors' surplus is not affected. This is an assumption which it may well make sense to relax in some situations. In addition, if people in both North Carolina and Ohio are given standing, the fact that the distributors that distribute North Carolina produce are located in Ohio does not matter. However, I could consider a scenario in which local people and farms are given greater weight in a cost-benefit analysis. In this case, it would be important to consider that the two distributors between the packer and OSU are both based in Ohio. The role of local distributors in supplying nonlocal goods is an important area for future study, given their importance in supply chains.

Local and Global Community

The local and global communities are likely to be impacted in a number of ways. The local community may value the direct investment in local agriculture in ways beyond the investment itself. If this is the case, this additional utility consumers gain

[20] It should be noted that in 2015, producers of sweet potatoes in North Carolina were able to produce nearly four times as many pounds of sweet potatoes per acre as producers of organic-certified sweet potatoes in Ohio.

[21] An anonymous reviewer suggested the analysis is incomplete without accounting for this change in demand. Due to the challenges of measuring North Carolina consumption of North Carolina sweet potatoes (since, unlike Ohio, much of North Carolina sweet potato production is exported out of the state), it is more difficult to estimate this effect than it is for Ohio producers. However, my hypothesis that this effect is small is confirmed by the simulation analysis; the price of sweet potatoes in North Carolina is affected by only fractions of a cent by Ohio's sourcing change in all of my simulations, which suggests North Carolina consumers would be affected minimally, if at all.

[22] As one reviewer pointed out, consumers in North Carolina *could* be affected by even this small relative change in demand by OSU if these consumers don't simply care about consuming local products but rather, or in addition, care about local production regardless of who consumes it—for example, as an aspect of maintaining local agricultural livelihoods. While this may be the thinking of some residents in Ohio and North Carolina, it is not really a relevant point for this current paper, since the question at hand is about how local *consumption* shapes welfare. If consumers care only about local production, as long as *something* is planted in the fields in each state and farmers earn the same or more from this product than they would from sweet potatoes, then what is planted and who buys it does not really matter. Welfare for residents of Ohio and North Carolina who care about local production will not change when an Ohio institution starts sourcing a product from Ohio for local consumption.

from purchasing locally would be an additional nonmarket benefit. There are two main types of impacts that may accrue to the local and global communities that we may want to consider: environmental and social.

First, I will consider environmental benefits. There is a perception that local food systems can increase ecological resilience (Brekken et al., 2018), but positive net environmental benefits from the re-localization of food systems are not a foregone conclusion. For example, Brodt et al. (2013) conducted a life-cycle analysis (LCA) to compare environmental impacts of processing tomato production and distribution between regional (Michigan) and national (California) supply chains. They found similar energy use and emissions across the two crops when shipping to consumers in Michigan; higher energy use and greenhouse gas (GHG) emissions from transportation of California production are nearly offset by increased yields and lower GHG emissions from the production relative to production in Michigan. Similarly, Christensen et al. (2018) conducted an LCA of community supported agriculture (CSA) operations in California's Central Valley, finding considerable heterogeneity in GHG emissions across farmers of similar scale producing similar products for similar markets. For example, the source of electricity and the production efficiency of soil amendments (e.g., compost) can cause significant differences in GHG emissions across operations. Edwards-Jones (2010) provides examples of various products, some with lower environmental impacts when purchased locally and some not. Keyes et al. (2015) highlight the importance of an energy mix for storage purposes, comparing local and nonlocal apples in Nova Scotia.

A very important point to note is that it takes less land (and associated resources expended, like water or labor, per unit of land) to produce sweet potatoes in North Carolina than it does in Ohio. About two acres of land is needed to grow the 9,060 lbs. of organic sweet potatoes demanded from local sources by OSU; a similar quantity of sweet potatoes grown conventionally (i.e., nonorganically) in North Carolina could be grown on less than one-half acre of land. Thus, any environmental impacts occurring on Ohio land due to the shift will likely be larger than any North Carolina environmental impacts, as the changes will apply to a larger land area.

To estimate the environmental impacts due to any production changes caused by the sourcing change, I would first need to estimate the cost of the environmental impact from production of each crop in each setting. Local environmental impacts could include changes in local water or air quality, and global environmental impacts could include changes in GHG emissions. Whether there are positive, negative, or zero environmental impacts depends on whether producers change their production in Ohio and/or North Carolina due to the OSU purchases. In both regions, there are several alternative activities to growing sweet potatoes that producers could engage in. An extreme, very unlikely case would be that producers do not produce or transport anything and that all resources sit idle. In this scenario, the environmental impacts of the change (from growing nothing to growing organic sweet potatoes) would in fact be negative, as even organic production and transportation over relatively short distances is likely to have a negative environmental impact compared to doing nothing. A more likely scenario is that farms would produce a different crop on the land and market it through their usual marketing channels. There could be either a positive or negative environmental impact. If growing sweet potatoes using the particular production practices of the farm causes less environmental impact than the alternative crop, growing sweet potatoes would yield a positive benefit. Conversely, if growing sweet potatoes with the particular production practices causes more impact than the alternative, growing sweet potatoes would yield a negative benefit. Thus, an interesting aspect of this research is understanding that the potential environmental benefits from a small sourcing change come *not* from production differences relative to the alternative production region, but, rather, production changes relative to the alternatives *within* production regions. For example, if an Ohio producer had been growing a conventional corn or soybean crop previously, and marketing it globally, then producing an organic crop and marketing it locally might be environmentally beneficial, and therefore contributing positively to the net benefits to society.

These environmental impacts, although conceptually easy to include in a cost-benefit analysis, are constrained by the availability of relevant data. While certain easily captured measurements of environmental impacts like "food miles" (the distance food travels from farm to consumer) were once popular, it has become widely understood that more comprehensive and holistic measures of the environmental impacts of food production are much more accurate. Life-cycle assessment (LCA) is one such methodology.[23] Several recent studies have used it to explore the global warming potential, acidification potential, and eutrophication potential of corn and soybean production at the county level in the U.S. Midwest (Lee et al., 2020; Romeiko et al., 2020).[24] (If cropland to produce sweet potatoes in Ohio were diverted from any crops, it would most likely be these, as 76% of Ohio's 10,960,704 acres of cropland were planted with one of the two in 2017 [USDA NASS, 2020]). However, there are several barriers to including these numbers in a cost-benefit analysis. First, economists do not appear to have estimated a dollar value for acidification and eutrophication potential, and it is not clear that the dollar values associated with each of these metrics would be uniform across space (in addition to the LCA potentials themselves varying across space). Second, when considering the monetization of global warming potential, economists suggest that it is not appropriate to consider all greenhouses gasses together, as they remain in the atmosphere for different lengths of time and impose different costs on society. Third, fewer LCA estimates exist for specialty crops than for commodity crops. I found only one LCA estimate for sweet potatoes in Ohio, and it only includes global warming potential (Uzunogullari, 2018). Finally, there is a lack of clear understanding about the LCA differences between organic and conventional production systems (Meier et al., 2015). Similar information for North Carolina would also be needed for a complete analysis. More research is needed on these topics to be able to accurately and comprehensively quantify the potential environmental impacts from a sourcing change like the one I examine.

Assessing the social impacts of this sourcing change, again there is a lack of relevant data. Researchers in a variety of disciplines, including sociology, anthropology, geography, and economics, have suggested that local food systems have the potential to increase justice, social equity, democracy, food sovereignty, food equity and justice, quality of life, social capital, promoting a sense of community, making a place for community, institution-based trust, trust in food information, structural change, community transformation, bridging diverse communities, community cohesion, transformative learning, social integration, natural human capital, and knowledge about alternative sources of food (Allen, 2010; Block et al., 2012; Boys & Hughes, 2013; Brown & Miller, 2008; Chen et al. 2019; Connelly et al., 2011; Franklin et al., 2011; Kerton & Sinclair, 2010; Lutz & Schachinger, 2013; Macias, 2008; Meehan et al., 2008). However, there is very little research that seeks to quantify and monetize these impacts. The bias toward quantifiable metrics can lead these possible impacts to be left out of analysis, while in contrast some research uses these qualitative impacts as the *entire* basis for a project without considering crucial quantitative information. Ideally, a cost-benefit analysis could help us understand *if* the community and environmental benefits are large enough to outweigh the decreased efficiencies of production. Quantification and monetization of community impacts are not included in this analysis for lack of data but remain a significant gap in the literature and an important area for future study.

[23] Life-cycle assessment (also called life-cycle analysis) is a set of resources and methods to measure and describe the environmental impacts of a product through its entire life cycle, from production to disposal (Sieverding et al., 2020)

[24] Global warming potential refers to the release of greenhouse gasses that trap the earth's heat and is usually measured in units of CO_2 equivalent. Acidification potential refers to the release of pollutants into the atmosphere that can cause acid rain and is usually measured in units of SO_2 equivalent. Eutrophication potential refers to the release of chemicals into surface water and is usually measured as the ratio of nitrogen and phosphorus in the average composition of algae. All three can have negative impacts on a variety of ecosystems (Socolof et al., 2001).

Table 1. Known Values for Simulation (from Observed Data) (All Currencies in US$)

Description of value	Value
Total quantity of sweet potatoes purchased by OSU in 2016–2017 (lbs./year, projected)	37,173.13
Quantity of sweet potatoes purchased locally in 2016–2017 (lbs.)	9060
Quantity of local, organic sweet potatoes produced in Ohio in 2016 (lbs.)	34,300
Quantity of sweet potatoes produced in North Carolina in 2016 (lbs.)	17,100,000
Average price paid by OSU for local, organic sweet potatoes in 2016–2017 ($/lb.)	$1.25
Average farm price of organic sweet potatoes produced in Ohio in 2016 ($/lb.)	$1.46
Average price paid by OSU for nonlocal sweet potatoes in 2016–2017 ($/lb.)	$0.55
Average farm price of sweet potatoes produced in North Carolina in 2016 ($/lb.)	$0.18
Wage (including benefits) of OSU executive chef in 2016 ($/hr.)	$57.03
Wage (including benefits) of OSU receiving manager in 2016 ($/hr.)	$37.33

Table 2. Parameter Ranges for Simulation (from Literature) (All Values in US$)

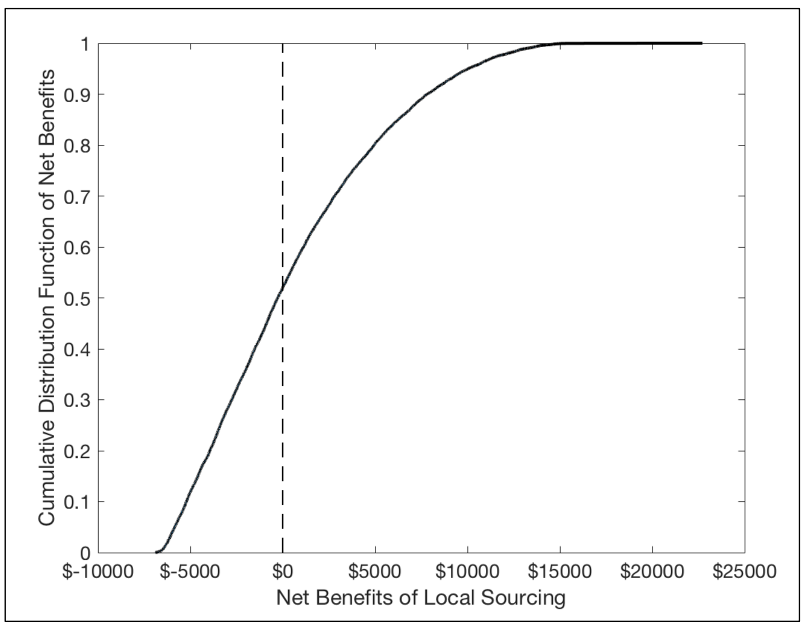
	Parameter range	
Description of parameter	Min.	Max.
Elasticity of *demand,* or responsiveness of *consumers* to changes in price:		
For organic Ohio sweet potatoes	0	6
For North Carolina sweet potatoes	0	3
Elasticity of *supply,* or responsiveness of *producers* to changes in price:		
For organic Ohio sweet potatoes	0	6
For North Carolina sweet potatoes	0	3
Student maximum willingness to pay for prepared whole sweet potatoes ($/lb.)	$1	$4
Consumer surplus, or net benefit, from local as share of total consumer surplus from nonlocal	0	0.30
Time spent by executive chef establishing relationship (hrs./year)	0	10
Time spent by receiving manager establishing relationship (hrs./year)	0	10

Simulation Description and Results

Tables 1 and 2 include the values and ranges of parameters, respectively, described in the sections on impacts and included in the Monte Carlo simulations. The purpose of these simulations is to measure the net benefits of local sourcing while accounting for uncertainty in the key parameters discussed throughout previous sections. Briefly, the benefits and costs included can be summarized as follows. OSU spends additional money to purchase local sweet potatoes and builds a relationship with the local vendor to do so. This provides consumer surplus benefits to students who value local produce. In addition, a small benefit (in the form of increased producer surplus) is created for local producers. Some of the new demand from OSU replaces previous purchases made by local non-OSU consumers (shown in Figure 3), but some of it does not replace others' sweet potato purchases. Given the very small amount of production this demand represents relative to the North Carolina market, that market is relatively unaffected by the decrease in demand (and it is assumed for simplicity that distributors are not affected either). Discounting, or the fact that benefits and costs now matter more to us than benefits and costs later, is not considered. Due to the short timeline and the even distribution of costs and benefits throughout the year, discounting is unlikely to have a substantial impact on the results.[25]

Figures 4, 5, and 6 display the key results. These figures present cumulative distribution functions (CDFs). Because I ran 10,000 different scenarios, or simulations, there are 10,000 different versions of each result; so rather than display a single number, these figures show the *share* of the 10,000 simulations (on the vertical axis) with a value at or below the value on the horizontal axis. Figure 4 shows the net benefits of OSU's sourcing change to society, considering all impacts discussed above. The net benefit estimates range from –US$6,888 to US$22,719 in the first year, with a median value of –US$265 and a mean value of US$611. As the median suggests, in the majority of cases (out of 10,000), the net benefit is negative: local sourcing yields a net loss in societal welfare. This result can be seen in Figure 4: the CDF crosses the dashed line (marking zero net benefit) at just above 0.5 on the vertical axis, signifying that over 50% of the scenarios yield a negative net benefit. However, it should be noted that possible environmental and social benefits are not included. Estimated producer surplus accruing to Ohio producers (Figure 5) is positive, as expected, but small. The units on the horizontal axis are large because there are a small number of scenarios in which the benefits to producers are very large. Consumer surplus accruing to Ohio students is non-negative (by construction) and ranges considerably depending on the assumptions about the existing consumer surplus from sweet potato consumption and the premium students place on local foods. Together the results indicate the substantial variability that may occur in terms of welfare.

Figure 4. Annual Net Benefits of Local Sourcing Relative to Status Quo



Using the Tool of Cost-Benefit Analysis in Your Own Setting

This work addresses the benefits and challenges of using cost-benefit analysis in local food settings. In particular, this process suggests that one reason for the common use of input-output analysis for economic impact analysis may be its accessibility. However, economic impact analysis with the input-output analysis method is not necessarily the appropriate evaluation approach to answer all questions of interest in local food systems. Cost-benefit analysis is a more appropriate methodology if local

[25] A technical issue is the possibility of double-counting consumer or producer surplus in markets for goods that are substitutes or complements to sweet potatoes. In this case, the primary market I am using for measurement is the market for organic Ohio sweet potatoes, and the secondary market is the market for North Carolina sweet potatoes, as Ohio sweet potatoes serve as a substitute for North Carolina sweet potatoes. When observed market demand is used in analysis, changes in the market in North Carolina will be captured in the primary market (as some existing buyers of Ohio sweet potatoes choose to purchase North Carolina sweet potatoes due to the relatively cheaper prices). However, in this case I must measure the surplus in the North Carolina market, because I assume the quantity shift in demand from OSU's purchase to be exactly equal to the change in demand in the market for Ohio sweet potatoes, all else held equal. If I instead *observed* the change in demand in the market for Ohio sweet potatoes, part of this increase in demand by OSU would be reduced as existing consumers in Ohio shifted their demand to North Carolina sweet potatoes (with a similar effect occurring for North Carolina consumers in their local market).

Figure 5. Producer Surplus Accruing to Ohio Producers Relative to Status Quo

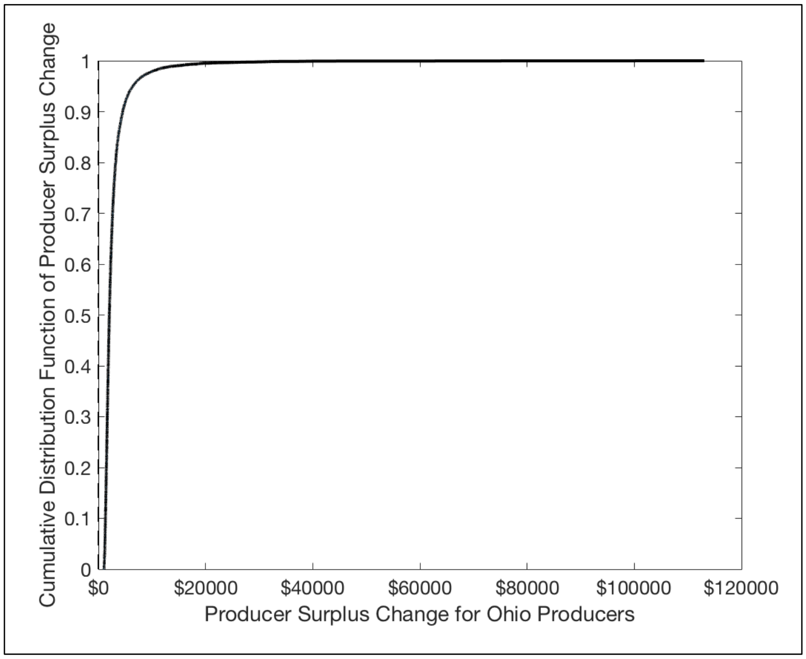
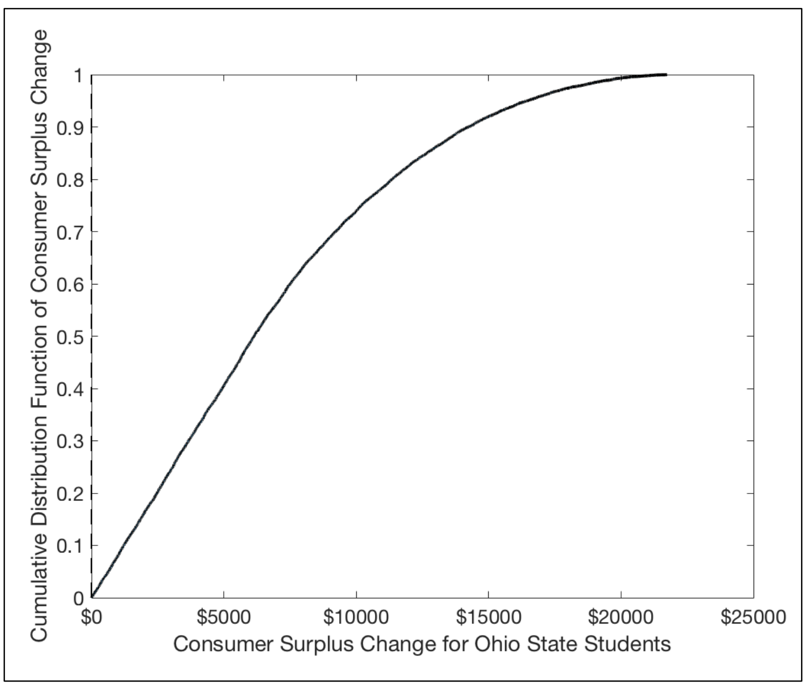


Figure 6. Consumer Surplus Accruing to Ohio State Students Relative to Status Quo



food system stakeholders want to answer the question: *should* we do this project? Given the costs and benefits of cost-benefit analysis itself, there are several possible paths forward for those who wish to undertake cost-benefit analysis of projects within a university setting.

Option 1: Engage faculty and students in departments with relevant expertise to conduct a complete quantitative cost-benefit analysis

In order to understand the impacts of local food system investments on more than just financial flows, as provided in economic impact analyses, it is necessary to use a multidisciplinary approach. Thus the work in the present analysis comes from a wide variety of fields. As is also probably evident from this study, some of the impacts may be surprising and may not fit our common narratives. Fortunately, universities have at their disposal a wide range of experts across fields to measure these kinds of impacts. The university could create a wish list of various projects and reach out to the departments capable of undertaking these projects with the help of students and faculty and incentivize research by providing funding.[26] More in-depth analyses (publishable in prestigious, peer-reviewed journals) could involve life-cycle analyses looking at local food production of various kinds to understand the environmental impacts of switching production among various crops or production practices. They could also include economic analyses such as choice experiments or con-

[26] In fact, this study originated with a class project I assigned in an upper-level undergraduate cost-benefit analysis class. Students' initial analyses piqued my interest and led me to conduct a more thorough exploration after the semester ended.

tingent valuation studies to understand students' willingness to pay for local food products. Community impacts are more difficult to assess quantitatively, but a project on this topic could be undertaken by economists and sociologists together, breaking new ground.

Option 2: Supplement a quantitative cost-benefit analysis with qualitative information

Many of the tasks that were utilized in this paper can be conducted qualitatively through the following methods: in-depth interviews with potential vendors to understand the environmental and market impacts of their production; assessment of students' levels of interest in eating local foods, which may vary across different university settings; and discussion with current vendors about where food comes from and how it is produced. It may be that food is produced more sustainably or with more positive community impacts elsewhere than is currently known, but the length of the supply chain obscures this information. For an analysis of the food system in the local community, understanding the production and demand for food in the local food system prior to purchasing will allow the university to better understand the potential community impacts of their purchases. For example, if the university started purchasing all of a certain product from the local community, what percentage of local production of that crop would the university's purchase represent? Who would produce it? This type of interview-based, qualitative cost-benefit analysis can get the university a long way toward understanding the potential welfare impacts of its food purchases. Engaging in local purchasing relationships without an examination of these questions could lead to outcomes that are actually worse for society. In contrast, a close examination of these topics, even if performed qualitatively, could allow the university to make strategic decisions in its local food sourcing that yield the greatest potential for positive net benefits. It should be noted that existing assessment tools (e.g., from organizations like Real Food Challenge) can be useful in helping to increase transparency of university sourcing; the processes they suggest can yield data relevant to a cost-benefit analysis (although it is important to recognize the assumptions implicit in any such tool).

Option 3: Use a combination of options 1 and 2 and benefit transfer methods

The analysis in this paper heavily relies on the method of benefit transfer, the process of using existing estimates from other settings and translating them to the setting at hand. This is not an ideal approach but can give a good estimate of the range of welfare impacts, especially combined with simulation methods, like the Monte Carlo analysis used in this paper, that account for sources of uncertainty in parameter estimates.

Policy Implications and Suggestions for Future Research

This work has important implications for food policy. Considerable confidence has been placed in local food system investments as an effective tool to combat a wide variety of societal ills. Nevertheless, and surprisingly, applied welfare analysis in the form of cost-benefit analysis has not been used to examine these investments and the policies that support them. Cost-benefit analysis is a well-accepted method for evaluating policies before and after implementation to answer a question that is, hopefully, central to the work of most policymakers: does this policy make society better off? In this work I use a case study to demonstrate that the answer to this question is not unequivocally "yes" for the case of local sourcing of sweet potatoes by Ohio State University, and to set an example for how this type of analysis could be used to inform decisions by policymakers and other food system stakeholders in addition to or in place of other forms of policy evaluation. This work also highlights some important areas for continued research in the field of applied economics and other fields that could enhance the accuracy of this tool and make the required data more accessible to a variety of stakeholders.

First, while scholars outside economics have spent ample time considering the social impacts of local and regional food systems, economists have done less on this front. The relative lack of work among economists is not necessarily due to a lack of interest in understanding these impacts, but because economists have not developed as many tools for this work as scholars in some other fields. However, these tools are far from difficult to envision. While monetizing community impacts will likely be seen as inappropriate by some, particularly non-economists, I would argue the issue of how to value social impacts is akin to the issue of how and whether to value nonmarket environmental impacts, which is increasingly accepted and expected in cost-benefit analyses. If decisionmakers continue to use cost-benefit analysis as a tool, then the value of these impacts should be considered in the setting described in this case study and in many others as well. In the current setting, it is expected that the unmeasured social benefits are positive, making the estimates in this study biased downward relative to the true net benefits of the sourcing change.

Second, this work reveals the challenges of understanding the net benefits of the environmental impacts of local sourcing, and the ways that this varies across crops and across regions. The research process undertaken here also reiterates the point made by others that the costs and benefits of local sourcing are very likely to be both crop- and location-specific. Both measuring and monetizing relevant environmental impacts will take a multidisciplinary approach that engages biological and environmental scientists, engineers, and others—to estimate the environmental impacts themselves—and economists to estimate the costs to society of those impacts for a wide variety of crops, production methods, and geographies. In general, existing estimates appear to have been generated as one-off projects and do not provide a comprehensive analysis that can be used by a variety of stakeholders. This work also conveys the importance of understanding the environmental impacts relative to previous uses of local resources rather than relative to nonlocal environmental impacts when conducting applied welfare analysis. In this setting, the expected direction of bias in my estimates is ambiguous, given the lack of information about the environmental impacts of resource use prior to sweet potato production for OSU.

In addition to these major categories of research that are important for providing accurate cost-benefit analyses of local food system investments, this work suggests a variety of important areas for future quantitative research that would be valuable in similar cost-benefit analyses. Examples include student willingness to pay for products in all-you-care-to-eat dining hall settings (similar to buffets); possible nonmarket benefits to the university, such as community goodwill; responsiveness of output supply to changes in price for specialty crops; trade-offs between university dining services budgets and other services provided by the university; the long-term impacts on students stemming from sourcing changes for university meal plan prices; and the psychological and lifestyle benefits that producers get from producing for and selling to local markets.

While this work suggests that cost-benefit analysis remains somewhat inaccessible as a project evaluation tool for local food system stakeholders at present, it also demonstrates the important potential role of cost-benefit analysis as an addition to local food system stakeholders' project evaluation toolkits. Cost-benefit analysis can answer different questions than economic impact analysis does and has an important role in demonstrating net benefits and highlighting key trade-offs of local food system investments. The suggestions for future research, if acted upon, can help pave the way for increased use of this tool by local food system stakeholders moving forward.

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Bridging scientific and experiential knowledges via participatory climate adaptation research: A case study of dry farmers in Oregon

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Abstract

In western Oregon's Willamette Valley, small fruit and vegetable growers have traditionally relied on irrigation to produce their crops. However, they are increasingly experiencing issues with water availability and access due to precipitation pattern changes associated with climate change. In 2016, the Dry Farming Collaborative (DFC) was developed as a participatory model for facilitating research, social networks, and resource-sharing among agricultural stakeholders to test the efficacy

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of dry farming as an adaptation strategy. Dry farming differs from irrigated cropping systems in that growers do not irrigate their fields and instead utilize a suite of practices to conserve soil moisture from winter rains for summer crop growth. To better understand how to meaningfully engage stakeholders in participatory climate adaptation research, this study explored how the participatory process facilitated the adoption of dry farming as a climate adaptation strategy among participants. Drawing on interviews with 20 DFC participants, including farmers, gardeners, and researchers, results indicate that the integration and use of different knowledge systems within the participatory research process made it easier for participants to integrate dry farming into their operational contexts. Processes designed to encourage interactions and information-sharing between participants and nonhierarchical researcher-grower relationships facilitated the exchange of these knowledge systems among participants, thus providing them with the trusted and salient information they needed to adopt new practices. Results indicate that these features could be useful for enacting future participatory climate research projects that lead to the adoption of effective adaptation strategies.

Keywords
Dry Farming, Participatory Research, Climate Adaptation, Small Farmers

Introduction

In western Oregon's Willamette Valley, many small fruit and vegetable producers traditionally have depended upon irrigation to produce their crops during the hot, dry summers. However, due to a changing climate in the region, small farmers are likely to experience more drought conditions, changes to peak flows associated with earlier runoff and reduced snowpack, and more extreme rain events (May et al., 2018). For many producers, this means that access to water during the growing season will be limited, especially for those who have junior water rights or no water rights (Li et al., 2019). While this challenging context may be unique to farmers in Oregon's Willamette Valley, many of these changes, especially access to water, will also be experienced by those in other parts of the globe (Alexandratos & Bruinsma, 2012).

In response to these changes, some Oregon farmers are adopting dry farming methods as a climate resilience strategy to cope with the reduced water supply available for irrigation. Dry farming and various associated techniques have deep historical and varied cultural roots. Desert farmers and Indigenous Peoples around the world have developed techniques for farming with minimal irrigation or rainfall (Nabhan, 2013). Dry farming differs from traditionally irrigated cropping systems in that farmers do not apply irrigation to their fields. Instead, they select a site with deep soil and good water-holding characteristics and utilize a suite of management practices to conserve soil moisture from winter and spring precipitation to be used for summer crop growth. Some of the practices that support dry farming include early soil preparation and planting; the selection of drought tolerant, resistant, or early-maturing cultivars; lower planting density; cultivation or surface protection to prevent crusting and cracking of the soil surface; diligent weed control; and improvement of soil health over time with practices such as cover cropping, rotation, and minimizing soil disturbance (Garrett, 2019).

In order to facilitate information-sharing as Oregonian growers began experimenting with dry farming, Amy Garrett, an associate professor in the Oregon State University Extension Small Farms Program, created the Dry Farming Collaborative (DFC). Dry farming is not a yield maximization strategy and as such has not gotten much attention from industry and academia over the past century. Dry-farming techniques have mainly been passed down from farmer to farmer, so facilitating knowledge-sharing to build trust, respect, and inform research efforts was key in the collaborative's inception. The DFC has since evolved into a multifaceted participatory research effort that facilitates networking, on-farm research, and resource-sharing among farmers, gardeners, agricultural professionals, and university researchers interested in dry farming.

To better understand whether and how participatory research can support farmers in adopting climate adaptive methods, this paper seeks to understand whether and how the DFC's participatory process facilitates the adoption of dry farming as a climate resilience strategy among participants. Important findings regarding this process may then be applied to similar participatory efforts in the future. Calls for participatory research such as this have been increasing, with the goal of creating usable science for farmers, ranchers, and others on the frontlines of climate change (Ballard & Belsky, 2010; Meadow et al., 2015). These efforts have arisen out of concerns about the traditional "top-down," loading-dock style of research in university extension and elsewhere. In the top-down style, research agendas are designed and studies are led by university researchers with farmers simply receiving the results and integrating them, if possible, into their operations (Prokopy et al., 2015). However, the results are oftentimes not usable or relevant for farmers, or at least not all types of farmers.

In contrast, participatory research emphasizes the coproduction of knowledge and seeks to bring together a plurality of knowledge systems that come from multiple stakeholders (Bezner Kerr et al., 2018; Meadow et al., 2015; Prokopy et al., 2017). In an effort to make science "work" for more types of farmers, participatory research has been championed as a solution to the flaws in these traditional methods, as it allows for more direct stakeholder involvement in shaping research agendas (Meadow et al., 2015; Yorgey et al., 2017). However, it is important to understand what aspects of research projects on participatory climate adaptation help effectively engage producers and create knowledge that is useful to stakeholders.

In this paper, we will first review the relevant literature regarding the role different epistemologies play within agricultural knowledge systems. We will also review previous research that has shown how participatory research efforts can facilitate a mutual process of knowledge exchange, particularly in climate adaptation contexts. The methods section then describes the DFC and this research project in more detail, including the participant sample and the data collection and analysis methods used. The results and discussion sections examine the findings from the in-depth interviews, which illustrate how different forms of knowledge were used and valued by participants, and the ways specific elements of the participatory process facilitated the exchange of those different knowledge systems between participants. The conclusion section describes how these results can inform future participatory research projects and offers some recommendations for future outreach and research.

Literature Review

Epistemologies within Agriculture

Understanding how different epistemologies are used by stakeholders is an important part of shaping successful participatory climate adaptation research. Epistemologies, or what and how we know, cannot be separated from the practices and socio-material conditions that give rise to them (Carolan, 2006a). Previous research has shown that knowledge itself is a form of social relation and only has meaning in a social context—when it comes from a source that is trusted and seen as legitimate (Carolan, 2006b; Ingram et al., 2016). Therefore, epistemologies are important for shaping perceptions and behaviors within agricultural contexts (Carolan, 2006a). In U.S. agriculture, peer-reviewed, scientific studies have traditionally been framed as the basis for trusted knowledge, and the goal of the Cooperative Extension Service has been to funnel this knowledge from university scientists to farmers. This type of knowledge arises through the use of the scientific method and is validated by replication and an extensive peer-review process.

However, farmers, particularly small-scale alternative-style farmers, do not always see this type of knowledge as trustworthy, reliable, or applicable to local realities (Carolan 2006b). Therefore, farmers do not rely exclusively on scientific knowledge when making management decisions. Instead, they often rely on other forms of informal, place-based knowledge. For instance, research shows that much of the knowledge involved in farming is embodied and gained through lived experiences in a body in the world: feeling soil, watching crop growth, experiencing the weather (Carolan, 2009). Furthermore, farmer-to-farmer exchange of their embodied and experiential knowledge has consistently played a critical part in helping farmers transition to sustainable practices (Bell, 2004). For instance, Šūmane et al. (2018) found that a diversity of knowledge sources, including other farmers' local, experiential knowledge gained through networking, was necessary for farmers transitioning to sustainable and resilient agricultural systems. In addition, in a study of farmer knowledge exchange, Wood et al. (2014) found that farmers preferred learning from others' direct farming experience. Of course, experiential knowledge is often combined "in the field" with farmers' scientific knowledge as well. Scholars have pointed out the substantive similarities between these two forms of knowledge, such as the fact that they are both empirical in nature and can have both local and abstract applications (Agrawal, 1995; Watts & Scales, 2015). In this way, experiential knowledge gained from interactions with other local farmers is just as important as scientific knowledge, and oftentimes it is even more trusted and salient for farmers.

Participatory Processes in Climate Adaptive Research

Participatory research efforts are one way to facilitate a process of knowledge exchange that can break down boundaries between scientific knowledge and local, experiential knowledge. We know that more conventional approaches to agricultural outreach and extension have often relied on top-down information transfer (Jackson-Smith et al., 2018). Therefore, participatory research is part of a suite of practices designed to respond to and counteract a top-down model of information delivery. It is designed to cultivate strong network ties to improve the ongoing dialogue between farmers (or other stakeholders) and scientists (Roncoli, 2006). Indeed, "participatory processes emphasize decentralization, transformation, empowerment, integration of local knowledge and application of research to locally relevant management scales" (Wilmer et al., 2018, p. 2). The increasing popularity of participatory methods, which are a form of collaborative science, is grounded in many of the schools of thought associated with coproduction of knowledge. This coproduction of knowledge can encourage greater engagement by nonscientists, particularly on the topic of climate science (Meadow et al., 2015), and encourage the creation of tools and information that might be utilized by agricultural stakeholders (Prokopy et al., 2017).

Participatory research integrates nonscientist stakeholders in the process of scientific research, from problem definition to data analysis and interpretation (Allen, 2018). The idea behind these participatory processes is to bring together scientists and those who use science to increase the likelihood that knowledge and information will be accepted and utilized by the relevant decision-makers. One critical aspect of maintaining and supporting these scientist-stakeholder partnerships is an iterative approach that relies on repeated interaction, the production of usable and understandable scientific information, and the incorporation of diverse disciplinary knowledges for understanding the world (Lemos & Morehouse, 2005), which can include local and indigenous knowledge systems.

In the context of adapting to a changing climate and improving management decisions, it has been found that participatory models can be effective ways to encourage natural resource managers in responding to global change (Roncoli, 2006). Indeed, these methods can foster the development of network ties that can lead to greater collaboration and joint action (Bodin & Crona, 2009; Wood et al., 2014). Furthermore, researchers have found that "stakeholder networks and participatory processes have been proposed as venues and mechanisms for repeated knowledge sharing, dialog, and learning about climate change adaptation" (Bartels et al., 2013, p. S46), and such sustained interactions can lead to mutual trust *and* the development of information that is locally relevant. Overall, there is evidence that participatory efforts can lead to sharing across epistemological boundaries, the creation of new knowledge, and enhanced network learning, as well as guide action taken in response to this new knowledge (Jackson-Smith et al., 2018; Wilmer et al., 2018).

In seeking to understand whether and how the DFC's participatory process facilitated the experimentation with and adoption of dry farming by participants, this paper explores how its structure supported the exchange of different forms of knowledge in a way that enhanced trust and salience among participants.

Applied Research Methods

Context of Study

The DFC is a group of growers, researchers, extension educators, plant breeders, and agricultural professionals partnering to increase knowledge and awareness of dry farming management practices with a hands-on participatory approach. The initial purpose of the group in 2016 was to facilitate information exchange as more growers started to experiment with dry farming. Since then, the DFC has evolved into a multifaceted participatory research project with growers all over the maritime Pacific Northwest. As of 2020, more than 50 DFC members have actively engaged with the group's research. DFC members are encouraged to experiment on their own with dry farming and share their lessons learned, as well as participate in larger participatory research projects to help answer common questions that align with their operation and interests. Some of the research projects that emerged from the onset focused on crop varietal and site suitability for dry farming. A study was also conducted to evaluate the ability of fungal inoculants to enhance drought tolerance. Each research project was developed through consultation with DFC growers and led by different researchers involved in the group who set up its own terms with the DFC growers who volunteered to participate. Participants in variety trials and the fungal inoculant study were provided seeds or transplants, instructions for setting up trials, and data sheets to fill out and submit after harvest was complete.

Each year after all data were submitted, a data analyst would then compile and illustrate the data to share at meetings and conferences. For example, the DFC winter meeting has taken place after each growing season since the group formed in 2016. This is typically a full-day event attended by approximately 60 DFC members who are actively dry farming or interested in dry farming. The agenda is a combination of short formal and informal presentations, roundtable discussions, seed swap, brainstorming, networking, and a potluck or meal prepared with some dry-farmed produce. Results, successes, and failures from the previous growing season are shared by DFC growers and researchers at this meeting, as well as ideas and suggestions for future research and invitations to participate in various trials in the coming growing season. Results and information about dry farming are also shared yearly at in-person and virtual field days hosted at Oregon State University's Small Farms Program's trial plots and/or on members' farms. The field days are an opportunity for those interested in dry farming to see dry-farmed crops up close, learn about trial results, network, and exchange information.

Another significant part of the DFC is the Facebook group (with over 950 members in 2020), which is a public group and discussion forum open to anyone interested in dry farming globally. Most of the group is from the Western U.S., although there is growing international interest. DFC growers and researchers post pictures and sometimes do live video walk-throughs of their plots, inquire about varieties that work well, and share events, articles, and stories relevant to farming with fewer resources.

Data Collection and Analysis

In the summer of 2018, a qualitative research project was initiated to better understand the DFC's participatory process and how it helped participants to introduce dry farming to their operational contexts. This study was approved by the Oregon State University Institutional Review Board and was funded by the U.S. Department of Agriculture (USDA) Northwest Climate Hub. Gabrielle Roesch-McNally along with Melissa Parks worked together with DFC founder Amy Garrett to design the research project to fulfill both the DFC's needs and to explore the utility of participatory research for adapting to climate change. Over the course of the summer, Roesch-McNally and Parks conducted interviews with various members of the DFC and conducted participant observation at several dry farming field days where members and prospective members were in attendance. Both Parks and Roesch-McNally led the collection and analysis of the data but included Garrett in the process of data assessment and analysis.

Overall, we conducted 17 semistructured interviews with 20 farmers, gardeners, and researchers in the DFC. Some interviews were conducted with multiple participants at once. Informed consent was received verbally from all interviewees, as per the Oregon State University Institutional Review Board guidelines. Participants were offered the choice to have their names and farm information remain anonymous. Some chose to do this, and others approved the use of their first name in reporting out the results. All interviewees were given a transcript of their interview and were given time to ensure that they felt their responses were complete and accurate. Overall, Parks and Roesch-McNally spoke to half of the growers and researchers involved in the DFC's trials and research projects. Purposive sampling was used to recruit members in different regions of Oregon. Farmers who had been actively involved in the DFC's research projects since its inception were also purposefully recruited because they had consistently participated in the DFC and were thus able to speak to the research and collaborative process. While this sampling method restricts the generalizability of the results, given that interviewees were selected by Parks and Roesch-McNally rather than selected at random, the large sample size allows for some broader generalizations to be made about the group.

Key topics discussed in the interviews that informed this study included participants' feelings about and experience with the practice of dry farming, as well as their involvement in the DFC. They were also prompted to describe the functioning of the DFC and to evaluate what they appreciated about the collaborative and what they thought could be improved. The interviews were audio-recorded and ranged from 36 minutes to over two hours in length. Participant observations were also conducted at three dry farm field days over the summer and at the 2019 winter meeting. At each event, Parks and Roesch-McNally participated while taking notes and photographs, focusing on the interactions between attendees and the functioning of the events. All interviews and fieldnotes were transcribed and coded for themes using NVivo qualitative analysis software.

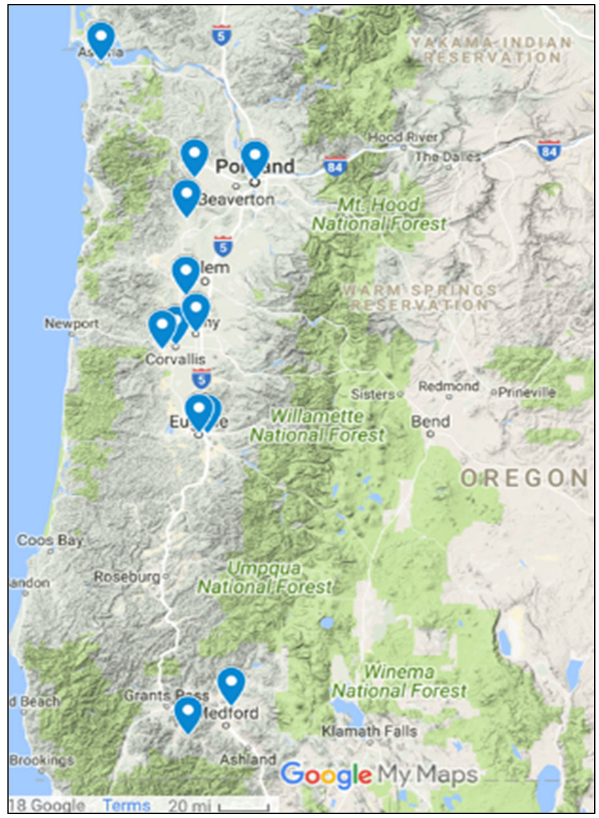
The coding process followed a grounded theory approach, following an open, axial, and selective coding approach (Charmaz, 2006). The coding process began with an initial meeting between Parks, Roesch-McNally, and Garrett to discuss the main themes that arose during interviews and to outline the preliminary codebook. Subsequently, the interviews were coded separately by both Roesch-McNally and Parks utilizing the same codebook. These two then met again to qualitatively discuss their findings and further refine their coding, focusing on an iterative and grounded dialogue to achieve coherence of themes (Charmaz, 2006). The themes that emerged for the purposes of this paper included successes and challenges with the practice of dry farming and the DFC group; processes of research design, development, and data collection; processes of knowledge exchange; the role of scientific or expert and experiential knowledges; and the cultivation of trust and mutual respect. All three authors then met to discuss the major conclusions and directions for publication. Finally, our preliminary analysis was ground-truthed by sharing at the DFC's 2019 winter meeting to gain insight on the findings from DFC participants themselves. Overall, the initial results shared were corroborated by those in attendance and the conclusions were seen as valid and helpful in guiding future work. This feedback was gathered in an ad hoc way, but we encouraged participants to reach out if they had additional feedback, reflections, or critiques. No such effort to contact us was made by any participants beyond the conversations had at the winter meeting.

Study Population

Seventeen interviewees were located in the Willamette Valley, located between the Coast and Cascade mountain ranges, the most populous region of Oregon. It is characterized by hot, dry summers and cool, wet winters (Taylor & Hannan, 1999). Two interviewees were located in the drier, more mountainous region of southern Oregon, and one was located along the milder coastal region of northwest Oregon, which borders Washington (see Figure 1).

An anonymous demographic survey of interviewees showed that 11 were women and 9 were men. Of those who responded to the survey, 14 individuals identified at least in part as White, while one identified as Native American and two as Hispanic. Their ages ranged from 29 to 72 years old. All 15 interviewees who farmed were small-scale fruit and vegetable growers, meaning per the USDA's definition that they made less than US$350,000 a year in gross cash farm income (Hoppe, 2018). Of the nine farmers who shared their gross cash farm income on the survey, three made less than US$10,000, five made US$10,001–US$50,000, and one made US$50,001–US$100,000. Another notable aspect of participants was their education levels. Seventy-nine percent of survey respondents held a bachelor's degree or graduate degree, and several mentioned their scientific backgrounds in interviews. This indicates a potential aptitude for, or at least interest in, scientific research among many of the participants, which may have contributed to their desire to participate in the DFC. For further information on participants, including a detailed breakdown of who were farmers, gardeners, and researchers, see the Appendix. Finally, most participants chose to use their real first name for this publication, except where noted in the Appendix.

Figure 1. Map of Interview Locations



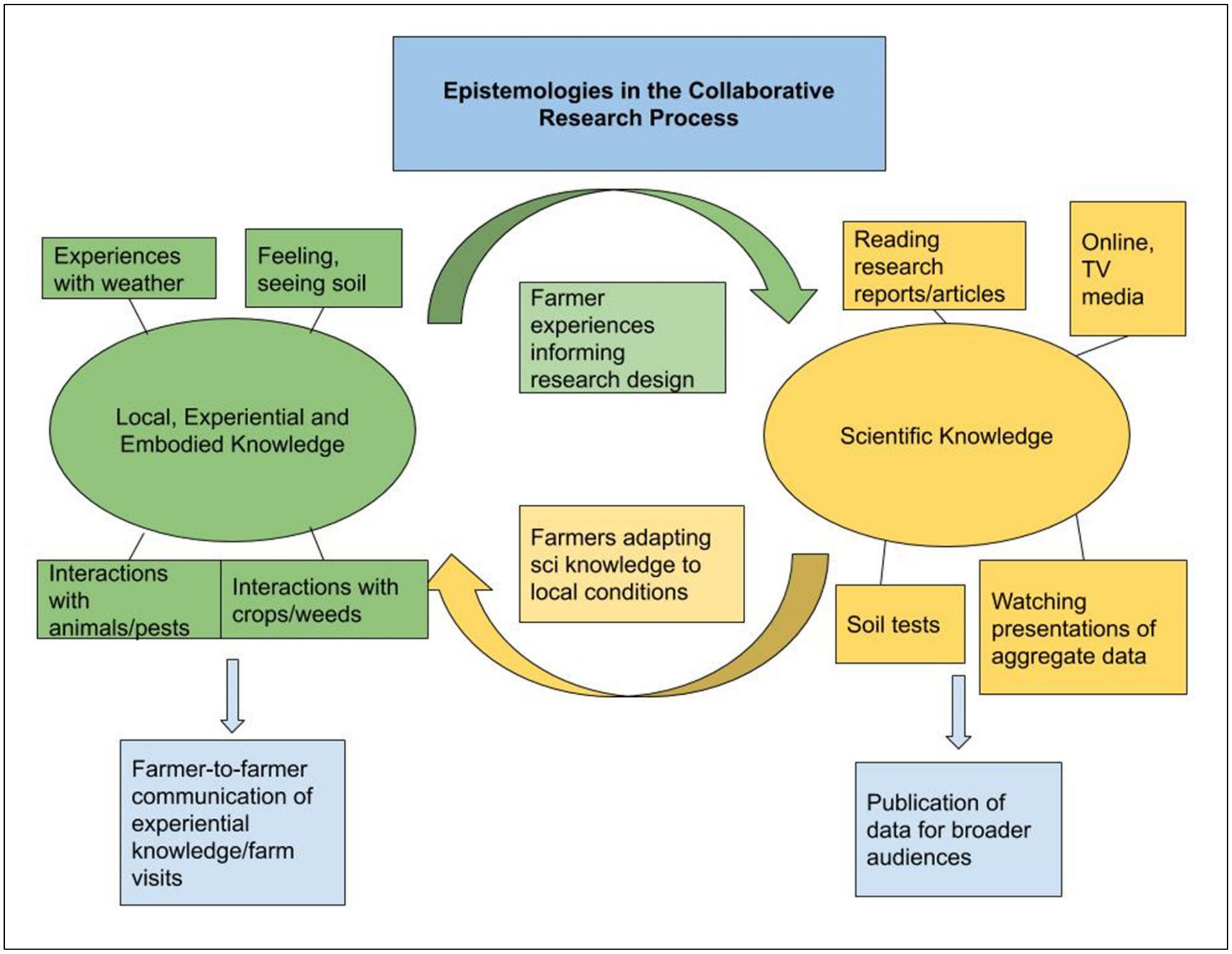
Results

The results overall indicated that participants were able to successfully integrate dry farming into their operations. The use of multiple forms of knowledge by participants was a major factor that facilitated this. Furthermore, the integration and exchange of multiple knowledges was supported by key aspects of the DFC's participatory process. The following subsections explore key themes uncovered during the data analysis including the most common forms of knowledge used by participants and how participants, including farmers, gardeners, and researchers, used these forms of knowledge to apply dry farming to their operational contexts. Subsequently, the key aspects of the participatory process that facilitated the development and exchange of these forms of knowledge are described. These aspects include the existence of multiple avenues for information exchange and opportunities for networking, as well as the cultivation of mutual trust and respect among participants, especially between researchers and farmers and gardeners.

Scientific and Experiential Knowledges: A Conceptual Framework

In an attempt to understand how multiple forms of knowledge were integrated into the DFC's process, a conceptual framework was developed to tease apart the differences between two common forms of knowledge described and utilized by participants (Figure 2). Overall, these two knowledges tended to arise from distinct sources and experiences. 'Scientific knowledge' was primarily knowledge which was more strictly derived from the scientific method. This type of knowledge was often gained by interacting with more distant information sources, such as the media, or by reading research reports written by scientists they did not know personally. However, this category also included knowledge gained from the DFC researchers' scientific experiments and expertise. This type of knowledge tended to be more generalized and less locally specific. Some examples of this knowledge include data from dry farming variety trials which were aggregated by the DFC researchers, data generated from testing soil in a laboratory, or information about global climate change as communicated in popular articles summarizing scientific

Figure 2. The Use of Scientific and Experiential Knowledges by Participants in the Dry Farming Collaborative Research Context



research. In contrast, local, experiential, or embodied knowledge was gained through direct participant interaction with the soil, crops, animals, or weather, or through direct communication with another participant about their own local, experiential knowledge. This included information about which crop varietals grow best under dry-farmed conditions, specific mulching or planting techniques, and embodied knowledge about soil health.

Uses of Experiential and Scientific Knowledge in Dry Farming

When it came to applying dry farming techniques on their properties, a pattern emerged whereby local, experiential, and embodied knowledge of dry farming techniques was utilized simultaneously with more generalized scientific knowledge. While participants liked having access both to generalized scientific information, such as the aggregated data analyzed and communicated by the DFC researchers, and others' experiential knowledge, these two forms of knowledge were valued for different reasons and incorporated in different ways. Their own and others' on-the-ground experiences with dry farming were seen primarily as critical to the dry farming process. When asked what it takes to be a successful dry farmer, Teresa[1] expressed this sentiment,

[1] For more details on each participant, including their role in the DFC, farm size, and length of time farming, see the Appendix.

> I feel like part of that's just really feeling almost at one with your ecosystem. . . . I think also part of it's just like if you've done this enough times and you've planted plants at these times and they do well, your instinct is like 'this is when I should plant this because it's probably gonna do well,' and sometimes I think we do that instinctively without really being able to quantify it, but it's almost just like there's a smell in the air, you know, there's these birds have shown up, there's a feeling, and you can't exactly explain what it is but it's like, I know the day it's spring and it's not necessarily when the calendar says it's spring... and I feel like dry farming has a little bit of that going on.

This idea that experiential, embodied knowledge of dry farming was critical to being successful was brought up in 10 of the 17 interviews. Furthermore, eight participants expressed that communication with others who have that knowledge was also critical, especially if you did not yet have it yourself. For instance, John expressed this when he said,

> [To be successful] you have to have experience farming, and you also probably have to have examples of seeing people who have done it successfully, and to know what they've done and, you know, what mistakes they've made, and how they've corrected those.

On the other hand, scientific knowledge was used mostly as a starting point from which they could then develop their own specific strategies. Given that many participants had never dry farmed before, they needed somewhere to start. The DFC's aggregated data and guidelines describing specific variety yields, planting dates, soil preparation, and appropriate soil characteristics helped to provide them with a starting point. As one participant put it, "having access to the data, to the research is super valuable." However, since this knowledge was not locally specific to participants' regions or farms, nor was it embodied, it needed to be complemented with the local, experiential, and embodied knowledge described above in order to be successful or useful to growers.

The lines between these two forms of knowledge began to further blur in the DFC because researchers were often farmers, and farmers were researchers as they were conducting their own trials and collecting their own data. This aspect was one that participants highly appreciated. As Harry put it,

> I don't feel like what we're doing is proper science in that I could ever publish anything, but I think that by paying attention to things, and every year tweaking and changing and trying to learn from your experience. . . . I think everyone's personal experience is really important, I'm not such a big fan of like . . . one set of practices that I think everybody should do, I think what's better for us is that we all are finding our own ways. . . . The great thing about [the DFC] is that scientists can come in and say "well you know these farmers have done trials, we can use that as the basis for our studies."

As this shows, farmers in the DFC expect scientists, and not just those in the DFC, to learn as much from them as they do in return. They appreciate that their own experiential knowledge is being translated into scientific knowledge to discover broader patterns and best practices, while simultaneously the scientific knowledge they are given can be bent and tweaked by their own experience when conducting trials and incorporating dry farming into their operational context. The incorporation of both of these forms of knowledge is front and center in the DFC, and it is part of what makes it successful, according to participants.

Finally, a blended reliance on scientific and experiential knowledges was also observed in participants' assessments of soil health. Soil type and health is critical in dry farming since it is necessary for the soil to hold moisture from winter rains throughout the hot, dry summer. While many participants had their soil scientifically tested by a lab to determine features such as nutrient levels and pH, most were also using embodied measures to assess their soil health. For instance, most farmers used the visual health of their plants and tactile or visual interactions with the soil as indicators of soil health. For instance, when asked how she assessed soil health in her garden, Janice said,

> By looking at it, by digging in it, a lot, you know, just a lot of observational stuff, soil tests for nutrient levels and pH, and observing not only the soil but the plants that are growing.

Similarly, Kevin said,

> I don't know how I define soil health, it's just like, I feel soil health by touching the soil. I see soil health by, you know, put a shovel in and a lot, tons of worms in there and dung beetles and, you see it in the plants.

These trends illustrate that embodied knowledge of the soil such as touching and seeing the soil and the plants growing from it was commonly relied on to assess soil health.

In contrast, scientific knowledge about soil health was valued as a complement to this in that it could illuminate factors that may not be readily discernible, or simply confirm what they felt to be true. For instance, Nate describes his interaction with Andy, a soil scientist who was also a gardener and researcher participating in the DFC,

> Andy came and took some soil for some tests and stuff, and I learned so much from the hour I got to spend with him. It was valuable and interesting to see how a soil scientist goes about evaluating and looking at what is present. He has been on a LOT of ground and to have him say, "your soil is some of the better stuff that I have worked on, there are a lot of worms out here," it is really fortifying, it sort of cinched it for me like, yep, we are going to keep doing this because it makes sense and it's not just my own sense of it.

This quotation provides one example of how participants valued scientific expertise by illustrating how a participant incorporated scientific knowledge delivered from a soil test and a DFC researcher into their management. While Nate had his own sense of the health of the soil, the knowledge he gained from interacting with Andy made him feel more confident in his approach and helped put his own embodied knowledge into a scientific context.

Processes of Knowledge Exchange in the Dry Farming Collaborative

One of the ways that participants negotiated their own experiential, embodied knowledge with the scientific information shared by researchers and other more distant sources was via the process of exchange and the network of DFC participants. Sixteen participants described the importance of talking with and relating to other participants who were also experimenting with dry farming, often in an in-person field day or winter meeting setting. They also described the importance of their relationships with the researchers, which nonresearcher participants described as collaborative and nonhierarchical.

Participants described this process of exchange as one of community-building and cooperation with others in the network, which for them has become an iterative learning experience. Participants often highlighted the importance of those in the DFC, both researchers as well as farmers and gardeners. They expressed that all groups were working toward a "common interest" in a symbiotic way. This idea that there are blurred lines between the researchers and farmers was aptly described by John, who said,

> Yeah, I think that the line [between researcher and farmer] gets, it's blurred quite a bit. . . . It's kind of a nontraditional kind of a group, in that respect . . . and I think that's useful in a lot of ways.

Participants also greatly appreciated being a part of this farmer-to-farmer exchange where they could share their experiences of dry farming and trying new varieties or soil amendment practices. Through this exchange they were able to boost their effectiveness with the practice by learning from one another and sharing their own knowledge and experience. For example, Anne describes this exchange in her effort to share a dry farm tomato variety that she helped to discover,

> I brought one variety of tomato into the program which was a tiny cherry tomato called Champagne Bubbles that was just absolutely fantastic flavor but 100% of them split and turns out if we don't water it then they don't split. And they're even better! So some of the farmers are using that variety that we brought, and Amy [Garrett] is growing some.

To this end, the participants appreciated the ways in which their knowledge and experimentation of dry farming could fit into the group research effort where there is both freedom to experiment and the pleasure of learning from one another, as explained by Harry,

> They're [the DFC] just doing iterations until each person arrives at a method that works for them, I think that's the most valuable thing for each other and for the future too. I think when I come to these meetings what I really love is hearing people and talking to people who have been paying attention, have lots of ideas, they're forming all these like hypotheses in their heads, and we just share that.

Eighty percent of participants also discussed a preference for knowledge delivered in-person through events such as field days and the winter meeting, while 40% also utilized online resources and the Facebook group. Overall, there was a general appreciation of the many ways that the network facilitated learning and sharing among participants. According to Darlene, there is such power that comes from participating in a group and learning from each other. When asked whether or not she would be participating in the DFC next year, she said,

> Definitely. It's something you could do on your own but there's so much you can learn from other people. . . . I enjoy being with other people, I enjoy learning from them.

While there was a deep appreciation for and desire to learn from other farmer or gardener participants, it was also clear that they valued the expert knowledge that was shared by the researchers. Many of the terms that farmers used to describe this relationship between researchers and nonresearcher participants suggested that it was collaborative, iterative, or not "top down." For example, when asked whether he thought that researchers and farmers were partners in the DFC, Andrew said,

> That's a good way to present that question . . . partners. . . . I think that they're trying to learn from each other and it's a mutually beneficial relationship . . . with the people learning from each other, becoming better, more efficient at what they're doing and what they're pursuing for the greater good of dry farming and how it can be implemented on a larger scale.

In addition, Lucas articulated that this approach is the heart of the DFC and an intentional part of its design by saying,

> Yeah, I'd say they're very much partners and I believe that Amy [Garrett] has sort of driven that point home a lot of time in the meetings, she tries to stress that academic researchers are equal to the farmers, and I think it's a really important concept that is not appreciated in the world of University Extension … [which is] too often sort of a delivery of knowledge rather than a collaboration.

Furthermore, Yadira describes having access to university experts as,

> [Something] that is unique about this collaborative … [for example,] somebody else who is super interested in winter squash varietals would be super stoked to spend time with Alex [Stone] and her group because that is what she does and someone who is crazy interested in data collection would be super stoked to talk to Amy [Garrett].

Finally, 72% of the growers described the importance of this partnership as a means of knowledge sharing. This was brought about by the fact that they needed to, and were responsible for, collecting data to benefit the whole group.

Janice noted that,

> I know that some of the growers were active in helping develop some of the [research] protocols. I mean that's being a partner, and they're taking our data at face value, which is like, my data is nasty data. I mean, I didn't trust it very much but you know they were having us collect data, they weren't coming out and doing it, and so that's being a research partner right there for sure.

This illustrates that this participatory process has enabled the farmers and researchers to feel like they are collaboratively working toward a shared common goal, which in this case is the development of more resources and data that will help growers in adopting dry farming techniques in the region.

Facilitating Knowledge Transfer: Cultivating Trust and Mutual Respect

The DFC was designed and functions as a nonhierarchical group, a feature which appears to have facilitated the development and exchange of both scientific and experiential knowledge by enhancing trust and mutual respect among participants. Primarily, this nonhierarchical approach has facilitated broad buy-in among participants, where each recognizes that they have a role to play in delivering results and in moving the project forward. This kind of commitment is articulated well by Teresa, who noted,

> When I say I'm going to host a trial on my farm, I agree to do that to the best of my ability, like that I'm gonna honor the guidelines that are set up so that the data I'm submitting is useful and valid, you know, that I'm gonna not cheat and water my plants or, if I do, I hate to even use the word cheat because I know sometimes people do water, but I'm gonna be honest about that.

Nate further notes that the lack of hierarchy makes him feel like there is space for his ideas to be heard and respected, which will build more buy-in over time:

> It doesn't feel like an ivory tower, it doesn't feel exclusive or like there is some clique to it or something, so I think as long as that spirit is kept up then the sky's the limit, everyone is going to come in who wants to do it and there will be more and more momentum.

Further, Jane clearly articulates that trust is more or less a given in the context of sharing among farmers and researchers in the collaborative:

> You know, I don't question. I'm just assuming being researchers, if I ask a question, they're gonna give me an honest answer. It's never crossed my mind that they're gonna give me a bad answer. And it goes the other way too, if they ask me a question, I try to give them honest feedback.

The vast majority of participants (80%) intimated that this mutuality, where their knowledge systems and expertise are shared in such a way to give both parties, growers and researchers, equal footing, has fostered a learning network that is iterative and respectful. There was no real discussion of trust being broken by any of the participants; however, two participants suggested that expectations or communication were sometimes unclear, and one noted that this had resulted in more work for them. However, this was not a common sentiment and, on the whole, most people we interviewed felt very positive about the trust that had developed between researchers and growers. Even this farmer who suggested that communication had broken down at points was still very much committed to the DFC.

It seems that one of the reasons that this commitment to the project remains is because of the trust and mutual respect that has been fostered through the collaborative approach. One of the reasons for this, as described by participants, is that participants felt that the leadership in the project, particularly Garrett, had fostered a respectful tone that generated interest and buy-in. The DFC was purposefully designed to be participatory in nature so that the growers and researchers were on an equal playing field, so to speak, with no one person or set of people being the sole decision-makers. In this way, the more traditional, one-way delivery of expert information that is common in university extension is complicated by this nonhierarchical and collaborative structure. Andy, one of the researchers who is also experimenting with dry farming on his property, suggested that Garrett is the glue that holds this thing together, noting that,

> She really is basically the Dry Farm Collaborative in one person, and who has kept it going, who keeps it going. Her personality and her style really are collaborative, I think that's a good name for it, and she finds out what people can do what, and gets the best out of everybody.
>
> This sentiment is echoed by Harry, who said,
>
> What I appreciate about the way that Amy [Garrett] is running things is that she gives us a lot of room to do our own things and explore. I know it must probably feel like herding cats at times, but I think it's really essential. I think if it was very prescriptive, honestly for me, I'd keep dry farming, but I probably wouldn't be a part of the collaborative.

Many participants commented on the importance of Garrett as a leader, the tone she set, and her commitment to the group. While she encouraged others' involvement and incorporated their diverse ideas, she was not seen as the sole decision-maker, making her a leader whose main role was to facilitate group cohesiveness rather than dictate its functioning. In this way, the group was largely nonhierarchical in its decision-making. However, some concerns did arise about the sustainability and long-term viability of the group if Garrett ever decided not to provide leadership for the DFC anymore. There are many real challenges associated with maintaining group cohesiveness and spreading leadership around in such a way so as to limit the importance of any one individual. Nonetheless, it is clear that without this collaborative process being established from the start, it is quite possible that the participants would have a very different experience. This might have had consequences for the ways different forms of knowledge were shared and utilized by the group and in driving further experimentation and adoption of dry farming methods among participating farmers and others in the broader network.

Discussion

Our results illustrate how DFC participants were able to integrate dry farming into their operations, in part by relying on different forms of knowledge and through the exchange of that knowledge. Participants primarily relied on their own local, experiential, and embodied knowledge as well as scientific knowledge to integrate dry farming into their operational contexts. For instance, participants drew on scientific knowledge in the form of soil tests conducted by laboratories and a soil scientist's expertise to understand the health of their soil, but they also jointly relied on their own embodied knowledge of the soil to measure its health. By interacting with the soil, the plants growing from it, and the organisms living in it, mostly through touch and sight, they came to know the health of the soil with their bodies (Carolan, 2009).

When it came to dry farming itself, local, experiential knowledge derived from their own experience or the experiences of others in their area was highly valued and trusted, whereas scientifically aggregated data provided by the DFC researchers was seen as interesting and broadly helpful, but less applicable to local realities and limited in its ability to help individuals select varieties or troubleshoot issues in their specific context. These results support previous research showing that local, experiential knowledge and extensive farmer-to-farmer knowledge-sharing are critical for successfully implementing sustainable practices (Bell, 2004; Smith et al., 2017; Šūmane et al., 2018; Wilke & Morton, 2017). This type of experiential knowledge may be more trusted and useful for growers because it is more localized and embodied, rather than generalized and derived from distant sources. With increased vitriol in the efforts to engage farmers in tackling the problem of climate change, building this trust and usability of data is more important than ever.[2]

[2] The #TimberUnity movement in Oregon is a great example of how farmers, ranchers, and forest landowners derailed bipartisan

Furthermore, the results show that there were specific aspects of the DFC's participatory process that allowed for and encouraged the exchange of these two forms of knowledge in a way that supported the process of implementing dry farming techniques. Specifically, the nonhierarchical organization of the collaborative as well as the trust and mutual respect that were cultivated between researchers and growers allowed for open scientific knowledge and data sharing, cultivating the kind of coproduction of knowledge that drives action and knowledge exchange (Meadow et al., 2015). Since participants trusted the group's leadership and knew them personally, they were more willing to incorporate the information they received from them. In this way, scientific knowledge was made less distant and took on an important characteristic of experiential knowledge—it was gained from a local, known, and trusted source.

In addition, providing ample spaces and opportunities for networking and information exchange allowed for local, experiential, and embodied knowledge, such as specific experiences with dry farming strategies, to be shared between participants. This was key as it was an aspect of the collaborative that was highly desired by participants and has been shown to make the information gained more trusted and salient (Wood et al., 2014). Not only this, but these exchange opportunities facilitated the sharing of experiential knowledge with researchers, which in turn allowed researchers to incorporate this knowledge into the DFC guidelines and process. This latter aspect added to the trust and mutual respect which were cornerstones of the group, as participants felt as though their experiences and knowledge were valued.

Conclusions

By exploring the use of different forms of knowledge and participatory processes in the DFC, this study has shown how creating space for multiple forms of knowledge to be exchanged and acted upon while building mutual trust and respect can be critical parts of successful collaboration efforts with growers. Participatory research projects, especially those regarding climate adaptation, should not assume that the generation of scientific data is the number one priority of participants, nor that the communication of this data is what they need most. If scientists wish to work with agricultural stakeholders to produce usable science from the bottom up, or to gain buy-in to advance mitigation and adaptation actions, local, experiential, and embodied knowledge must be taken into consideration and not forsaken for "hard line" scientific data (Finucane, 2009) or scientific perspectives on the "correct" course of action, since growers' experiential knowledge is often blended with scientific knowledge "in the field" (Watts & Scales, 2015).

In participatory research it is critical to encourage farmers to collect their own experiential "data" and share their experiences with one another while cultivating trust between researchers and participants so that scientific knowledge can be successfully integrated. While every participatory context will be different, in the DFC trusted and respected leadership gave credence and legitimacy to participants' lived experiences and influenced their persistence with experimenting with and adopting dry farming techniques. Future research should examine whether the presence of these aspects is beneficial in other participatory research contexts as well, especially those pertaining to climate change adaptation and mitigation. Additional research could also explore the role of strong leadership in these efforts and how leaders can facilitate trust and mutual respect. This research could also be expanded to examine whether leaders affect overall group cohesion, especially when or whether that leader is no longer active. Overall, participatory climate adaptation research can be beneficial for growers and researchers alike, particularly when it is grounded in the needs and experiences of those the science is intended to reach.

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efforts to accomplish climate mitigation legislation, two years in a row (Schlarb, 2020).

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Appendix. Details on the Study Participants

Name or Pseudonym	Farmer, Gardener, or Researcher	Farm Location (ecoregion)	Farm Size (acres)	Length of Time Farming at Current Location (years)	Length of Time in DFC (years)
Andrew	Farmer	Klamath Mountains	60	4	3
Anne	Farmer	Willamette Valley	15	19	3
Darlene	Farmer	Willamette Valley	106	9	3
Harry	Farmer	Willamette Valley	2	7	3
John*	Farmer	Willamette Valley	UNK	4	2
Kevin	Farmer	Willamette Valley	60	4	3
Kimberly	Farmer	Klamath Mountains	26.5	7	1
Nate	Farmer	Willamette Valley	15	4	3
Paul	Farmer	Willamette Valley	12	11	3
Rene	Farmer	Willamette Valley	15	19	3
Teresa	Farmer	Coast Range	18	8	3
Jane*	Farmer	Willamette Valley	40	22	2
Yadira	Farmer	Willamette Valley	15	4	3
Harriet	Gardener	Willamette Valley	<1	12	1
Janice	Gardener	Willamette Valley	<1	3	2
Amy	Researcher	N/A	N/A	N/A	3
Ana	Researcher	N/A	N/A	N/A	2
Alex	Researcher/Farmer	Willamette Valley	UNK	3	1
Andy	Researcher/Gardener	Willamette Valley	<1	UNK	3
Lucas	Researcher/Farmer	Willamette Valley	3	UNK	3

* Pseudonyms
Note: UNK=Unknown

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Exploring differences in communication behaviors between organic and conventional farmers

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Abstract

This exploratory qualitative study sought to gain initial insights into how farmers involved in different production practices communicate with consumers. A thematic analysis of in-depth interviews conducted with eight organic and 12 conventional farmers in Ohio indicated that organic farmers are proactive in communicating with the public about their production practices, unlike conventional farmers, who focus on improving productivity. Furthermore, the organic farmers reported using different communication channels such as Facebook, flyers, and YouTube when communicating with consumers, while conventional farmers reported being busy working on their farms and not having time to communicate with consumers. Organic farmers' involvement in communication activities with the public about their production practices and products was reported to stem from their beliefs and values toward sustainable farming practices and environmental conservation. Furthermore, unlike conventional farmers, most organic farmers sold their produce directly to consumers, and as such, used communication as a marketing tool. The active involvement of organic farmers in communicating with consumers may be attributable in part to increased media coverage about the benefits of organic farming practices. On the other hand, limited involvement of conventional farmers in communicating with the public may be partially attributable to limited media coverage about the benefits of conventional farming. Therefore, to ensure that consumers make informed decisions,

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there is a need to start developing standalone communication organizations and interventions committed to providing unbiased information about the benefits and disadvantages of the different farming practices.

Keywords
Negative Perceptions about Agriculture, Farmers, Communication, Mainstream Media, Conventional Farming, Organic Farming, Production Practices, Proactive Versus Reactive

Introduction

As early as 1940, scientists recognized the need for investing in the development of improved technologies as essential for increasing agricultural productivity to feed the world (Patel, 2013). These developments led to the introduction of farming practices that today we call conventional farming. The development of new food production technologies has led to changes in agriculture, differentiating farmers based on their production practices (Cranfield et al., 2010). The differences in production practices have led to a growing debate among the public as to which farming practices are best, with the majority preferring organically produced foods (Abrams et al., 2010).

Conventional farming involves "the use of seeds that have been genetically altered using a variety of traditional breeding methods, excluding biotechnology, and are not certified as organic" (USDA, 2015b, p. 1). Thus conventional farming is associated with high productivity and characterized by the increased use of synthetic inorganic fertilizers, herbicides, and pesticides (Kirchmann, 2019; Mzoughi, 2011). Despite the high productivity, the use of chemical fertilizers and pesticides has been associated with negative environmental and health impacts due to increased emission of green-house gasses (Kirchmann, 2019).

In response to these negative impacts, organic farming was introduced as one way of conserving the environment and ensuring production of high-quality foods in a sustainable way (Barton, 2018). Organic farming, among other techniques, has been known to contribute to higher food quality and reduction in greenhouse emissions (Kirchmann, 2019). However, no clear or standard definition of organic farming exists, as it differs depending on regulations and consumers' perceptions (Seufert et al., 2017). For example, the USDA (2015a) defined certified organic farming for certification purposes as "farming practices [that] exclude the use of irradiation, sewage sludge, synthetic fertilizers, synthetic pesticides, and biotechnology" (p. 1). On the other hand, organic farming is also defined as a cultural movement aimed at reducing the need for use of chemical fertilizers and pesticides in crop production (Barton, 2018).

The increased chemical and pesticide use associated with conventional farming has led to consumers' concerns about the safety of conventionally produced food products. In response, there has been increased media coverage about the benefits of organic farming (Cahill et al., 2010). However, public perceptions of organically produced foods as healthy, tasty, and safe have been attributed to consumers' attitudes, and not to actual differences in the foods based on production practices (Da Cunha et al., 2019; Nadricka et al., 2020; Xie et al., 2015). The mainstream media has been criticized for framing organically produced food as "ethical" and "healthy" (Abrams et al., 2010; Cahill et al., 2010). Several studies conducted in the U.S. indicate that the mainstream media contributes to negative perceptions about conventional agriculture among consumers (Baker et al., 2011; Charanza & Naile, 2012; McCluskey et al., 2016; Sellnow & Sellnow, 2014; Specht & Beam, 2015). For example, media coverage of genetically modified organisms (GMOs) has been associated with negative perceptions about GMOs among consumers (Marques et al., 2015; McCluskey et al., 2016).

In response, agricultural communication has been used as a public relations tool (Irani & Doerfert, 2013). Agricultural communication involves the delivery of information to the public and various stakeholders involved in the agricultural industry using different communication channels. It plays a crucial role in ensuring that the public has access to reliable and clear information to guide them in making informed decisions (Gottschalk & Leistner, 2013).

Since its establishment as a field, agricultural communication in the United States has gone through a lot of changes—from disseminating information to farmers about improved farming practices to disseminating scientific information to the public, advocacy, and public relations (Irani & Doerfert, 2013). Recently, agricultural communication research and interventions in the U.S. have focused on the impact of the media on the creation of negative perceptions about agriculture among consumers (Baker et al., 2011; Charanza & Naile, 2012; Kurtzo et al., 2016; Meyers et al., 2011; McCluskey et al., 2016; McKendree et al., 2014; Sellnow & Sellnow, 2014; Specht & Beam, 2015). Unlike in the past, when information was disseminated from experts to farmers, improved technological advancements in communication have led to the presence of a myriad of information sources, including farmers. Now, farmers are not merely passive receivers of information but information generators and sharers as well (Prokopy et al., 2017). Therefore, realizing that farmers involved in different and contradictory farming practices are also considered as knowledge generators and have potential to use various communication channels to communicate with consumers, there are questions regarding the impact of their communication behaviors on consumers' perceptions of agriculture.

Theoretical Framework

Communication research "involves understanding how people behave in creating, exchanging, and interpreting messages" (Littlejohn & Foss, 2010, p. 9). Several theories are used in understanding this, such as interpersonal communication and relations theories that describe processes by which people exchange messages and the associated effects on relationship development (Dainton, 2010). In an attempt to establish relationships, farmers communicate with each other as well as the public. The messages exchanged during the communication process influence relationship development. Therefore, in this study, some of the concepts of theory of planned behavior (TPB) and attribution theory were used to explore farmers' communication behaviors and the associated relationships.

The theory of planned behavior (Ajzen, 1985) describes various factors that influence an individual's decision-making process to act or behave in a certain way (Conner & Armitage, 1998). It emphasizes the role of perceived control as well as normative beliefs in influencing behavior (Ajzen, 1985, 1991). The theory indicates it is easier for a person to portray a certain behavior when they feel they have control over resources or opportunities necessary for them to behave in a particular manner (Ajzen, 1991). In addition, it describes the role of beliefs and values in influencing attitudes regarding certain behaviors (Conner & Armitage, 1998). The theory indicates that believing a given behavior will yield an acceptable outcome contributes to the development of a positive attitude toward that behavior.

Values describe an individual's attachment of judgment to an object or behavior as being either good or bad and right or wrong (Gasson, 1973). They play a critical role in decision-making as they serve as guidelines for acceptable or unacceptable behavior (Gasson, 1973; ÖhlméYr et al., 1998). Differences in production practices among farmers, which stem from differences in experience, size of land, potential markets, membership in groups or organizations, and beliefs and values toward agriculture have the potential to contribute to differences in farmers' communication behaviors (Agunga, 1995; Alexopoulos et al., 2010; Bravo-Monroy et al., 2016).

Farmers, like consumers, have different reasons for engaging in certain systems when producing agricultural products (Bravo-Monroy et al., 2016; Darnhofer et al., 2005; Torjusen et al., 2001). For example, Mzoughi (2011) reported that among other concerns, moral and social concerns were the drivers for choosing to engage in organic farming, while economic concerns were among factors for not engaging in organic farming. Farmers who are in favor of organically produced foods have been known to also prioritize sustainable farming practices and value environmental conservation (Bravo-Monroy at al., 2016; Torjusen et al., 2001). Additionally, Spooner, Schuppli, and Fraser (2014) suggest a link between farmers who value animal welfare and sustainable and organic farming practices. These values may influence organic farmers' communication behaviors and increase the likelihood of positive relationships with consumers, while encouraging negative perceptions toward conventional production (Coombs, 2007).

Despite the impact of beliefs and values in influencing farmers' choice of farming practices, no studies have been conducted aimed at exploring how beliefs and values influence farmers' communication behaviors with consumers. Moreover, the theory has mainly been applied in quantitative research studies (Stone et al., 1999), where the closed-ended questions used limit respondents' chance to express their views freely. Therefore, in order to capture participants' opinions, a qualitative approach has been employed in this research.

Attribution theory has also been used in this study. The theory looks at the tendency and presence of critical analytical skills among people to explain causes of events or behavior (Heider, 1958). The theory provides explanations of factors that influence people's behavior and judgments (Fatemi & Asghari, 2012). Such explanations are based on the tendency by people and among people to attach outcomes of events to one another (Weiner, 1986). Several studies have reported mainstream media as being responsible for perpetuating negative perceptions about agriculture in general among consumers (Charanza & Naile, 2012; Sellnow & Sellnow, 2014; Specht & Beam, 2015). Moreover, there has been growing media coverage regarding the debate between organic and conventional farming (Cleveland et al,, 2015; Feldmann & Hamm, 2015; Harper & Makatouni, 2002; Hughner et al., 2007; Krystallis & Chryssohoidis, 2005; McCluskey et al., 2016). Furthermore, there has been more coverage and positive frames being created about organic farming as opposed to conventional farming (Abrams, et al., 2010; Cahill et al., 2010). The availability of food produced through different production practices provides mainstream media with an opportunity to select messages that resonate with their audience (Funk & McCombs, 2017).

In addition, the presence of organic advocacy groups has contributed to increased media coverage of organic farming as the best farming practice, further exacerbating negative consumer perceptions of conventional agriculture (Charanza & Naile, 2012; Coombs, 2007; Sellnow & Sellnow, 2014). Research using attribution theory has focused on understanding consumers' abilities to critically analyze the information contained in the message (Chakraborty & Bhat, 2018; Legendre & Coderre, 2018). However, such analysis has been based on understanding consumers' internal or external attributes associated with the message and how such attributes influence their receptivity of the message (Laczniak et al., 2001).

The absence of research aimed at assessing factors influencing farmers' involvement in communication stems largely from an emphasis on the use of agricultural communication as a reactive tool for mitigating negative perceptions about agriculture among the public (Kurtzo et al., 2016). Since the inception of agricultural communication, there has been emphasis on using it as a tool for educating the public and farmers. However, agricultural communication can be used as a science for understanding people's behaviors. Moreover, the role of farmers in communication has often been viewed as that of receivers of agricultural information. Because of this, research on farmers' communication behaviors has focused on understanding farmers choice and use of communication channels for accessing information (Arbuckle et al, 2015; Mase & Prokopy, 2014; Varble et al., 2016). A gap remains in explaining farmers' feelings, values, and intentions that they are likely to contribute to their choices of production practice and communication behaviors.

Similar to consumers who have attributes that determine their consumption behaviors and food choices, farmers have attributes that influence their production decisions (McGuire et al., 2013). In the mid-1990s, Agunga (1995) reported about the potential for differences in farmers' attributes to contribute to the differences in production practices used, and, hence, differences in their communication behaviors. However, at that time, the differences in farming practices were not as much a cause for debate as they are currently. Therefore, it is important to explore how differences in farmers' attributes influence their communication behaviors and how that affects the type of information available to consumers.

Purpose and Research Questions

This study sought to explore how farmers involved in various production practices communicate with consumers. The following questions served as a guide for the research: How do farmers involved in different production practices identify themselves? Are there differences in communication behaviors among and between farmers following different production practices? How might differences in communication behaviors between and among conventional and organic farmers contribute toward negative perceptions about agriculture?

Methods

The study employed a qualitative research design, as it "focuses on the meanings, traits and defining characteristics of events, people, interactions, settings/cultures and experience" (Richard, 2013, p. 38). Data were collected in January 2018 during the Young Farmers conference after getting approval from Ohio State Institutional Review Board. The conference drew all farmers regardless of their farming practices. Thus both organic and conventional farmers were recruited for the study. No deliberate efforts were made to recruit a specific group of farmers based on their production practices.

Using a convenience sample, 20 farmers (12 conventional and eight organic farmers) who were attendees at the Young Farmers conference that was held in Ohio in January 2018 were recruited and involved in key informant interviews. An interview guide was developed based on the results of a content analysis of communication artifacts that were created between 2010 and 2016 (Masambuka et al., 2018). It contained questions that assessed farmers' use of different communication channels when accessing or sharing agricultural information. A question regarding participants' connection to agriculture was added to the guide during the data collection process when the researchers realized there were differences in participants' communication behaviors based on their farming practices (Galleta, 2003). The question focused on establishing how the participants identified themselves in relation to their farming practices. The interview guide was reviewed by a panel of experts composed of two communication professors, one agricultural extension educator, and one qualitative data research expert.

The conference ran for two days; during registration on the first day, the researchers approached attendees and asked if they were willing to take part in the study. On the second day, only participants who attended sessions focused on communicating with the public were approached (Paul et al., 2013). The researchers attended all of the sessions on communication. Each interview lasted for a minimum of 30 minutes and was recorded with an audio recorder after obtaining consent. Before analyzing the data, member checking was conducted with selected participants who were provided with the transcribed data through email (Harvey, 2015). Member checking is one of the quality control processes used in qualitative research where participants are provided with an opportunity to review their statements to ensure that the researcher captured them accurately (Harper & Cole, 2012),

Data Analysis

Data were analyzed using NVivo Pro, a data analysis software where themes and subthemes were generated. Case-oriented analysis was employed when analyzing the data (Della Porta, 2008). This involves analyzing the number of themes emerging from the data collected from a specific participant as opposed to analyzing data from various participants while searching for specific variables (Ragin & Schneider, 2011). In addition, a similar analysis method to Valli and Buese (2007) was used, where data were analyzed in phases. However, unlike Valli and Buese, who followed four phases, this study used only three. The first phase involved identification of farming practices, where farmers were categorized as organic farmers, conventional farmers, or both. Based on this categorization, each farmer's codes were created pertaining to their values regarding the farming practice in which they were involved, communication behaviors with other farmers and consumers, and motivations for engaging in communication behaviors. Following the preliminary data analysis, another researcher who was not involved in the data-collection process compared the themes and subthemes with the transcribed data and identified common themes that informed the findings (Flick, 2002). Saturation was established when there were no new themes emerging from the data (Urquhart, 2013). Only themes that were present for both categories of farmers (conventional and organic) were used to inform the results of the study.

Reflexivity Statement

The primary researcher was an international doctoral student at The Ohio State University at the time of data collection. The researcher recognized she was perceived as not being knowledgeable about the participants' lived experiences or American agriculture in general because she was an outsider, which may have contributed to the openness of the participants to share more information than they may have otherwise (Dwyer & Buckle, 2009). Moreover, being an outsider allowed the researcher to ask more questions and seek elaboration on issues that she did not understand because of cultural differences as well as lack of familiarity with the American agricultural system (Couture et al., 2012). However, a second researcher assisted in unveiling some of the issues or areas where the primary researcher may not have understood or captured the issues properly since English was their second language. In cases where the second researcher noticed that something did not make sense or was not clear, the researchers emailed the participants to ensure that the necessary changes were made.

Results

Farmers' Identification

Differences were observed regarding how farmers identified themselves based on their production practices. All of the organic farmers (five men and three women) identified themselves by indicating their production practices. One of the middle-aged, male, organic farmers stated,

> Oh, well my wife and I live on a 400-acre farm. It is owned by her parents and we are looking to start our own type of business model with agriculture and hopefully looking into what most people wouldn't say the regular route which is open field grass fed. Trying to get out from the cages and to treat animals as they should be treated and produce for the consumers in a way that they want food to be produced.

However, all of the conventional farmers (11 men and one woman) did not identify themselves based on the production practices they followed but rather by what they farmed. For example, a middle-aged, conventional farmer from northern Ohio stated, "I farm corn, soybeans, wheat crops, and also raise livestock cattle and several hundred chickens, we produce eggs." This was echoed by another conventional, female farmer from southern Ohio who stated,

> So, my husband and I we have a beef cattle operation in southern Ohio, in Highland County, … we raise beef cattle, commercial, and we do a little bit of like club calf, show calves, and then we raise hay on our farm. So, we have a 94-acre farm there. We do hay just for our own production.

Even though the conventional farmers did not identify themselves based on their production practices, they described organic farmers as being inexperienced, as stated by one of the male conventional farmers from central Ohio:

> Some organic people maybe weren't raised on the farm. They've started later on in life and they think well we can do it better than these guys. We've read all the books. We gonna do it this way. And let alone they don't wanna talk to us because they are in the path. That's OK. Other people, they have very few acres and they can get more money per acre out of an organic crop. It takes more work but there is more money in revenue there per acre instead of mass acres so they are trying to do more with less and get more for their product, which is great so there's all different aspects of it.

On the other hand, the organic farmers perceived themselves as being stewards of the environment and producers of products that are healthy, as exemplified in the following quotation from a middle-aged, male farmer from central Ohio: "I have to maintain absolutely 100 percent integrity for my products. … I will never go beyond what my land can sustain." This sentiment was echoed by another middle-aged, organic, male farmer from eastern Ohio:

> I will never go beyond what my land can sustain and go beyond questioning the integrity of my product. So, I will never outgrow myself to alter what am doing to lessen the integrity of my product. That's number one.

The organic farmers also emphasized the need to produce healthy products as one of their motivations for engaging in organic farming. A middle-aged, male, organic farmer from southern Ohio stated,

> I have seen what hunger is in the world and not only do I wanna feed people but feed them correctly and in the right manner. Hunger could be in the form of poverty and in a rich sense, too, when people are just not eating the right way and in a familiar way.

Farmers' Communication Behaviors

The interviews revealed that differences existed in communication behaviors between organic and conventional farmers. The differences were categorized into the two subthemes: access to agricultural information, and communication with consumers.

Access to Agricultural Information

The conventional farmers who were interviewed indicated that as far as accessing agricultural information, they depended on their experience and knowledge that was passed to them by their parents and on print publications. For example, a middle-aged, male, conventional farmer from northern Ohio stated,

> A lot has been learned just throughout the years. My father, just growing up around it and then publications, *Ohio Farm Journal,* different kinds of magazines, not a lot of stuff online or the internet, kind of old school things, I guess so. When deciding planting depths, we read but you know most of these things is just a learned thing different people teach ya and you pay attention.

A majority of organic farmers mentioned conducting extensive research individually and consulting with other organic farmers before they made decisions on their farms. A middle-aged, male, aspiring, organic farmer from central Ohio stated,

> We are in the route of looking at other farms and seeing how they grow and if they are similar to our interests then we'll go out and learn from them. But we also research our own. We read books and we look into the science of growing and try to take that route.

This was echoed by another middle-aged, male, organic farmer from southern Ohio who stated, "once again it goes back to the research, we are willing to read those 200-page books."

Another organic farmer who described himself as an upcoming entrepreneur stated, "I get many newspapers and magazines and articles and books at home that I obtain information."

Communication with the Consumers

Another key theme identified is that the organic and conventional farmers reported different communication behaviors with consumers. Conventional farmers discussed being busy and not having time to communicate with consumers, while the majority of organic farmers indicated being passionate about communicating with consumers. The following excerpts of an interview with one of the organic farmers from northern Ohio is an example of how organic farmers are reaching out to consumers:

> We have a Facebook page obviously; we have an email and phone numbers that our customers have access to and then we've produced a smaller version of a pamphlet of what we have to offer and a short biography of our farm and what we have to offer and that's something that we can give to somebody. Even if they read it over just once we try to keep it to just have enough information for them to see what we have to offer in a compact package. We post our videos on YouTube and share short videos of what we do when people visit our farm.

However, when one of the conventional farmers was asked about their involvement in communicating with consumers, their response indicated they were too busy working on the farm, and they did not have time to produce communication and outreach materials to reach consumers.

> We are not very good at reaching out most of the times. We too busy. Got a lot of stuff to do and we are not, we don't measure our time in hours, we've more stuff to be done so we are doing it. Uh, unfortunately, we need to take more time to educate people but at this stage it's hard to educate people that are in such a busy lifestyle.

Contributions of Differences in Communication Behaviors among Organic and Conventional Farmers on Creation of Negative Perceptions about Agriculture

The interviews revealed that the difference in perceptions about agriculture between farmers following different production practices may be contributing to negative perceptions about agriculture among the public. One of the conventional farmers from eastern Ohio, who also described himself as a communicator, stated,

> The consumer is hard enough to please where it is. We want them to go direct to us with what they want. Are you sure you want grass or . . . OK, that's what I want, and we are both working together, you pick what you like. Both are very humane, both done very healthy, both are this way or this. So, stop taking all the questions out for the consumer because we have so many write ups. And like I have said, not everybody that's writing that up is for the farmer. A lot of them are for different reasons and it could be to take away from the farmers so once consumers read that then it's start checking it out and well let's just eat vegetables that's all we are eating so the more we can stick together. As farmers, no matter if we are different on either side it will be, we will get a lot further because consumers do not want confusion.

However, most conventional farmers were quick to point out that the agricultural industry needs to reach out more to consumers with one voice. One of the middle-aged, male, conventional farmers stated,

> It's opening up the farm gate, it's talking about how all food is raised and it's talking to them about the choices. So if you want to buy organic or if you wanna buy free range you know, you wanna buy something that's sugar free, fat free, or whatever, no matter what you are looking [for] we should be able to talk to you about what these food choices are and make sure that you understand what those food choices mean.

This was reiterated by another female conventional farmer from western Ohio:

> How do you advocate through like your social media and stuff like that? I think that's an important . . . just because I feel like there is a lot of uneducated people in agriculture industry, you know. I think the media portrays things as sometimes farmers are bad or we slaughter and butcher animals and things like that. But, I mean, farmers are not bad people, we all eat, you know, you don't just go to the grocery store and buy your meat from Kroger, the meat came from somewhere, you know, so I think that's where there's a lot of miscommunication, and, you know, personally I've grown up with it so I know, you know, the way of the farmers and things like that. And I want to help educate, and so I wanna educate people about our farm and what we do. We sell our feeder cows and eventually they are gonna go to market, that's just what we do and it helps feed America. I want to get that out there to help people learn more. I think that there's a lot of missing education. I think there's a big opportunity there to kinda put that out there so if we can do anything on our side a little bit to help towards that goal then, you know, I wanna do our part, so.

While the conventional farmers focused on ensuring that they produce enough food to feed

America, organic farmers emphasized the need for consumers to know how their food is produced and the impact that farming practices have on the quality of food produced and the environment. The organic farmers also indicated they were focused on informing consumers about the superiority of their produce, as indicated by one of the organic farmers from central Ohio, who stated,

> Ag folks have masterminded their advertising and utilizing labels to give consumers feel-good feelings when I see a commercial. So, as a small 50-acre farmer competing against those corporate big guys, I have to compete against all those commercials, all those things you see walking through a grocery store and convince folks why I believe my product is more sustainable, healthier and so on.

This was also mentioned by another organic, middle-aged, male farmer, who described himself as being a part-time farmer and full-time teacher:

> I think people are on a grand stand . . . and I see this in my classroom as well, that people really don't think about what they are eating and it is a convenience factor. Can I have it right now? . . . I understand that when prices go up people aren't happy. However, when health and quality of life can go up that might be a reasonable thing.

Furthermore, we observed that most of the organic farmers engaged with consumers as one way of getting markets for their products, as evidenced by the following quotes from organic farmers.

> Am a direct sales farmer. I have consumers buy directly from me. I need to be able to, be able to converse with people who have zero exposure to agriculture, I have to make my customers come to me, I have to be able to communicate with my customers, otherwise they gonna go elsewhere for their product.

This was echoed by another farmer who indicated that they are active in communicating with the public because unlike conventional farmers, they work independently to sell their products.

> So I have to compete against all those commercials, all those things you see walking through a grocery store and convince folks why I believe my product is more sustainable, healthier and so on while the big Tyson's, Purdue, uh, Monsantos, BRFS, seed companies to really have to compete against their pamphlets, their commercials, et cetera.

Discussion

The authors acknowledge that, given the scale of our study, the results of this exploratory study cannot be generalized to other populations of farmers in the U.S. Thus the discussion is limited to the results from the sampled participants and literature review. This paper is aimed at starting a conversation about other potential sources of negative perceptions about agriculture to inform research and practice.

The availability of multiple sources of agricultural information puts consumers at risk of being misinformed and developing negative perceptions about agriculture (Charanza & Naile, 2012; Sellnow & Sellnow, 2014). In an attempt to address these challenges, agricultural communication experts have been producing various messages to counteract the negative perceptions, which has contributed to the use of agricultural communication as a public relations tool and has been criticized as being reactive instead of proactive (Kurtzo et al., 2016). Results of this study suggest that there are differences in farmers' communication behaviors with consumers based on their production practices. The differences in communication behaviors may be contributing to a presence of misinformation about agriculture, which has led to the creation of *otherness* among farmers. For example, in this study, all of the organic farmers introduced themselves as "organic farmers," while conventional farmers introduced themselves as "farmers" and focused on the commodity they produced.

The results of our study affirm that differences in farmers' beliefs and values may be responsible for differences in production practices (Thompson et al., 2015). From the interviews, we observed that most of the organic farmers were focused on ensuring that consumers know how their food is produced, unlike the conventional farmers, who were concerned about improving productivity. This is in line with a study conducted by Peterson, Barkley, Chacon-Cascante, and Kastens (2012), who reported that organic and younger farmers are motivated to engage in organic farming because of their interest in promoting quality of life and being good stewards of the environment. Since most of the organic farmers consider themselves to be environmental stewards, they tend to be highly involved in civic engagement activities (Goldberger, 2011). As reported by Goldberger (2011), increased participation in civic engagement to educate the public as well as their involvement in direct marketing are some of the factors that influence organic farmers' communication behaviors with the consumers. However, apart from civic engagement, the results of this study indicate that organic farmers sell their produce directly to consumers, and so they use communication with consumers as a marketing tool.

The results also indicate that conventional farmers' motivations for engaging in farming seem to be influenced by the need to produce more food. Thus they do not value communicating with the public. This is likely because large farmers sell their products to co-ops or distributors, rather than directly to consumers. Therefore, they do not feel obligated to communicate with the public, which has likely contributed towards their limited engagement in communicating with the consumers. Conventional farmers in this study cited a lack of time as a reason why they did not communicate with consumers. However, the presence of social media platforms, such as YouTube and Facebook, provide opportunities for these farmers to share information through short videos of how they carry out different operations. Therefore, it is important for agricultural communicators to encourage conventional farmers to capture videos of their daily activities and share with the public, so the public is informed.

The results of the study also indicated that the differences in production practices have created some rivalry between organic and conventional farmers. For example, during the interviews it was clear some of the organic farmers considered themselves to be better stewards of the land, and that they paid special attention to ensure production of quality products, unlike conventional farmers. Even though this may not be true of all farmers, it was evident that farmers of differing production practices did not always see issues the same way. Such rivalries have distracted them from focusing on the one thing that unifies them: farming. In this study, organic farmers believed they were doing the right thing and their product was the best, while conventional farmers perceived organic farmers as inexperienced. Moreover, organic farmers seemed to be proactive in identifying different sources of agricultural information while communicating with each other and the public, unlike conventional farmers, who typically learned from generations before them. Organic farmers' proactiveness in communicating with the public, as well as the perceived benefits associated with the farming practice, may help explain the reasons for increased media coverage about the benefits of organic farming (Cleveland et al., 2015; Hughner et al., 2007). Furthermore, some organic farmers have been reported to be part of organic farming activist groups, which are proactive in delivering information about the benefits of organic farming to the consumer (Charanza & Naile, 2012; Coombs, 2007).

The results from this study indicated that organic farmers were proactive in taking advantage of new and emerging media to communicate about their products. The presence of various communication media, including social media, serves as an opportunity for organic farmers to market their products and help them deliver messages that resonate with consumers. The results of this study are in line with what Agunga (1995) found: differences in farming practices have the potential to contribute toward differences in farmers' communication behaviors. However, most of the research conducted has placed a focus on the differences in farmers' information-seeking behaviors (Jacobson et al., 2003) and not their communication with each other and consumers. A number of studies conducted on agricultural communication have focused on identifying farmers' communication behaviors when accessing agricultural information (Chiu, et al., 2015; Duram & Larson 2001; Egri, 1999; Niewolny & Lillard, 2010). However, the results of this study indicate that organic farmers are not only seeking information, but also are communicating with consumers. There is need for more research on farmers' communication behaviors with consumers to identify the content of these messages and how they influence the audience's perceptions of agriculture.

Conclusions

Due to the small sample size, convenience sampling strategy, and use of qualitative research methods, the results from this study should not be generalized. Nevertheless, the results indicate that in our sample there are differences in communication behaviors between farmers involved in different farming practices. Even though the sample may be small, these results provide a basis for starting a conversation regarding the impact of the differences in farming practices on how the agricultural industry communicates with consumers. Furthermore, the fact that these differences were observed among farmers attending the same conference and sessions is telling because it speaks of the differences in the reasons for farmers' participation in conferences or sessions. Conflicting views were apparent among farmers who used different farming practices, and it is likely that these conflicts are influencing the information the public is receiving. Despite the challenge, farmers continue to focus on the media as a source of negative perceptions among consumers. However, though this may be true, it is important to understand the role played by differences in production practices as well as communication behaviors among farmers. There is need for more research to be conducted with different farmers who follow different production practices in order to examine thoroughly the impact of differences in production behaviors on creation of negative perceptions about agriculture. More research should also be conducted on how consumers access and process information received from farmers.

There is also need for more research aimed at identifying the factors that motivate farmers to engage in various communication behaviors. These studies should employ mixed methods that include a content analysis of the messages that farmers share with consumers in relation to demographic factors such as land size, education level, number of years involved in farming, and marketing strategies used. In the current study, demographic characteristics such as age, education status, and size of farm were not captured. It is recommended that future research be conducted using quantitative research methods to establish the impact of demographic and farm characteristics on farming practices as well as communication behaviors. Conducting such research will be useful in identifying factors that influence farmers' communication behaviors with consumers and will help identify the sources for the negative perceptions about agriculture.

Unlike in the past, where communication was used as a tool for relaying information to farmers, the current challenges and increased technological advancements in communication call for a way to better explore ways of improving communication among farmers as well as their ability to communicate with consumers. This necessitates the implementation of interventions and projects aimed at promoting collaboration and coordination among farmers who are involved in different production practices, so they speak with one voice and send a unified message to the public. Such interventions will be useful because in some cases the public is not aware of the differences between organic and conventional farming (Abrams et al., 2010; McFadden & Huffman, 2017). It will be useful to establish standalone communication organizations and interventions aimed at providing platforms for dialogue between organic and conventional farmers to discuss the advantages and disadvantages of each farming practice. The platforms used could include podcasts, YouTube, and Facebook groups where organic and conventional farmers would be provided with an opportunity to interact with the public. The provision of fair and balanced information to the public that outlines the benefits and downsides of each production practice is crucial to ensure that the public makes informed decisions (Gottschalk & Leistner, 2013).

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Nested risks and responsibilities: Perspectives on fertilizer from human urine in two U.S. regions

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Abstract
This paper reports on social research investigating perceptions concerning the diversion of urine from the waste stream and its use as fertilizer in two study regions, New England and the Upper Midwest. We hypothesized that discomfort or disgust might affect acceptance of such a shift in human "waste" management. However, our findings suggest that a more significant concern of those po-

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Author Note
During the research, writing, and revision of this article, Kim Nace was co-founder and a co-director of Rich Earth Institute. She has since left the research division of the organization to found and serve as CEO of Rich Earth LLC, a for-profit division that develops products and tools for urine nutrient recovery.

tentially involved in this process may be distrust of how economic interests influence scientific and technical information. Both physical risks (to the environment and public health) and socio-political risks (to fragile farm economies and consumer communities) play out at individual, household, regional, and global scales. We describe the intersection of these complex understandings as *nested risks and responsibilities* that must inform the future of urine reclamation. Our respondents' shared concern about environmental risks has already galvanized communities to take responsibility for implementing closed-loop alternatives to current agricultural inputs and waste management practices in their communities. Attention to these nested understandings of both risk and responsibility should shape research priorities and foster participatory approaches to urine nutrient reclamation, including strategies for education, planning, regulation, technology design, and agricultural application.

Keywords
Community Development, Human Urine, Fertilizer, Participatory Action Research, Wastewater Management, Food Systems, Circular Economy, Risk Perception

Introduction

This paper reports on social research investigating attitudes about the diversion of urine from the waste stream and its use as fertilizer in two study regions, New England and the Upper Midwest. We initially hypothesized that individuals might experience visceral negative reactions to resource recovery from human urine, as has been the case with the land application of biosolids and the potable reuse of highly purified wastewater (Jones, 2011; MacPherson, 2015; Mason-Renton & Luginaah, 2018). Our findings suggest, however, that it is distrust in how economic interests influence scientific and technical information, not disgust about biological processes, that might affect widespread uptake of urine recycling (Stern & Baird, 2015). We also find that concern about both environmental risks and the resilience of local economies is galvanizing efforts at local stewardship and sustainable practices that could enhance the spread of closed-loop alternatives to current waste management and agricultural inputs. However, as Lachapelle (2008) has emphasized, to build a "sense of ownership" on the part of all participants in projects involving multiple layers of socio-technical change, "a focus on trust in community development research and practice would draw attention to how various voices view risk" (p. 56). This paper describes the complex understandings of our respondents as the *nested risks and responsibilities* that can shape the future of urine reclamation. Our framework builds upon the nested risk system model elaborated by Blair, Lovecraft, and Kofinas (2014), emphasizing that local values and perceptions must be integrated into adaptive risk management. Our effort here is to elaborate those perceptions, not to "manage risk" per se (Beck, 1992), but rather to foster knowledge exchange leading to research partnerships and inclusive strategies for recycling bodily nutrients. We analyze participants' understandings of both physical risks (to the environment and public health) and socio-political risks (to fragile farm economies and consumer communities), as well as concepts of individual and collective responsibility for addressing these risks. We then consider how they play out at individual or household, community, regional, and international scales.

The research was conducted by a joint social science team including faculty, postdoctoral, and graduate students from the University of Michigan in Ann Arbor and the Rich Earth Institute in Brattleboro, Vermont. It was part of a larger project, including technical teams, funded by the INFEWS section of the National Science Foundation. Conducting our study in the New England and the Upper Midwest regions enabled us to consider how both geographic location and scale of implementation will influence patterns of adoption. Several recent studies have addressed the value of urine reclamation to achieve sustainability goals, including completing nutrient cycles and reducing greenhouse gas emissions (see Hilton et al., 2021; Legrand et al., 2020; Simha & Ganesapillai, 2017). Other site-specific social studies conducted across the globe on urine diversion have emphasized different facets of the complex risks and understandings caught up in both the technological implementation and agricultural reuse of human urine. These have included research with diverse communities such as general public perspectives in South Africa (Wilde et al., 2019); farmers, college students, and consumers in Switzerland (Lienert et al., 2003; Lienert et al., 2006; Pahl-Wostl et al, 2003); and pilot implementations in university settings and villages in Australia (Abeysuriya et al., 2013; Cook et al., 2013). These studies have been focused on behavioral and attitudinal approaches of specific stakeholder groups. In comparison, North American social research into this topic has been relatively limited. Building on Ormerod's (2016) work proposing that knowledge gaps in sustainable sanitation must be addressed, our study sought to deepen our understanding of the values, beliefs, and concerns of diverse participants in two regions, thus facilitating equitable knowledge exchange.

The wider project of which our work is part explores how human urine has the potential to complete the nutrient cycle (preventing nutrient pollution and supporting sustainable agriculture) while also reducing greenhouse gas emissions (Hilton et al., 2021).[1] From the wastewater perspective, urine contributes approximately 75% of the nitrogen and 50% of the phosphorus in domestic wastewater (Vinnerås, 2006), nutrients which are rarely removed before their discharge into waterways, resulting in nutrient pollution that contributes to harmful algal blooms. On the agricultural side, it is estimated that urine could replace 9 billion pounds of greenhouse gas–emitting synthetic fertilizer each year in the US and maintain yields while limiting pollution, as urine contains vital plant nutrients, including nitrogen, phosphorus, and potassium. Small-scale field and lab trials by our technical teams are beginning to generate relevant data in these directions (A. Noe-Hays, personal communication, 2020).

Ecological sanitation, including urine diversion, potentially can enable climate-resilient community development by offering a safe, affordable path for waste collection and reuse (Cavicchi et al., 2020; Les Greniers de l'Abondance, 2020). On the consumer side, a large-scale survey explored attitudes regarding urine-derived fertilizers (UDFs) to determine the potential for these to be embraced as an alternative at scale (Segrè Cohen et al, 2020). But such potential cannot be realized without also attending to the hopes, fears and concerns of individuals and communities; that is the focus of the present qualitative study. Our work takes seriously how participants' aspirations to responsible action for environmental sustainability relate to notions of nested risk.

Our results indicate that when participants learned about the nutrient value of human urine, though they often ascribed potential disgust or discomfort to others, they themselves were often open to considering its use as a fertilizer. Humor was frequent and helpful in enabling discussions about the possible benefits of urine recycling, while *holistic thinking* about environmental risks and responsibilities (on both individual and community levels) appeared to be an overarching motivation for interest in the topic.[2] However, many respondents expressed uncertainties about the safety of urine recycling that they embedded in their larger concerns regarding widespread water and food contamination in local communities.

Respondents also expressed variations on the theme of taking responsibility for human waste in the current context of ecological and economic risk (Alaimo, 2016). However, many also expressed anxiety about which institutions and individuals are trustworthy in this regard. In particular, some respondents noted distrust in agroindustry and of wastewater and drinking water management systems. Several of these individuals, and others, spoke of needed work toward the protection of watersheds and food supply chains. In sum, our team's work illuminates fears of infection or contamination risk (particularly important during a global pandemic) and concerns about ownership, decision-making structures (Stern & Baird, 2015), and equitable generation and distribution of profit from urine, given that it is a substance produced by

[1] See also https://news.umich.edu/peecycling-payoff-urine-diversion-shows-multiple-environmental-benefits-when-used-at-city-scale/

[2] We use the term "holism" to reference expressions by our respondents that individuals, society, and the environment are intertwined and interdependent. This coding category thus emerged for us as appropriate in ways we describe in a separate methods manuscript (Schreiber et al., 2020).

human bodies.

These findings have important implications for questions of food sovereignty (Carney, 2012), nutrient sovereignty (Tornaghi, 2017), and watershed stewardship. As our participants suggest, completing the nutrient cycle—and therefore addressing both food and wastewater system challenges—can only be done successfully through transparent and accurate communication of research results that directly address their concerns. Guiding system change with this kind of ongoing dialogue is vital when there are knowledge conflicts (Heiss & Suozzo, 2020). Participants indicated that this approach could support the adoption of alternatives to mainstream practices, as has been demonstrated in existing alternative, community-based watershed stewardship models. In New England, for example, a group of farmers have self-organized to manage riparian flooding by altering their cultivation practices and working on watershed conservation issues up and down the Connecticut River (Vermont Farmer and Environmental Advocate, 2018). In Michigan, similar experiments are underway, amidst growth in river-based conservancies and their collaborations with both recreational and agricultural organizations (Aparicio, 2019). These responses affirm the need to design urine reclamation systems through a dialogical approach that prioritizes local knowledge.

Applied Research Methods

The U.S. Department of Agriculture (U.S. Department of Agriculture, National Agricultural Statistics Service [USDA NASS], 2017) agricultural census suggests some similar trends in the two regions we included in this project. For example, there have been recent losses in farm numbers, increases in farm size, and substantial increases in organic production. Both areas evidence the low awareness of urine diversion and reuse suggested by recent research (Ishii & Boyer, 2016). Given our initial concerns that this practice could become stigmatized, we wanted to ensure that all participants engaged by each of our research methods—surveys, interviews and focus groups—had access to a common base of educational information from which might emerge participants' most important categories of conversation. Thus, each survey instrument and interview or focus group guide included a brief description of urine's nutrient content (i.e., fertilizer value) as well as results from Rich Earth's yield studies applying sanitized urine to hay in Brattleboro.[3] The information also mentioned water conservation and wastewater treatment efficiency benefits that could be derived from urine diversion. The entire research team assessed all educational language for clarity, accuracy, and avoidance of bias, with final approval from the University of Michigan Institutional Review Board Human Subjects committee (No. HUM00116968).

In addition to the information provided in the focus group guides, participants in the Michigan focus group, one of the two New England general public focus groups, and both New England farmer focus groups watched a 6-minute animated video produced by New Water Resources[4] that also described the concept of urine derived fertilizer.

Both interviews and focus groups utilized semi-structured guides with open-ended questions to facilitate rich dialogue. The guides were adapted to reflect interviewees' areas of knowledge. All interviewers and focus group facilitators used these guides but were free to ask additional questions emerging from the conversations.

Context Methods: Surveys

To discover categories of interest among various constituents and to shape our focus group and interview guides, we first implemented 400 Qualtrics surveys at festivals and farmers markets in Vermont and Michigan that assessed attitudes about the use of urine as a fertilizer across a range of demographics. As an example of how the surveys provided context, we asked participants to rank in importance potential implications of urine diversion and reuse. Discovering that mitigation of cli-

[3] The Rich Earth Institute purifies and concentrates urine into a ready-to-use fertilizer product through a four-step process of acidification, pasteurization, freeze concentration, and charcoal filtration (see https://richearthinstitute.org/).
[4] New Water Resources is a group that has worked internationally on water reuse issues (https://www.newwaterresources.com). The animation mentioned and a shorter version can be seen at https://www.youtube.com/channel/UCSRKi2j0HQvVNRoC2DKV2eQ.

mate change was ranked high determined the inclusion of a question about climate change on our interview and focus group guides. These data shaped and strengthened our research design, but the results reported here rely primarily on our core methods: the richer responses offered by the interviews and focus groups that followed the survey phase of our work.

Core Methods: Interviews

We conducted in-depth interviews lasting 60 to 90 minutes—13 in New England and 11 in the Upper Midwest—with individuals selected for their specific knowledge areas, parallel across both sites. These included environmental advocates, city planners, wastewater treatment engineers and plant operators, farmers, agricultural educators, agribusiness leaders, nutrient management advisors, and soil scientists. We also interviewed two legislators in New England and two lakeside property owners concerned about water quality in the Upper Midwest. Interviewees at both sites had no previous connection to Rich Earth Institute except for three farmers (identified in the ensuing narrative) who are currently partnering with the institute to apply sanitized urine. Participants were informed that their responses would be kept confidential. Although many of them felt comfortable with being identified, because others did not, we have chosen to deidentify respondents here.

Core Methods: Focus Groups

In New England we conducted four focus groups; two consisted of members of the general public and two of farmers. General public participants were all recruited by fliers describing a discussion on "the use of human waste as an agricultural resource." In our recruitment process we pursued participation only from households with incomes below US$30,000/year both to broaden inclusivity beyond the parameters of current early adoption communities and to collaborate with stakeholders frequently excluded from discussions on technology and policy change. The two other focus groups in New England consisted of farmers recruited through agricultural listservs for the southern Vermont region, email invitations to farmers within 30 miles (48 km) of Brattleboro, and phone calls to follow up with these farmers. These groups ended up with a small number of participants, five overall, which may have been influenced by the late March timing converging with the busy spring season. All farmers worked at a small scale, common in Vermont's agricultural landscape, with farms ranging from under 6 acres (2.4 ha) up to 300 acres (121 ha). One farm was certified organic, one was "conventional," and the others identified as either "organic, not certified" or "beyond organic." While no large-scale commodity farmers participated, we urge their inclusion in future research.

In the Upper Midwest, we conducted only one pilot general public focus group consisting of four undergraduate students at the University of Michigan and one resident of the surrounding Ann Arbor area, recruited through fliers similar to those in Vermont. The research team decided instead to invest its limited resources in the Upper Midwest through interviews with key stakeholders as described above. Although the small number of focus groups included in this data is a limitation, transcripts of these rich conversations provided insights that informed our subsequent interviews and illuminated a host of areas for the ongoing research we recommend. See Appendix A for details on the focus groups and interviews.

Data Analysis

We transcribed the audio of interviews and focus groups in full. Then, two researchers who did not participate in conducting the interviews coded each transcript in Microsoft Word using a common coding guide. Seventeen codes (with subsections) were initially elaborated based on key themes that emerged in the interviews and focus groups, iteratively revised as our team discussion proceeded. Within some categories we developed scales from "low" to "middle" to "high" values. Our interdisciplinary team used a consensus process to arrive at the coding categories and subcategories.[5] We merged the coders' independent results into master documents for group analysis with interactive and collaborative methods described in a separate pa-

[5] The coding categories we identified are described in Appendix B.

per (Schreiber et al., 2020; see also Saldaña, 2015). We extracted the coders' comments into a Microsoft Excel spreadsheet to observe how frequently a specific code was used and its co-occurrence with other codes.[6] Given our use of multiple coders, the total occurrence suggests the strength of consensus in our analysis and relative frequency of results, not specific numbers of statements. We thus employ semi-quantified language that is empirically based in the spreadsheet results such as "most," "many," or "often" to designate concepts proportionately representative of data, and "some" or "few" to describe outlier examples not aligning with major trends.

Results

Each section below reports key results in order of respondent categories—first the general public, then farmers, then specialists—to help guide the reader through our findings. Subheadings below indicate categories which emerged most frequently in our coding analysis. The quotations we include from interviews and focus groups were selected to illustrate specific ways that respondents expressed the important themes that emerged from our data.

Overarching Motivations

As noted earlier, we coded as holism expressions on the part of our respondents that connect ecological system health and function with the economic health of local communities (for instance, efforts to reduce the use of external or energy intensive inputs). This concept emerged as an overarching motivation for those considering urine diversion and reuse, sometimes in tentative language, but with surprising frequency.

Among the general public, while holism may not have been an overt theme, the concept of closing loops resonated. Many expressed a desire for connections within their communities to address common problems. For example, one focus group participant said:

> I've just been thinking about it, so, if the pee is . . . locally acquired . . . I feel . . . if it's like a community effort almost, like we're all going to do this together and the money's gonna come back to our community and we're going to make the crops in our community less . . . pollute them less. . . . I feel like it could be like a group effort. (General Public Focus Group 1, 2017)

A few participants also supported urine diversion because it could help farmers. One focus group participant noted:

> Farmers have it pretty tough right now, they always have it pretty tough . . . this would help because it would be one less thing they'd have to worry about . . . assuming that it all checked out and they could get a good quantity of it. (General Public Focus Group 2, 2017)

However, several participants raised concerns that production and processing of urine to meet safety standards could undermine the circular economy promise. For example, one respondent said:

> Urine derived fertilizer . . . just seems like it would still be an energy intensive way to get your fertilizer. . . . If you want to get the greenest possible formula, if straight urine is still safe. . . . I think reused urine seems more, like, natural. (General Public Focus Group 1, 2017)

Farmers in our focus groups also expressed interest in waste-related innovation to complete the food-nutrient cycle. One said:

> I've always been really interested in . . . completing the cycle, from human waste back to food . . . using as little synthetic or engineered substances that maybe have a lot of energy input. . . . We really try to reduce, so this seemed like a really interesting thing . . . depending on how much processing the urine would need. (Farmer Focus Group 1, 2018)

Yet an important theme in farmers' responses was the economic calculation they would have to make about any innovations. Our codes differenti-

[6] We modified this method from Knoch (2018).

ated between environmental, economic and other potential benefits and concerns around urine diversion and reuse. When we located co-occurrences among coded comments, we found that farmers often spoke about holism by evoking reuse, local scale actions, and recycling—ideas in line with notions of circular economies.

Respondents seemed in fact to enjoy thinking out loud about more and less localized, and smaller- and larger-scale visions of this idea. For example, one suggested:

> If it could . . . become . . . an industry that sort of weaves itself into the community in some way, then that also seems . . . incredible and positive. If you're collecting local urine from local people, then there's going to be some level of cross-accountability . . . of shared responsibility for keeping it clean or that sort of thing, then it becomes an opportunity for offering employment for people who are running those programs. You know, there's all sorts of positive, positive impacts that could have; it could also go the other way where it becomes one large company that just trucks the urine out to some location and processes it and then trucks it back and no benefits are really realized because it becomes a product that is, you know, sort of dictated by the market I guess. (Farmer Focus Group 1, 2018)

Among specialists, the theme of holism was also central to their thinking about this topic, but in different ways than expressed by farmers. For example, an environmental advocate who heads a large water conservation group noted that the organization strives to consider ecosystems as a whole. Urine diversion might fit into that vision when it reduces the amount of nutrients (i.e., nitrogen and phosphorus) entering waterways:

> Our concern is that we not just focus on particular numbers, but that we begin to express the definition of a healthy river in terms of its biology—not milligrams per liter, not cubic feet per second—but what communities and guilds and structures of diatoms, bugs, fish, live in that system? [This is] a much more sophisticated expression . . . [than more reductionist thinking] and nutrients are driving that conversation. . . . So, we recognize, there's too many nutrients in our aquatic systems. There's too many nutrients in our atmospheric systems and often in soil systems, they're completely saturated with things like phosphorus, and we do not yet have the best use of nutrients. (Massachusetts Environmental Advocate, 2017)

However, the advocate noted that for the organization's constituents to consider urine diversion and reuse, they would need to know the specific possible climate benefits, reduction in pollution, or benefits to aquatic ecosystems that urine diversion might provide:

> Does diverted urine in whatever form as an agricultural product, in fact, promote more responsible use and get it out of the wastewater stream? We would need to be able to say "Yeah, this has got a practical effect of X percentage of reduction.". . . You know, that type of work to be able to demonstrate it. (Massachusetts Environmental Advocate, 2017)

This advocate's recognition of the need to address his constituents' concerns is echoed in many of our respondents' pondering of how their communities can and should respond to both the potential benefits of urine recycling and the potential challenges to its implementation.

Considerations of Community Responsibility

Respondents indicated several specific potential benefits of urine recycling beyond their personal concerns. For example, they noted water conservation, energy efficiency, and the reduction of chemical inputs into agriculture (possibly lowering costs for agricultural production), suggesting that many of our respondents share a sense of community or collective responsibility to both address environmental harms and support local economies.

Among the general public in our focus groups, many saw urine diversion's potential to conserve water through reduced flushing as the biggest benefit that could drive them to adopt the technology. They thought water conservation would motivate people in other areas of the country facing water shortages and would personally consider changing their toilets to urine-diverting fixtures if reductions in water bills significantly covered the cost.

In considering food fertilized with UDF, the potential to reduce environmental impacts of current commercial fertilizers (mining for phosphorus, for example) and the carbon footprint associated with shipping these inputs worldwide were important factors to participants, especially if these environmental benefits helped farmers and/or translated into lower prices for consumers.

Farmers had a range of reasons for their interest in UDFs. For example, one commented that "there's very few sources [of high-nitrogen fertilizers] that are approved organically, and so the fertilizer we use that we purchase doesn't even have nitrogen in it" (Farmer Focus Group 2, 2018). This was a key reason for his interest in UDFs.

Farmers also hoped that a local source of fertilizer could reduce the transportation costs of bringing in fertilizers and/or have other benefits. For example, urine contains a range of micronutrients in addition to the macronutrients nitrogen (N), phosphorus (P), and potassium (K), and secondary nutrients such as calcium and magnesium, an appealing attribute to one participant, who noted that "most soils have certain limiting micronutrients. And so, having a diverse product that you are applying, because the human diet is diverse. . . . I would think that would also be a positive thing" (Farmer Focus Group 2, 2018).

Several farmers connected these personal concerns to wider community needs. For example, one said: "The idea that it's better for the land and my community would be the other huge impact, you know, because I want to do the best I can to take care of our land and our water . . . those are the biggest things for me" (Farmer Focus Group 1, 2018). Farmers were aware that urine, like other fertilizers, would need to be applied with care so as not to create the same problem of nutrient pollution that other fertilizers do, but the possibility that it could be used more precisely was of interest to many of the farmers in this study.

Among specialists, there are a range of motivations that they felt create opportunities for adoption of urine diversion and reuse. For example, a legislator with many years of working on wastewater issues and regulation noted that removing nitrogen and phosphorus from the waste stream would be highly beneficial from an economic point of view:

> The most expensive way to reduce phosphorus and nitrogen discharged into the waters of the state . . . is, in fact, to require higher levels of treatment at the wastewater treatment facilities. . . . We need to think in other directions, and that's where something like this comes in. . . . It's pretty imaginative. . . . It takes hands-on work to be able to get it right . . . but if costs are lower, and I suspect they will be, then that is definitely a plus for this as a direction for us to go. (Vermont Legislator 1, 2017)

A New England nutrient management specialist said the idea of using human waste as a resource makes sense because of the region's population density:

> I've just always . . . had a consciousness that [given] our nutrient issues in New England . . . we need to cycle our own waste. Because, there's a very disproportionate . . . distribution of nutrients. . . . So, we produce a lot, but we don't have a large demand for nutrients. . . . We would need to be an exporter, basically. (Massachusetts Agricultural Educator, 2018)

Another agricultural educator explained that farmers already face climate-driven changes to the technological and seasonal aspects of their work, and mentioned that some farmers are looking for ways to address the effects of their emissions and that this could motivate interest in UDFs:

> We have some farmers who are interested in mitigation and reducing their carbon footprint. . . . We talk about finding organic nitrogen sources instead of synthetic nitrogen sources because of the high carbon footprint of . . . fixing nitrogen in synthetic fertilizers, [so] any organic nitrogen source like this would have climate benefits. (Vermont Agricultural Educator, 2017)

Respondents shared an apparent sense of both personal and collective responsibility for addressing larger environmental issues. However, they also noted a range of concerns that reveal the specific ways in which they feel vulnerable. Such perspectives ranged from their personal health or finances to the well-being of their communities, and from the integrity and resilience of the environment to the costs and challenges of navigating institutional change. Another significant theme that emerged was the question of *who* should have responsibility for addressing these many challenges and who can be trusted to do so with integrity. Below we explore some of these specific concerns. Their "nested" nature means that the obstacles and opportunities for UDF are linked.

Vulnerability, Risk, and Trust

The larger NSF-funded project, of which our team's social research is a part, has centered around mitigating risks to individual health (documenting and limiting the virological, pharmaceutical, or bacteriological contaminants that might be found in human urine, for example). Yet we found most respondents to be equally or more concerned about wider risks to the health and safety of their communities from environmental toxins and contaminants. For example, discussions about the potential risk of microconstituents in urine quickly led to discussion about likely contaminants in other fertilizers and "natural" soil amendments commonly used in agriculture. Many acknowledge that they share this vulnerability with other species such as aquatic life, plants, and animals in their watersheds and food supply chains. These wider risks, in aggregate, combined with a lack of trust about how science gets used and how communication happens in formal political and governmental channels, as well as informal networks, has created what we describe as a set of "nested risks" from the combined vulnerabilities.

These concerns are not synonymous with, say, conspiracy theories. Rather they reflect understandings of the limitations of scientific, commercial, and policy processes where knowledge is not complete. They also reflect experience with and insights about the individuals or organizations, and the scale and scope (e.g., personal, community, regional, national) at which risk mitigation might take place (see Figure 1).

In both focus groups and interviews, we asked respondents what information would help address their uncertainties and guide their decisions about using UDFs. Among the general public, answers to their questions about human and environmental safety measures were most frequently mentioned. Participants would want to know that it has been treated, how it has been treated, and what the safety standard used means for them. One participant explained:

> Since it's used from humans, I worry about diseases or infections being transmitted. . . . So I would want to know . . . is it safe, and how is it safe before I would go ahead and be like yeah, I support this 100%. (General Public Focus Group 1, 2017)

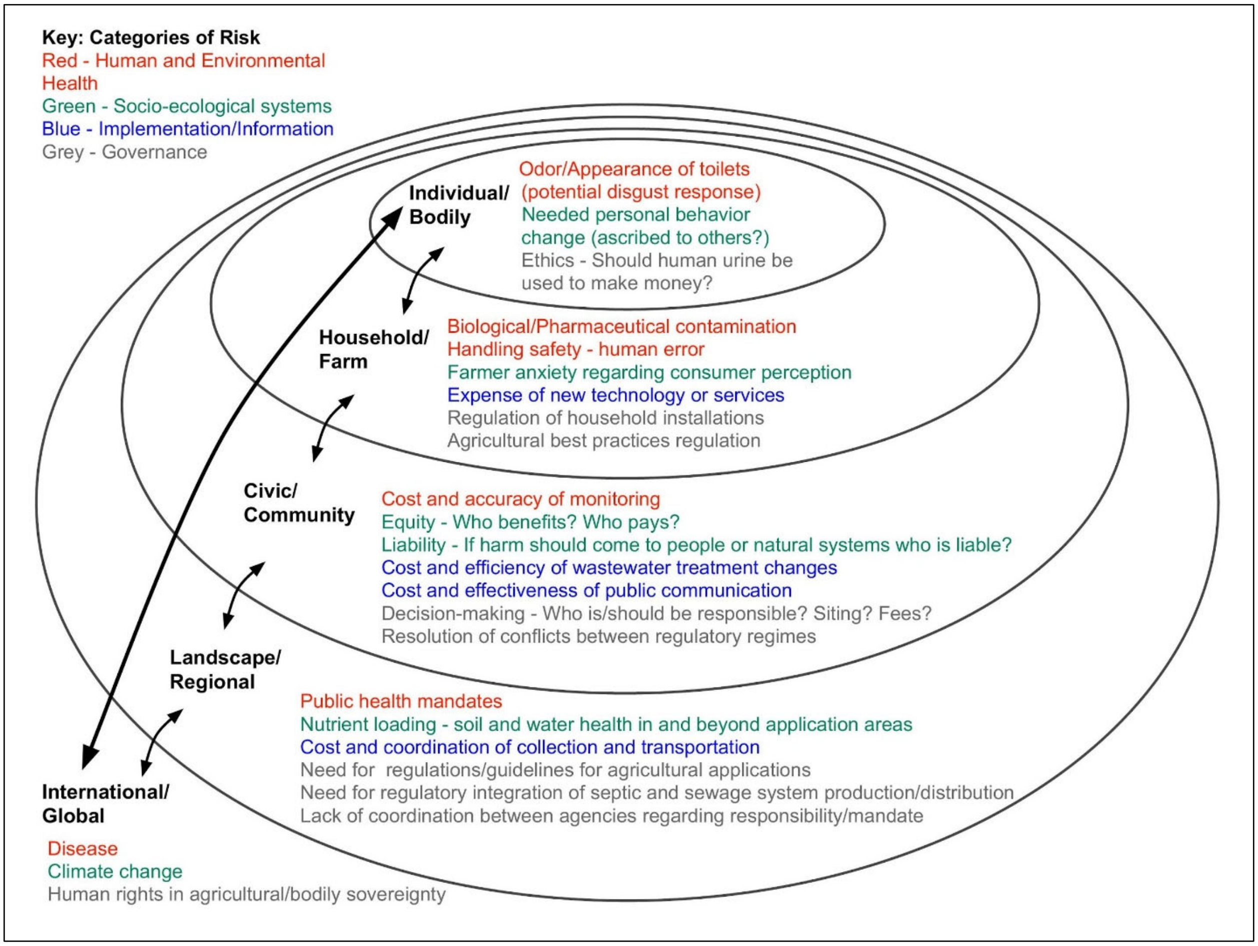
To further aid their decision-making, participants also wanted to better understand what implementing urine diversion would look like and see specific research findings on the costs and benefits of this potential change. They wanted to know what new infrastructure would be required and what it would cost; how urine would be collected; the form the fertilizer would take and how it would be applied; and how potential contaminants would interact with plants and the soil over time.

However**,** when asked who they felt should regulate or ensure the safety of UDFs, the conversation in our general public focus groups quickly became complicated. For example, one respondent said:

> The way I'm thinking with this is . . . is this really something to help the environment, or is it just a Band-Aid to get rid of solid waste? . . . I'm looking to see who is benefiting from this, who stands to make money and who is going to lose. . . . Are we going to be on the losing end with crap, because it's going to be cheaper, and we can buy [it] . . . and they're selling to us as "it's great" when down the road it's really killing us? (General Public Focus Group 2, 2017)

Figure 1. Nested Risks and Responsibilities Identified by Participants

Graphic representation of the nested risks revealed by our research, in concentric circles that correspond to the scales at which risks exist and/or are experienced by respondents. The color coding represents different types of risk at each scale, as they connect to and drive or inform one another. These range from human and environmental health (red), to those concerning complex environmental and social systems (green), to those related to implementation and information needs (blue), and finally considerations of governance and regulatory factors (grey). Of course, by "scale" we mean to include the permeability of these boundaries and the new relationships created among people and across differing scales (see Sayre, 2009).



This comment suggests that questions of responsibility are closely related to concerns about which individuals and organizations can be trusted to make the most appropriate decisions and on what basis. Our coding on the question of trust of authorities was scaled from least trusting to most. However, even when reviewing comments coded as most trusting, many respondents expressed varying degrees of skepticism about whom they could trust, and when. For example, one respondent asked: "What is the rest of the world doing about this stuff? Because I might trust the government in Norway more than the United States. . . . So if the Norwegian government said this was great for our people then maybe that might be good to know!" (General Public Focus Group 2, 2017). There was anxiety about industry influence in both government and science and fear that potential risks are not being communicated accurately or are underreported.

Some respondents also raised ethical concerns about who might benefit from the use of their urine. As one focus group participant put it,

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> Something I'm really not okay with is this system being used to make a profit for people to get really rich? That to me is just ethically wrong. And I didn't even think about it until now, but just thinking of it that way . . . It just rubs me the wrong way. I think it's ethically wrong to make money off it because it's from humans. (General Public Focus Group 1, 2017)

Respondents emphasized that local decision-makers such as town managers, planners, and farmers need to be involved as urine diversion is scaled up. Some also questioned the very notion of "scaling up" because of the potential loss of local agency in response to their questions about fairness and equity in the development of UDFs.

Farmers in our focus groups and interviews were clear that in order to use this product they would need to know its nutrient analysis, including micronutrients, and they would want data for yield results over several years. They would also want to know how soil health is affected over time. One farmer who is currently partnering with Rich Earth and applying urine on hay would want more data before using it on vegetables: "I haven't yet seen the information to understand what's passing through and building up. . . . I'd want to see, like, to be honest, 15 years of data that, like, pharmaceuticals and God knows what else we put into our bodies, isn't getting built up in the soil" (Vermont Farmer 2, 2017). Farmers also wanted to better understand when the nutrients in urine would be most available to plants, and to see guidelines for the most effective application to benefit crops and reduce nutrient losses. Some wanted testing to ensure the palatability of urine-fertilized pasture for their livestock, particularly for goats.

As with the general public group, farmers had substantial concern that research is unduly influenced by industry. One of the farmers currently partnering with Rich Earth Institute remarked:

> I very definitely view [most research results] with . . . a healthy skepticism. . . . The research they do is always funded by somebody and the people who have the money to do that are monied interests in business. . . . I'm not interested in big money of any kind making decisions for the rest of us. (Vermont Farmer 1, 2017)

This led to questions about how and by whom UDFs should be certified as safe for crops (both those used for human consumption and those for animal feed) and of consistent quality. Our farmer focus groups included several farmers who described themselves as "organic, not certified." Nonetheless, they hoped UDFs could be approved by the USDA National Organic Program (NOP) for use on organic farms. They suggested that potential impacts on soil health would need to be addressed and "there would have to be a certain amount of convincing those that approve or certify organic farms, and that would all be a part of that process, figuring out whether it had any detrimental effects on the soil function" (Farmer Focus Group 2, 2018).

Some farmers also offered suggestions to address these concerns. A few indicated they would want to make sure there was some sort of liability insurance to indicate that the product had been properly tested so that, in case someone got ill later, the farmer could not be held responsible. They also recommended working with supermarkets, co-ops who buy farmers' products, and the fertilizer industry to address any regulatory and labeling concerns that may arise and influence marketing strategies. Farmers expressed a desire to work in partnership with scientists and regulators to ensure that their own concerns for human, livestock, and environmental health were addressed.

Like the farmers, the specialists we interviewed wanted to see a comprehensive analysis of the components in UDF, including macro and micro nutrients and the specific chemical formulations of each. They wanted this analysis to include any potential microconstituents such as pharmaceuticals, heavy metals, or hormones, and to see how any levels found in UDF compared to those in water supplies, wastewater, and other existing environmental sources. They also thought yield trials (for a range of crops) would be helpful. They sought studies on microconstituents' uptake in plant tissue and impacts on soil microorganisms, as well as studies on the environmental fate of the nutrients in UDF and best practices to prevent leaching and volatilization.

Some specialists with experience in the operation or regulation of wastewater treatment systems pointed out the need for more information on how urine diversion's removal of nutrients from influent would affect biological treatment processes. They also thought it would be useful to have more data on the flow reduction caused by urine diversion and its resulting potential to extend the life of a given wastewater treatment system. For example, one Vermont legislator, thinking about economic concerns in her community, mused:

> [What if] you could sort of sugar off the most motivated people in a town . . . and say "You know what? We actually could postpone expensive infrastructure upgrades for x number of years if we had 500 people willing to do this." . . . And I'm interested in, what does that do? Does it help the lake? Does it prolong the life of their treatment plant? Can it help make combined sewer overflows, which is a chronic problem in that town, less polluting, you know, and I hope that's gonna [be] where . . . your next level [of research] is gonna take us. (Vermont Legislator 2, 2017)

Compared to farmers and the general public**,** the specialists we interviewed had more confidence in regulatory and government processes and want to be involved in these processes, but they were concerned that decision-making often is not backed by sufficient evidence. A soil scientist expressed skepticism about the possibility that science would necessarily be used appropriately, and go deeply enough:

> Just looking at this as an organic nitrogen application, and therefore good . . . I don't know what your team, the depth of your analysis about this, but I think it should be critically evaluated as far as what the effects are, into aquatic and terrestrial systems, of applying a very high nitrogen fertilizer source. Even if it is organic, and even if it is diverted from the waste stream. . . . On the surface it looks good, but when you dig deeper, it may not really be. (New Hampshire Soil Scientist, 2018)

Specialists also pointed out conflicting priorities and distrust between different groups and agencies, and acknowledged that each stakeholder group does not necessarily understand the needs of other groups. For example, a New England agricultural educator noted farmers' needs have not always been fully recognized when developing fertilizers from waste materials. She cited cases in Massachusetts where farms were overloaded with nutrients as developers worked to site digesters that process urban organic waste on farms:

> [A] company will come to the farms saying, "We'll install the digester . . . and then you get free fertilizer. No big deal." Regulations allow them to bring up to 70, maybe 80% of off-farm waste into these digesters. And then these farms are overloaded. (Massachusetts Agricultural Educator, 2018)

Farmers are unable to move the digestate fertilizer they cannot use to other farms because of the high cost of transportation, and this agricultural educator imagined the same could be true of liquid urine.

Many of the specialists we interviewed emphasized that facilitating understanding across various spheres of influence on the topic is critical. For example, a legislator noted that when trying to promote a practice, if other decision-makers do not know about or understand the research behind it, "[the idea] is dead. I mean, it just isn't going to happen, and so the political class needs education and bringing along" (Vermont Legislator 2, 2017).

However, a New England planner pointed out that in terms of determining how best to manage human waste, now may be the opportune moment to have these conversations because "one of the challenges [regulatory agencies are] recognizing is that the cost of all the traditional approaches [is high] and isn't working [laughs]." As a result, the planner said, agencies are:

> working on updating both the environmental protection rules, which are the rules for the

> [smaller scale] onsite wastewater . . . as well as the indirect discharge rules, which are the rules for the soil-based, larger community-scale systems . . . and I think that's a good opportunity to begin some of these discussions about flow diversion and flow separation. (Vermont Planner, 2018)

Discussion

Language such as "begin some of these discussions" is a cue from an experienced planner that relationship-building is crucial to regulatory and practice outcomes, echoing what risk scientists since Short (1984) have asserted: "perceptions of risk, including judgments as to the acceptability of particular risks, are a function of the degree to which the institutions which are responsible for the assessment and management of risks are trusted" (p. 714). And, as Lachapelle (2008) points out, successful community development research and practice must build this trust if participants are to feel a sense of ownership in the development process. The important window of opportunity represented by our aging wastewater treatment systems in the face of climate extremes and demographic changes may pave the way for solutions like UDFs to emerge and take root, beginning with these conversations in local communities. However, the value of UDFs for reducing risks from reliance on imported agricultural inputs must be balanced with an awareness of the types of nested risks and responsibilities perceived by all those affected—in this case, all of us who consume food and produce waste.

It remains to be seen in practice whether the cost savings represented by urine diversion—both in terms of agricultural productivity and waste-water system safety and efficiency—can be achieved over time locally, and expand at scale geographically. For example, a nutrient management advisor pointed out that New Hampshire's regulations concerning the use of biosolids are different than Vermont's; the advisor imagined this may be the case with urine (New Hampshire Agricultural Advisor, 2019). However, common trends across sites exist as well, such as farmers' interests in environmental stewardship and in organic production (USDA, 2017). As economist Veronica Nigh writes in an American Farm Bureau Federation analysis of the USDA 2017 census:

> Farmers increased the number of acres of cropland planted to a cover crop by nearly 50 percent. Further, the number of operations with renewable energy devices increased by 132 percent. This huge increase was driven by large increases in the number of operations with solar panels, wind turbines, methane digesters and geo-exchange systems. (Nigh, 2019)

This environmental orientation on the part of many farmers may indicate potential interest in the reuse of human urine in agriculture and suggests that certification of UDFs as organic at the federal level could both enable more farmers to use UDFs and help mitigate regional differences in regulation. While our data are not adequate to assess regional differences writ large, they do indicate that specialists and agricultural producers are mindful of the importance of regulations that can enable or constrain innovation.

Regarding the potential effect of system redesign on local communities, farmers in this study saw the value of recycling human urine as part of strengthening local economies. But at the same time, some worried that commodification of urine as a fertilizer could translate into the inequalities already embedded in agricultural systems. Farm inputs are increasingly provided by conglomerates beyond local or regional production communities, creating what Richard Lewontin (1998) described as "agricultural alienation." Pushing back against evolutionary psychology and sociobiology as explanations for inequality, Lewontin draws conscious parallels with labor alienation in industrial sectors, but notes that farmers face even deeper anxieties of having land, water, and food become commoditized and beyond the reach of an individual or family. In small farm communities that are struggling to retain a sense of sovereignty (or cultural and technological control—see Anderson et al., 2018) over their practices, individuals might fear the hidden exploitative possibilities of separating people from their waste in new ways.

This constitutes one of the wider layers in our nested risk concept (see Figure 1), speaking not only to the fear of being exposed to something bad, but also to the fear of losing access to that which is deemed good or natural in life (Colsa Perez et al., 2015). In general, with regard to informed, equitable participation in environmental decision-making, Webler, Tuler, and Kruger (2001) find that for the process to be seen as legitimate, "technical information *as well as local knowledge* [emphasis added] needs to be gathered . . . evaluated in valid ways . . . and used to support recommendations" (p. 441).

Many of our respondents are already mindful of and collecting evidence about nested risks, including hydrological variations that play into nutrient runoff, contamination events, and toxin exposure from a wide range of sources. They expressed a need for more data on the microconstituents of existing industrially manufactured agricultural inputs like imported fertilizers as well as the natural amendments currently used by many organic and ecologically oriented farmers.

This reflects the ways that financial risk is increasingly nested within notions of moral and physical risk, particularly when we consider our dominion over most of the planet and its consequences for our health over the long term and for the existence of other life forms. Future research on these topics might leverage such partnerships for civically engaged and citizen scientific work on ecology and soil microbiology. Such data collection and modeling of complex agricultural systems can and should combine with further agroecological and policy research to feed findings such as ours into systemic work toward safer, more resilient, and just agricultural systems. Our conceptualization of ways in which ongoing research can be co-created to reflect the priorities revealed by our respondents is illustrated in Figure 2.

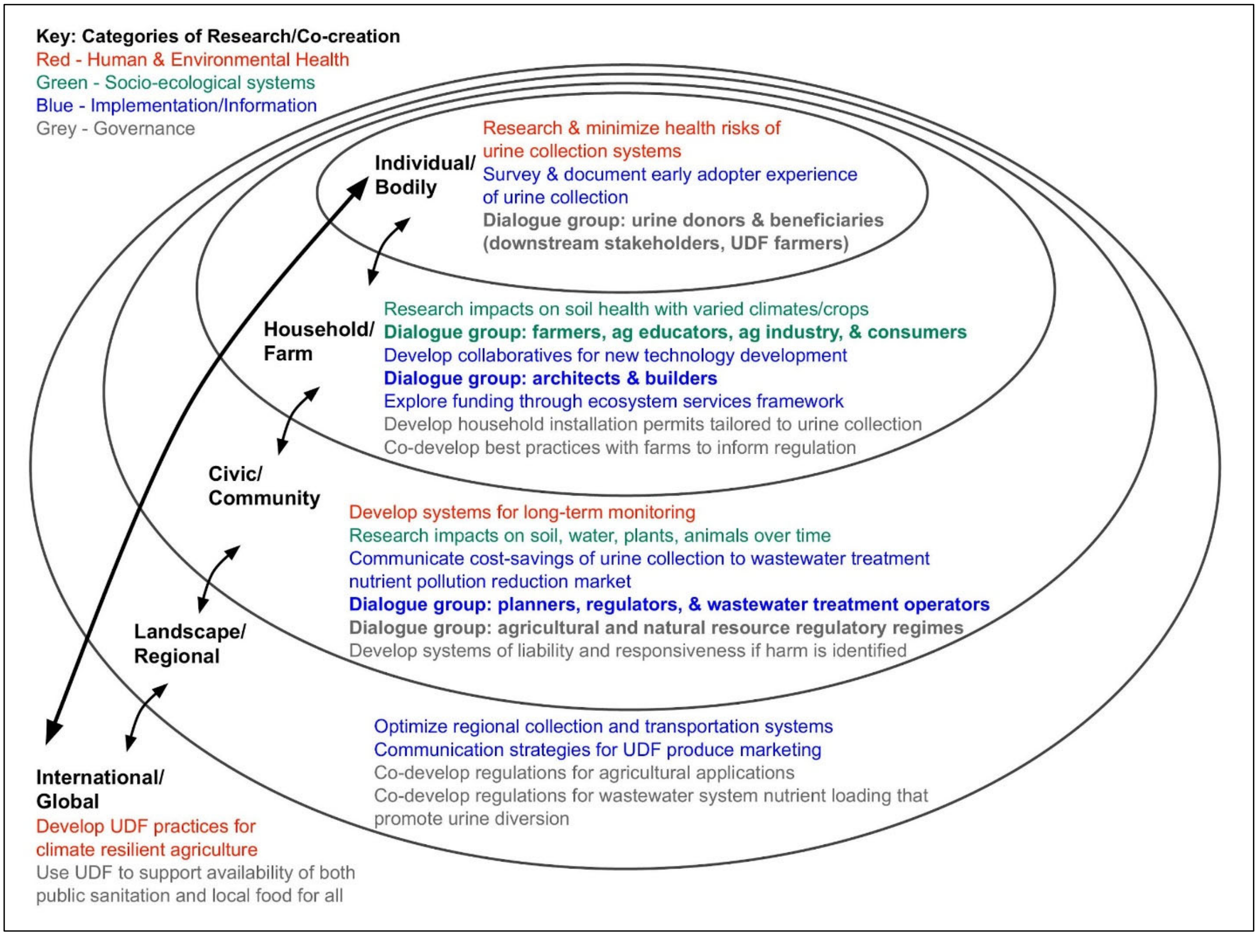
The opportunities and challenges noted by our interviewees provide important guidance for research and experimentation going forward. For example, researchers with our larger INFEWS project are working on concentrating urine to reduce transportation costs and labor requirements and continue to work on appropriate treatment methods to reduce microcontaminants. Coupled human/natural systems research could be applied productively to understand and predict UDF implications for soil health under different soil type and management scenarios. Such a complex systems-based focus could also enable current UDF related research, such as that underway for specific crops, sites, and application protocols (see, for example, Pradhan et al., 2010), to be connected with research on environmental impacts within wider food and water systems (Tidåker et al., 2007). As advancing climate change affects growing seasons, hydrological conditions, and agricultural management regimes, this becomes especially important.

This work might best be conducted in relation to other sustainable agricultural inputs, like recycled water. Foundations from this part of the project can undergird ongoing dialogue and documentation of early adoption. Teams should continue to collect adaptation and implementation insights to shape the potential for scaling forward, both within and across ecologically distinct regions with different regulatory contexts.

Limitations of this study include the small numbers of focus groups, relatively small numbers of individuals interviewed, the narrow demographic range of respondents, and some aspects of the sites where the research was conducted. For example, in Vermont, Brattleboro is perceived by some from other areas as being the "granola belt" where green and progressive ideas are more prevalent than in other parts of the state. Similar differences exist between urban and rural farms in the state of Michigan, and across northern versus other parts of the state (recognizing that suburbs can have more and less rural or urban characteristics in ways that are historically linked to septic versus main sewer line infrastructures; see Rome, 2001). Ann Arbor, where the UM team is based, has a comparable role in the state of Michigan, and is often described teasingly as a "bubble" or "the people's republic of Ann Arbor." That said, one aspect of our team's mandate was to ascertain existing enthusiasms or concerns among relevant stakeholders and communities of potential adopters. This was intended to enable co-creation, with relevant organizations and individuals, of the educational tools that could support learning, adoption, and eventual regulation of alternatives to

Figure 2. Priorities for Research and Co-creation

Figure 2 parallels our initial representation of the nested risks revealed by our research, to show priorities for action research going forward, reflective of those concerns. The color coding here represents categories for co-creation of research and implementation strategies and tools across permeable scales. Red suggests research in the realm of human and environmental health; green concerns wider socio-ecological systems; blue concerns methods of communication and implementation; and grey addresses governance, policy, and regulation.



current commercial fertilizers in a range of social and geographic circumstances. We hence see this less as a limitation than as a condition of the research, one that is relevant for future work in distinct sites, and comparable across the two sites. We recognize, however, that the type of in-depth dialogue needed for inclusive processes leading to technological change requires long-term commitments and partnerships that the present research has only begun to generate. We advocate for multidisciplinary teams across academic, practitioner and grassroots organizations to utilize this initial work to foster a range of follow-up action research.

Conclusion

Our results point to the necessity that researchers recognize the nested risks that entail shared responsibility by co-creators of this innovation. If an appropriate dialogical process can be developed in response to these perceived risks and responsibilities, the implementation of such systemic change could be effectively assessed and adapted (see Webler et al., 2001) beyond the pilot communities of relatively small and varied farms like those around Brattleboro, Vermont, in New England, to include more large-scale, commodity-oriented agricultural economies like those in Michigan in the Upper Midwest.

The data analyzed here (interviews, focus groups) can be mined for content and tone in future convenings of stakeholders. Given that the development and introduction of UDFs might entail modifications not only of farming practice, but also of personal hygiene practices at home and in public infrastructure, this work should continue to build robust dialogue and collaboration over time such that pilot and prototype communities can feel ownership of and trust in these co-created innovations.

To scale and assess such adaptive changes further will require consistent respect for those internalizing the varied levels of risk that come with changing practices. It will also require sharing knowledge between policy-makers, farmers, and consumers in order to "stay with the trouble" (Haraway, 2016). In other words, we must continue to heed the concerns and opportunities identified by our participants through dialogue mechanisms that engage a wide range of perspectives in a given place. Such "dialogue territorial" prioritizes the accessibility and transparency of new technologies and is anchored regionally in particular communities and places (Les Greniers de l'Abondance, 2020). Such foundations are crucial for cross-regional dialogue and leverage the cumulative experience of misapplied products, mismeasured impacts, and unintended consequences, recounted only in part here. Such experiences—failures as well as successes—are a kind of renewable resource themselves. They bear witness to the ways that sharing knowledge in families, farms, and communities has long constituted the foundation of human experimentation for positive transformation.

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Appendix A. Focus Groups and Interviews

Focus Groups (these represent a subset of the 5 focus groups conducted)

Farmer Focus Group 1, Facilitator: Tatiana Schreiber, with Phoebe Gooding. Brattleboro, Vermont. 15 March 2018.

Farmer Focus Group 2, Facilitator: Tatiana Schreiber, with Phoebe Gooding. Brattleboro, Vermont. 21 March 2018.

General Public Focus Group 1, Facilitator: Audrey Pallmeyer, with Chris Askew-Merwin. Ann Arbor, Michigan. 14 August 2017.

General Public Focus Group 2, Facilitator: Tatiana Schreiber, with Phoebe Gooding. Brattleboro, Vermont. 10 August 2017.

Interviews (these represent a subset of the 24 interviews conducted)

Massachusetts Agricultural Educator, Interview with Tatiana Schreiber, with Alex Sabido. Amherst, Massachusetts. 6 June 2018.

Massachusetts Environmental Advocate, Interview with Tatiana Schreiber. Greenfield, Massachusetts. 3 August 2017.

New Hampshire Agricultural Advisor, Interview with Tatiana Schreiber. Walpole, New Hampshire. 4 April 2019.

New Hampshire Soil Scientist, Interview with Tatiana Schreiber. Keene, New Hampshire. 26 June 2018.

Vermont Agricultural Educator, Interview with Tatiana Schreiber, with Malavika Sahai and Audrey Pallmeyer. Burlington, Vermont. 1 March 2017.

Vermont Farmer and Environmental Advocate, Interview with Tatiana Schreiber, with Phoebe Gooding. Woodstock, Vermont. 18 June 2018.

Vermont Farmer 1, Interview with Tatiana Schreiber, with Audrey Pallmeyer and Malavika Sahai. Brattleboro, Vermont. 28 February 2017.

Vermont Farmer 2, Interview with Tatiana Schreiber, with Audrey Pallmeyer and Malavika Sahai. Brattleboro, Vermont. 28 February 2017.

Vermont Legislator 1, Interview with Tatiana Schreiber, with Phoebe Gooding. Westminster West, Vermont. 2 August 2017.

Vermont Legislator 2, Interview with Malavika Sahai, with Tatiana Schreiber and Audrey Pallmeyer. Montpelier, Vermont. 1 March 2017.

Vermont Planner, Interview with Tatiana Schreiber, with Alex Sabido. Morristown, Vermont. 27 June 2018.

Appendix B. Coding Categories

Bin 1.1: **Familiarity** (with concept of urine as fertilizer)

a) Yes, familiar—record stories
b) No, was not familiar
c) Formal training

Bin 1.2: **Comfort Level** (*note what factors influence comfort level*)
Scale: Low to high comfort level (e.g., would *eat* specific foods, would *use* on specific crops)

a) Low: Would not eat (or serve to family/friends)
b) Middle: Would use/eat x crop, not y crop
c) High: Would eat/use on anything

Bin 2: **Personal Response**—e.g., disgust, discomfort, enthusiasm
Scale: Positive and negative feelings

a) Low: Disgust
b) Middle: Measured acceptance
c) High: Openness across the board

Bin 3: **Ascribed Attitudes** (feelings they think others will have)
Scale: Positive and Negative attitudes

a) Low: Think others will be opposed
b) Middle: Think others will be open in some cases
c) High: Enthusiasm

Bin: 4: **Perceived Benefits: Environmental** (Coder should note level of importance)

a) Water conservation
b) Soil health
c) Climate change
d) Less nutrient run-off into waterways
e) Other

Bin 5: Perceived Systemic Benefits OR Concerns: Economic or Infrastructural

a) Cost/efficiency of food
b) Cost/efficiency of wastewater treatment
c) Cost/consequences of fertilizer
d) Cost/efficiency of infrastructure changes (also how much people would spend on toilets)

Bin 6: **Other Perceived Benefits** of urine/diversion recycling including health

a) Help farmers, nutrients, value as fertilizer
b) Reduce chemical inputs
c) Urine or UDF may be less contaminated (risk to human) than current commercial fertilizers
d) Urine or UDF may be less contaminating (risk to environment) than current commercial fertilizers

Bin 7: **Holism**—Concerns about natural cycles and human impact
Example: I don't like hydroponics because "they're growing in styrofoam or something, and rocks…"

a) Low: Transform nature to suit human needs
b) Moderate: Use some parts of nature for our needs, protect others
c) Strong: Reconnect natural cycles and close loops

Bin 8: **Humor**

a) Positive humorous response
b) Negative humorous response

Bin: 9: **Perceived Community Concerns about Urine Diversion/Re-use**

a) Perception of health risk (*note type of health risk, e.g., opioids, other pharma, heavy metal, anti-biotics, radiation, disease, fecal contamination*)
b) Perception of risk to environment (*note type of risk, e.g., water, soil*)
c) Odor
d) Impact of treatment on fertilizer value (i.e., would treatment of UDF reduce fertilizer value—kill beneficial organisms, etc.)
e) Concern re what new toilets will be like/how they will work

Bin 10: **Attitudes Toward Authority And Science**

a) Being taken advantage of or talked down to
b) Being misled (by scientists, government agencies, corporations)
c) Human error causing health risk
d) Trust science and regulators to guide best practice
e) Other

Bin 11: **Communication** (suggestions, ideas)

a) Medium (animation, interviews with scientists)
b) Content (i.e., what they feel content should be)
c) Audience (which strategy for which audience)
d) Terminology/Language
e) Tone
f) Other

Bin 12: **Uri** (specific comments on Uri animation)

a) Medium (animation vs. other approach)
b) Content
c) Narration
d) Terminology/language
e) Tone
f) Other

Bin 13: **Implementation**

a) Suggestions/comments about infrastructure
b) Suggestions/comments about implementation strategies
c) How much they would personally spend to change toilet, for example
d) Ideas about regulation (who in community should regulate; what types of regulation are needed, labeling or certifying?)
e) Implementation depends on scale
f) Implementation depends on geographic location

Bin 14: **Information Needs**

a) Data, research results
b) Technical specifics (how to apply, what happens to urine in storage)
c) Safety measures (i.e., what treatments were done, what were results)
d) Regulations (what regulations or guidelines are in place, questions about who will certify safety (including impact on soil health))
e) Economic information such as costs of implementation
f) Other

Bin 15: **Fertilizer Use Comments/Preferences**

a) Prefer untreated urine (i.e., for home/garden use)
b) Prefer treated, processed
c) Comments about biosolids in relation to urine or UDFs
d) Dry (concentrated) versus liquid
e) Preferred use depends on scale and type of operation
f) Other

Bin 16: **Decision-making about Food**

a) Economic
b) Environmental (thinks about environmental impact of how food is grown)
c) Health, nutritional value
d) Local, seasonal
e) Methods of growing (organic, conventional—thinks about fertilizer practices)
f) Perceived health risk (GMOs, pesticides)
g) Other

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Can large-scale land acquisition deals improve livelihoods and lift people out of poverty in sub-Saharan Africa? Empirical evidence from Tanzania

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Abstract

The recent wave of large-scale land acquisitions or land deals, popularly called 'land grabbing' in subSaharan Africa, has provoked vigorous debate over the potential benefits and risks to local people, with results structured by complex policy and institutional context. Land deals present new development challenges and aggravate old vulnerabilities, raising critical questions for investigation. Yet empirical evidence of impacts on local populations is limited, particularly regarding how land deals affect local people's livelihood assets, strategies, and outcomes. Guided by the sustainable livelihood approach and a quasi-experimental design, I compare livelihoods before and after a land deal project and between an affected and a control community in southwestern Tanzania. I use household surveys, focused group discussions, and key informant interviews to collect data. The ANOVA analyses revealed that the project severely deteriorated households' natural, financial, and social capital and had far-reaching impacts on well-being in the affected community compared to the control village. The study recommends that African countries should consider (1) scrutinizing land deals and enforcing contracts, (2) conducting rigorous environmental and social impact assessment, (3) strengthening customary land rights and reinforcing compensation policies, and (4) meaningfully involving locals in land deal negotiations. This contribution responds to the deficit in research on land deals' impacts on livelihoods and well-being and lays the groundwork for future research.

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Keywords
Large-Scale Land Acquisition, Land Grabbing, Livelihoods, Sustainable Livelihood Approach, Tanzania, Sub-Saharan Africa, Kilombero Plantation Limited, Agricultural Investment

Introduction

Since 2007, a convergence of global crises in food, fuel, and finances have driven multinational corporations (MNCs), sovereign wealth funds, and private investors from the Global North to acquire large tracts of farmland in the Global South. This acquisition usually entails a transfer of rights to use, control, purchase, or lease land. The land size varies but typically ranges from 200 to several thousands of hectares (ha) in a single deal (Land Matrix, 2020). This practice, called large-scale land acquisition (LaSLA), has sparked a debate that has become increasingly contentious among the media, academics, policymakers, and human rights organizations. The debate revolves around LaSLA's impacts on local people's development and well-being across sub-Saharan Africa (SSA) (Nkansah-Dwamena & Raschke, 2020). This region accounts for approximately 70% of global land acquisitions (Anseeuw et al., 2012). With 754 LaSLA deals equivalent to about 56.2 million hectares, SSA has become an attractive destination due to available water and fertile land (Land Matrix, 2020).

The recent scale and intensity of LaSLA are unprecedented, and the exact extent of land under investment remains a matter of discussion (Hajjar et al., 2020). Scholars and the media often use terms as 'land grabbing,' 'commercial pressures on land,' 'land rush,' and 'new enclosures' to describe LaSLA (Anseeuw et al., 2012; Tafon & Saunders, 2019; White et al., 2012). These terms depict the fast pace of land deals, their highly contested nature, and the continuous struggles of local people who depend on land for their livelihood (Dell'Angelo et al., 2017; Zoomers et al., 2017). Approximately 78% of LaSLA investors produce food, biofuels, and other agricultural commodities for export to their home countries to meet growing demands or to the international market for profit (Byerlee & Deininger, 2013; Cotula, 2012). Usually, land acquisitions happen through negotiations with the host government. However, in some countries, the investor deals directly with local landowners. Access to water is critical for LaSLA projects; thus, investors often seek water rights (Breu et al., 2016; D'Odorico et al., 2017). Investors' scramble for water and land raises an essential question about how these projects affect local people's access to natural capital, particularly land and water, for their livelihoods.

Is LaSLA a Development Opportunity or a Threat to Development?

In the following section, I discuss the debate on LaSLA to contextualize the need for more empirical studies to improve our understanding of LaSLAs' impacts on local communities and reveal the apparent weaknesses in structuring LaSLA deals. By offering a more holistic discussion about the opportunities and threats of LaSLA, I hope to contribute a clearer picture of the procedural and distributive problems associated with the phenomenon. Such a discussion is also vital because the results of LaSLA projects are context-specific and provide insights into local people's experiences in SSA host countries.

LaSLA has attracted considerable attention in global development circles because there are significant benefits and severe impacts of the practice. Two competing narratives shape the current LaSLA debate. On the one hand, we can consider LaSLA, if done right, as a 'win-win' deal where investors secure land for production and host countries reap development benefits. Proponents claim that introducing foreign capital and transferring technology will modernize agriculture and improve local livelihoods (Salverda, 2019). Such structural transformation through the commercialization of subsistence farming is critical, the argument goes, to enhancing food security in countries like Ethiopia and Kenya (Baumgartner et al., 2015; Hajjar et al., 2020).

LaSLA can also enhance a nation's gross domestic product (GDP), diversify rural economies, and help reduce poverty by providing loans and employment for households (Li, 2011; Sulle, 2017). Advocates highlight the vital role of LaSLA projects in tying together land, labor, and capital, especially in countries with dwindling official development assistance (Baumgartner et al., 2015; Byerlee et al., 2011). They claim that LaSLA generates positive spillovers by improving human capital through capacity building and training local farmers (D'Odorico et al., 2017). For countries like Uganda and Mozambique, LaSLA provides an opportunity for global market integration and improved infrastructure such as machinery, roads, and irrigation systems (Byerlee et al., 2011). This study examines whether these potential benefits are occurring in the case study communities in Tanzania.

LaSLA critics, on the other hand, argue that governments and investors ignore local populations' diverse land values when making LaSLA arrangements (Tafon & Saunders, 2019). In many cases, LaSLA has led to the loss of livelihoods due to displacement of smallholders (Gironde & Golay, 2015), decline in income (Shete & Rutten, 2015), food insecurity (Atuoye et al., 2021) and competition for land and water between investors and locals (Breu et al., 2016). The competition for resources further leads to social upheaval and violence, especially in countries with weak governance like Madagascar and Ethiopia (Mollett, 2016). In SSA, access to land is indispensable to people's livelihoods. Land is a source of identity and belonging. It is often their most significant asset and is a safety net even for those who do not depend directly on the land for livelihood. In Ethiopia, LaSLA has dispossessed smallholders and pushed them into labor markets (Regassa et al., 2019). Thus, it has increased unemployment, creating conditions in which investors continuously exploit cheap labor (Shete & Rutten, 2015), bring workers from their home countries (Gingembre, 2015), and create seasonal jobs (Hajjar et al., 2020; Li, 2011).

Previous research indicates that LaSLA weakens tenure security and reduces local people's access to resources for livelihood (Breu et al., 2016; Gironde & Golay, 2015). Moreover, studies show examples of LaSLA practitioners excluding locals from consultation and LaSLA negotiation processes (Nolte & Voget-Kleschin, 2014). Governments and investors have occasionally realized the need to involve locals in LaSLA processes and pledged to adhere to international guidelines on land acquisitions such as USAID's *Operational Guidelines for Responsible Land-Based Investment* and the FAO's *Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries, and Forests in the Context of National Food Security* (VGGT), and other relevant instruments, like the United Nations' *Guiding Principles on Business and Human Rights* (UNGP). Nonetheless, such promises are all too rare (Salverda, 2019), and governments infrequently involve affected people in decision-making or compensation negotiations for displacement. They also ignore the principle of free, prior, and informed consent (FPIC). Because of these grave threats to local communities, Liberti (2013) argues that LaSLA is ruthless exploitation of the poor and reminiscent of colonialism.

The ongoing discussion here shows that LaSLA is a double-edged sword with both positive and negative effects. Despite these realities, our understanding of how the local political economy determines the winners and losers of LaSLA projects in Tanzania is limited. This paper contributes to this debate by examining the structures and processes that influence households' vulnerability context (e.g., displacement, unemployment, food insecurity, and loss of livelihood) in rural Tanzania. Knowledge of these nuances can offer insights on policy relating to the design of LaSLA investments. Thus, this study focuses on how LaSLA affects local people's access to the various capital assets needed for household well-being. In so doing, it responds to calls for more empirical work on the benefits and risks associated with LaSLA.

Although there is research on the socioeconomic impacts of LaSLA on contract farmers in Tanzania (Pedersen, 2016; Sulle, 2017), the literature has yet to offer a comprehensive analysis of LaSLA's effects on the five livelihood assets while taking into consideration livelihoods before and after LaSLA. My objective is to analyze the impacts of the Kilombero Plantation Limited (KPL) LaSLA project in southwestern Tanzania on these five livelihood assets. In other words, I rely on the SLA to examine whether and how LaSLA processes and structures (e.g., investors and governments) affect households' livelihood assets, strategies, and outcomes. By examining LaSLA's impacts on livelihoods in Mkangawalo (affected village) and comparing it with livelihoods in Chita (control village) using a pretest-posttest approach, I hope to tease out determinants of livelihood outcomes.

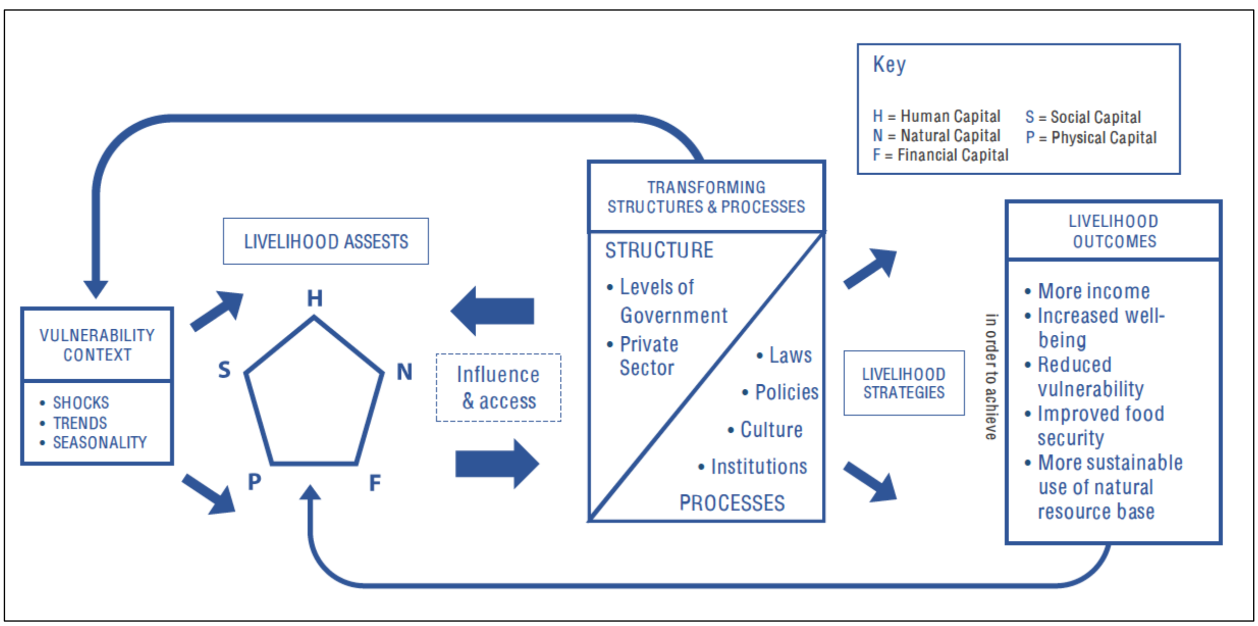
The Sustainable Livelihood Approach (SLA)

I adopt the sustainable livelihoods approach (SLA) (Figure 1) to evaluate LaSLA's impacts on households' livelihood assets, strategies, and outcomes in the study area. The SLA developed by the Department for International Development (DfID, 1999) is relevant for this study because it provides an analytical approach to explore LaSLA's impacts on households' livelihoods. The study employs the SLA to understand how household livelihood systems interact with the external environment—both the natural environment and the policy and institutional context. Relying on the earlier definition by Chambers and Conway (1992) and further developed by Scoones (1998), we can define a livelihood as "compris[ing] the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, [and] maintain or enhance its capabilities and assets, while not undermining the natural resource base" (p. 5). According to Chambers (2011), it is "a level of wealth and of stocks and flows of food and cash which provide for physical and social wellbeing" (p. 5). A sustainable livelihood provides security against poverty and ensures the well-being of households. For rural people, "well-being" may mean just the ability to provide adequate food, shelter, and security for household members. For others, standards may be higher, but whatever the definition, a livelihood is primarily the means to achieve and sustain well-being (Messer & Townsley, 2003).

Components of the Sustainable Livelihood Approach

Five concepts are crucial for understanding the linkages within the SLA framework. These are the vulnerability context, livelihood assets, institutions, livelihood strategies, and livelihood outcomes. Regarding the vulnerability context, many factors which households may have little or no control over can affect their access to adequate livelihood assets. These factors can include weather-related shocks (drought and floods, pest and disease epidemics), economic shocks (drastic changes in market prices affecting households' purchasing power), seasonal stress (famine and food insecurity), environmental stress (land degradation, soil erosion, and bush fires), structural vulnerability (lack of voice or power to make claims), and civil strife (displacement and destruction of property) (Messer & Townsley, 2003). These events and forces can

Figure 1. The Sustainable Livelihood Analysis (SLA) Framework, Adapted from the Department for International Development



Source: Department for International Development (DfID). (1999). *Sustainable livelihoods guidance sheets: Overview, 1.1,* p. 1.

undermine livelihoods and potentially make households more vulnerable to poverty. For example, inadequate or lack of access to land, water, or social support due to displacement by LaSLA could make households vulnerable to shocks that contribute to adverse livelihood outcomes, an underlying condition for poverty. It is worth noting that policies, institutions, and processes that do not support households in achieving an adequate livelihood can also cause poverty. We can think of these many factors as contributing to the vulnerability context in which households operate, affecting how people use their assets and strategies. For example, where governments displace smallholders to make way for LaSLA projects, smallholders may choose to work as casual laborers or contract farmers for the investor.

Livelihood Assets (Capital) and Strategies

Livelihood assets include social, financial, human, natural, and physical capital. These assets are critical for individuals, households, and communities to pursue their livelihood strategies, which enable them to achieve their desired goals or livelihood outcomes (e.g., reduced vulnerability, more income, improved health, and food security). The ability of household members to work together and with the broader community is vital to their livelihoods. However, national and local policies, institutions, and processes also influence livelihood assets.

In rural areas, households are connected by ties of social obligation and mutual support, which are especially crucial during emergencies. We can consider these as *social capitals* that constitute a household's livelihood capabilities. Thus, social capital encompasses the norms of reciprocity, mutual trust, social networks, and relationships that support individuals (Bourdieu et al., 2019). Putman (1993) refers to it as the "feature of social organization that facilitates coordination and cooperation for mutual benefit" (pp. 35–36). The *financial capital* at rural people's disposal may originate from converting surplus harvest for money to save for an emergency or invest in other activities. It includes cash, credit, gold and jewelry, bank deposits, loans, income, and savings (Scoones, 1998). In rural areas, households use their financial capital to establish businesses or shield against stresses and shocks.

People's active labor, health, education, training and skills, leadership qualities, and the knowledge they have gained over generations of experience that enable them to earn a living constitute their *human capital* (Flora et al., 2016). In rural households, human capital determines the quantity and quality of available labor or the workforce and is also needed to leverage and enhance other capitals. *Natural capital* refers to stocks of naturally occurring environmental resources such as land, fresh water, forest, pasture, and wildlife that directly or indirectly support people's livelihoods (Scoones, 1998). For rural people, these assets are essential for producing food, shelter, and income. How households access these resources—ownership, lease, communal land, etc.—and for how long and under what conditions are all crucial considerations in determining livelihood outcomes, in addition to the condition of the resources themselves. Finally, *physical capital* includes the infrastructure, facilities, services, and structures that support society, including roads, buildings, vehicles, equipment, communication technologies, irrigation, health care, and energy (Flora et al., 2016). These also enable households to improve their human capital.

People exploit the livelihood assets described above to pursue livelihood strategies—combining different activities and choices to achieve their livelihood goals or outcomes. These strategies include how households combine their revenue-generating activities, such as using, investing, or preserving their assets. For example, rural households might grow a mix of staple and cash crops, raise livestock, fish, and gather forest products to meet their food and nutritional needs, combined with the sale of farm harvest surpluses on the local market. Depending on their individual goals, knowledge of assets, and options available, households may pursue distinct livelihood strategies.

Policy and Institutional Context

The policy and institutional context in which households live also influences their access to livelihood assets, their vulnerability context, and their livelihood strategies. It involves how institutions shape the different livelihood assets available to households, by controlling access to resources or influencing how, where, when, and who uses them (Scoones, 2015). For instance, when governments implement agriculture investment policies like LaSLA projects, it may lead to loss of access to land (livelihood asset) and displacement (vulnerability context) and consequently may cause people to migrate (livelihood strategy) in search of alternative livelihoods. The term "institution" refers to various formal and informal organizations (structures), policies, and processes (arrangements) at national and local levels that determine the amount of assets and how households use their assets (Scoones, 2015). Formal or visible institutions are structures of recognized and accepted roles with clearly defined rules and regulations; informal or invisible institutions are unstructured and have no written statutes. Example of institutions include:

1. government agencies that implement and enforce rules and regulations, and protect the peoples' rights;
2. political groups that act on behalf of certain groups or people and effect new laws and policies;
3. investors, entities, and corporations with capital that employ people and produce goods and services; and
4. social-cultural institutions such as kinship, marriage, inheritance, and religion.

One can assume that households that are members of or have better access to these institutions potentially have better access than others to the services the institutions provide, the assets they control, or the rights they protect. At the local level, institutions may affect household livelihood strategies by deciding whether certain activities are suitable for women and men, incentivizing the pursuit of specific livelihoods and choices over others, and influencing a household's perception of achieving desired goals. Where an enabling policy and institutional context (e.g., one that is democratic and accountable) enhances households' access to livelihood assets, a disabling context (e.g., one that is elite-dominated and less transparent) disfavors the poor and worsens their access to the resources needed to escape poverty.

Different government levels decide and enact policies that shape household decision-making and the use of their assets. For instance, policies that place more autonomy and authority in village leaders' hands may provide locals more power and influence over the decisions and actions affecting them directly. Similarly, environmental protection and conservation policies that take full control of a given natural resource can make it more difficult for households to access the resources they usually rely on to supplement their livelihoods. Equally important to the policy is the policy formulation processes. For example, failure to consult and involve locals in the mechanisms that lead to policy formulation implies that the locals will have no means of influencing the policies that might affect them directly. Thus, they are more likely to be adversely affected by those policies.

Livelihood Outcomes

Livelihood outcomes can be positive or negative. They are what households achieve through their livelihood strategies, such as food security levels, income security, health, well-being, asset accumulation, and high status in the community (Scoones, 2015). For example, suppose LaSLA results in food and income insecurity, increased vulnerability to shocks, displacement, and loss of access to assets; in that case, we can consider these as unsuccessful outcomes. With adequate access to livelihood assets, reduced vulnerability, and the right policies, institutions, and processes, households are more likely to develop appropriate livelihood strategies, leading to better livelihood outcomes (Messer & Townsley, 2003). Livelihood outcomes, in turn, may improve or deteriorate livelihood assets. The vulnerability context (e.g., households' encounters with unexpected shocks) affects their livelihood outcomes, depending on their livelihood assets.

In this study, I apply the SLA to explore the relevant channels of asset distribution and the roles of various LaSLA actors, including the investor, Tanzanian government (hereafter GoT), and NGOs, in shaping livelihood outcomes. These actors and LaSLA policies and processes control, distribute, and transform households' livelihood assets and strategies. Although the SLA framework is relevant for identifying and evaluating the effects of development projects such as LaSLA on poverty reduction (Chambers, 2011), it fails to address power relations. Nevertheless, similar to Scoones (2015), I argue that it provides a critical and comprehensive approach for analyzing a complex issue like LaSLA. The SLA framework puts "people" first and enables us to understand complex local realities. In the next section, I provide a brief background of Tanzania's LaSLA development and describe the LaSLA project.

Background: LaSLA Development in Tanzania and Study Villages and LaSLA Project

I rely on in-depth case studies in two communities in southwestern Tanzania to investigate the consequences to livelihoods of LaSLA. Tanzania is a well-suited area in which to study these issues. Additionally, it was logistically convenient to collaborate with agriculture investment experts at the Sokoine University of Agriculture. With only 23% (10.2 million ha) of Tanzania's land under cultivation, land is considered underutilized (Sulle & Nelson, 2009). Thus, Tanzania is regarded as one of the top LaSLA target countries in SSA (Anseeuw et al., 2013). The GoT, keen to transform small-scale farming into commercial production, has established new initiatives, including the Kilimo Kwanza (meaning 'agriculture first'), to attract foreign investors. GoT's efforts to extend state authority and tighten control over land afford it a unique opportunity to negotiate with investors and transfer control over massive tracts of land. Renewing its interest in foreign investments, the GoT established the Tanzania Investment Act of 1997. It also formed the Tanzania Investment Centre (TIC), a 'one-stop agency' that streamlines LaSLA investment procedures and provides tax holidays for investors. Figure 2 shows the trend of LaSLA deals in Tanzania over the last two decades. One such capital-intensive farm is the Kilombero Plantation Limited (KPL) LaSLA project, the case study for this research. Studies on recent LaSLA in Tanzania show similar adverse livelihood outcomes for local communities as described across SSA (Atuoye et al., 2021), making a study of LaSLA's impacts on livelihoods in Tanzania all the more relevant and urgent.

This study's spatial focus is Kilombero Valley of Morogoro Region (Figure 3), a district that has seen high demand for LaSLA since the early 1990s. Kilombero, with approximately 392,600 hectares of land (Tanzania National Bureau of Statistics, 2018), is one of Tanzania's largest rice-producing areas.

Figure 2. The Number of LaSLA Deals and Land Size Acquired by Investors Between 2000 to 2015 in Tanzania Registered by the Tanzania Investment Centre

Data source: The Land Matrix (2020).

With 5,818 hectares of land, the KPL, located in the Mchombe Ward of the Mngeta Division, is among the top commercial rice producers in Tanzania. Because it has operated for nearly two decades, its impacts on livelihoods are visible, making it suitable for the study. The project is a joint venture rice plantation between the Rufiji Basin Development Authority (RUBADA), which owns 8.7%, and Agrica Guernsey Limited, a United Kingdom private firm, which owns 91.3%. The firm aims to create employment for local people, connect farmers to market, and improve exports in Tanzania. The investor operates a plantation farm and a nucleus estate (outgrower model), which operates through contract farming to produce rice for export and the domestic market.

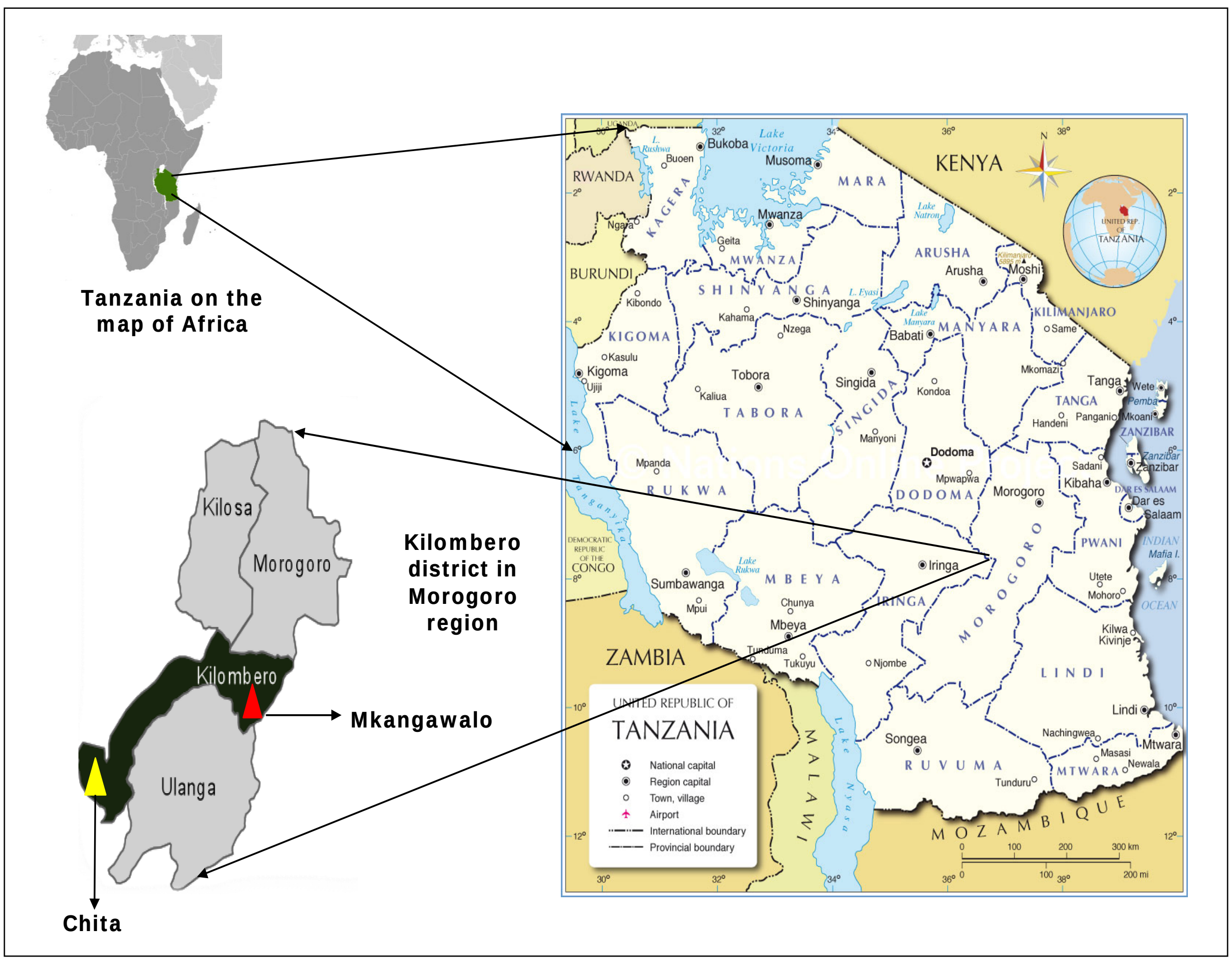
Methods

Study Design

This study uses a pretest-posttest and quasi-design to explore the differences and similarities between the treatment and control village to understand the LaSLA's impacts (Chan et al., 1998; Dimitrov & Rumrill, 2003). This understanding then provides a basis for conjecturing about LaSLA's implications in similar local settings in Tanzania and SSA. A case study methodology allows insights into people's real-life and contextual experiences to uncover the deeper meaning of LaSLA (Yin, 2017).

I conducted fieldwork in two rounds of visits to the study sites—preliminary studies in May 2014 and field studies in June 2015. After interviewing

Figure 3. Map of Tanzania Showing the Study's Location (Mkangawalo Village) and Control Site (Chita Village) in the Kilombero District of Morogoro Region



key informants during the pilot studies in eight villages, I selected Mkangawalo as the case study community (the "treatment" village) in the Kilombero District (Figure 3). My goal was to choose a village with strong ties to the LaSLA project to examine the impacts on households' livelihoods. Mkangawalo shares borders with the project, and some residents work as contract farmers for the investor. I also selected a "quasi-control" community, Chita, where no LaSLA had occurred; this community is part of Kilombero, is further away from the KPL LaSLA project, and was less affected or unaffected by the project. The fact that Chita had a similar socio-economic profile and contextual factors as Mkangawalo helps to tease out the LaSLA's impacts on Mkangawalo. I used information from Chita to compare livelihood outcomes that occurred in Mkangawalo, the affected community. Households in both areas are mainly smallholder rice and maize producers. The study areas' predominant ethnic groups are WaBena, WaNgoni, WaChagga, WaSukuma, WaNdamba, and WaPogoro.

Table 1. Demographic and Household Characteristics of Respondents in the Study Area (*n*=200)

	Kilombero District	
	Mkangawalo Village	Chita Village
Average yearly income (USD)	$2,342	$2,533
Average age of respondent	54	42
Average household size	5.2	5.6
Average land holdings (ha)	1.4	2.2
Average years of residence	42	27
Gender		
Male	58	49
Female	42	51
Marital status		
Married	45	56
Single	55	44
Household status		
Head	66	62
Wife/Member	34	38
Years of formal education		
None	4	3
0–5 years	89	91
6–10 years	7	6
11–15 years	0	0
16–20 years	0	0
Farming as livelihood		
Before	47	45
After	53	55
Main farm crops		
Rice	91	85
Maize	9	15

Data Collection

I collected data primarily through household surveys, focus group discussions (FGDs), and key informant interviews. In the household survey, I used structured and semi-structured interviews to solicit households' perceptions of impacts on their livelihoods. I pretested the questionnaires and checked for coherency and comprehension and made the necessary modifications. Cronbach's alpha, a test of scale reliability and internal consistency in the questionnaire, was determined to be high, i.e., 0.7452 (Gliem & Gliem, 2003). The interviews involved a one-to-one in-depth discussion with respondents. Overall, I interviewed 200 households (*n*=200), 100 in each village. I selected households using stratified random sampling to increase statistical representation and reliability and reduce sampling bias. I grouped households into different strata based on religion, hamlet division, ethnicity, and wealth status.

The interviews solicited the households' demographic information (Table 1) and their perceptions of changes in access to livelihood assets and how these changes affect their livelihood strategies and outcomes. The livelihood assets inquired about included natural capital (land, water, forest, and pasture); financial capital (savings, loans, and farm and off-farm income); human capital (health, education, training, and skills); social capital (trust, relationships, networks, and external services); and physical capital (irrigation schemes, clinics, roads, and farm inputs). After each interview, I summarized the responses and asked the interviewee to affirm whether the summaries reflected their views, feelings, and experiences.

For each village, I conducted separate FGDs with men, women, and youth from 21 to 31 years old, drawing on participants' collective experiences and beliefs moderated by a team of skilled facilitators. I further separated the youth group by gender. All FGDs consisted of eight participants except the youth group (four young men and four young women). The village leaders and ward officers (lower administrative unit) assisted in selecting FGD participants to diversify the group along various axes: religion, employment with the investor, ethnicity, hamlet location, and wealth status. For the women's groups, I also ensured the representation of widows and female-headed households. I acknowledge that relying on the local authorities to select the FGD participants potentially may have introduced a sampling bias. Nonetheless, this sampling method was the most efficient and practical because of the local culture and time constraints.

The FGDs started with a participatory mapping exercise. The villagers worked together to sketch the village's key physical features, including the sacred areas, forests, rivers, and boundaries of the LaSLA project concerning their farmland. In the process, the groups deliberated over their relationship with the investor and shared their observations and personal stories about land tenure changes, displacement, compensations, and contract farming. I used the mapping exercise to start a dialogue about livelihood assets, strategies, and outcomes before and after the LaSLA project. The discussions occurred in multiple sessions until reaching theoretical saturation, where a clear pattern emerged and subsequent sessions produced no new information. The FGDs facilitators created a conducive environment to engage in an open discussion, free from individual dominance and influence. The FGDs lasted 2–3 hours, and they were instrumental in exploring the village's legitimization and level of support for the LaSLA project.

I also conducted key informant interviews with five informants from the study area, including the investor's representative, an officer from HAKIARDHI (a local NGO), an officer from the Tanzania Investment Center (TIC), village leaders, and an agricultural development expert from the Sokoine University of Agriculture. Each interview lasted 2–3 hours and focused on understanding the LaSLA implementation process, the government's role and/or support, investor's responsibilities, changes in access to natural resources, the project's benefits and risks, and livelihood strategies before and after the LaSLA project.

Data Analysis

I collected data on LaSLA's impacts on a household's (as a unit of analysis) livelihoods. Impacts were measured by determining the changes in livelihood assets, which refer to increase or decrease, comparing before (2005) and after (2015). I recorded the changes on a 5-point numerical rating scale, where 5 represents much better (50% more), and 1 represents much worse (50% less). The quantitative data were statistically analyzed in two steps using Minitab Statistical Software.

The first step involved multiple pairwise comparisons using one-way ANOVA (with Tukey test) to determine whether and how the means (averages) of livelihood assets between Mkangawalo and Chita are significantly different. In other words, I compared the changes in livelihood assets—measured by the difference between before and after LaSLA and between the treatment and control village. Using averages can hide the disparities in the data and give a misleading result; however, the data had no dispersions. Thus, it was safe to use averages for comparison. The statistical significance of the difference was set at $p<0.05$. For comparison of livelihood assets between the villages, if Mkangawalo and Chita share the same letter (see table 2), they belong to the same group, or their asset did not change. Thus, we can say that LaSLA did not affect that particular asset in Mkangawalo. However, if the villages show different letters, it indicates changes in livelihood assets between Mkangawalo and Chita as an impact of LaSLA.

The second step involved calculating a percent change to evaluate the changes' significance (i.e., better or worse) in livelihood assets between the villages. A positive change represents an improvement, while a negative change represents a deterioration in livelihood. All assumptions underlying the one-way ANOVA were satisfied. The demographic data provided an aggregate picture of the villages, including information about their human capital (household size and education level), financial capital (income), natural capital (land holdings), and social capital (years of residence). It also provided insights on households' livelihood strategies, food security, and knowledge of the LaSLA project.

The qualitative data were analyzed using content and ethnographic techniques. I audio-recorded and transcribed the FGDs, household interviews, and key informant interviews, after which I coded the data in two stages after transcription. I initially coded and re-arranged the transcripts into themes based on livelihood assets and emergent codes such as livelihood strategies and outcomes. This enabled comparisons between the treatment and control village. As much as possible, I tried to triangulate information from the household interviews with the FGDs, key informant interviews, and available documentation.

In the second stage, I used focused coding to eliminate, merge, and categorize the codes identified in the first step to concentrate on recurring ideas and broader themes connecting the codes (O.Nyumba et al., 2018). This allowed for comparisons between groups. I sought to examine all the evidence and significant rival interpretations, particularly regarding the critical issues of the case study (Yin, 2017). I interpreted the results by assessing and comparing the data with similar studies done in Tanzania and other parts of SSA. In the next section, I present the results (Table 2), highlighting the changes in households' livelihood assets associated with the LaSLA project and how these changes have caused livelihood strategies within households to shift. Finally, I present the consequences and well-being resulting from the project.

Table 2. Changes in Livelihood Assets, Comparing Affected Village (Mkangawalo) and Control Village (Chita) Before and After LaSLA Project in the Kilombero District (*n*=100)

		Mkangawalo			Chita				
Type of Capital	Livelihood Asset	Mean	SD	Group	Mean	SD	Group	*p*	Percent change
Natural capital	Access to land	2.00	1.36	B	3.08	1.07	A	0.000	−35.06
	Access to water	2.04	0.88	B	2.46	1.07	A	0.035	−17.07
	Access to forest	1.44	0.67	B	2.42	1.18	A	0.000	−40.50
	Access to pasture	1.50	0.89	B	2.58	0.95	A	0.000	−41.86
Financial capital	Savings	2.48	1.25	A	2.70	1.22	A	0.374	−8.15
	Access to loans	2.50	1.02	A	2.20	1.11	A	0.161	+13.64
	Average farm income	2.68	1.02	B	3.40	0.90	A	0.000	−21.18
	Average off-farm income	3.08	1.21	A	3.36	1.01	A	0.211	−8.33
Human capital	Health	3.06	1.41	A	3.36	1.08	A	0.235	−15.00
	Education	3.18	1.30	A	3.28	1.09	A	0.678	−3.05
	Training	2.94	1.15	B	3.34	0.63	A	0.033	−11.98
	Skills	2.22	1.11	A	2.10	1.19	A	0.148	+5.71
Social capital	Social networks	2.60	0.97	B	3.56	0.73	A	0.000	−26.97
	Trust in people	2.94	1.06	B	3.68	0.74	A	0.000	−20.11
	Relationships	3.26	0.90	A	3.60	0.88	A	0.059	−9.44
	External service	2.17	1.30	A	2.28	1.09	A	0.678	−4.82
Physical capital	Irrigation scheme	2.40	1.01	A	2.23	1.10	A	0.159	+7.62
	Health clinic	3.13	0.98.	A	3.04	1.09	A	0.146	+2.96
	Road and transport	2.01	0.71	B	3.18	1.24	A	0.000	−36.79
	Farming inputs	2.12	1.01	A	2.08	1.14	A	0.110	+1.92

Results

Impacts of the Kilombero Plantation Limited (KPL) on Livelihoods in the Study Area

Natural capital

In comparing natural capital between the study village (Mkangawalo) and control village (Chita), the results (Table 2) show that in Mkangawalo, access decreased significantly in all measures of natural capital post-investment. More specifically, households' access to the forest declined by 40%, pasture by 41%, water by 17%, and average land holdings by 35%. The LaSLA project displaced approximately 35% of Mkangawalo's residents off their farmland, leading them to become dependent on the investor for casual labor. They did not have any land to grow their own crops for food and sale on the market. This worsened their financial security because of the low wages and seasonality of the job. Regarding the displacement, the investor's representative said:

> We did not displace any villager. After processing our documents, the government allocated the land to us, and the district authorities helped us claim it. Maybe they were displaced by the officers and not us.

Relocated farming and grazing lands at the village outskirts were generally smaller and infertile following the LaSLA project (decreased from 4–5 ha to 1–1.4 ha). Similar events and trends, like forest conversion and shrinking landholdings, were also happening due to population growth in the control village. However, the key informant interview revealed that the LaSLA project accelerated the affected village's situation. A few households in Chita experienced a decline in landholdings, but over 90% continued to be larger than in Mkangawalo. According to the FGDs, some households cultivated vegetables along the riverbanks to supplement their farm yield before the project, but the investor cleared the land, destroying their farms. This worsened their food security and made them vulnerable to hunger. The smaller landholdings and crop pests, including rodents from the investor's plantation, resulted in a low crop harvest and crop variety grown for household consumption and sale. Households reported no longer growing crops like wheat, sorghum, millet, and beans but having to buy these products from the market. In contrast, households in Chita reported increasing farm yield and diversity of crops grown and reported consuming more food than in the past decade while buying less food. A key informant from HAKIARDHI commented on the issue of food insecurity in Kilombero, saying:

> Food insecurity will continue in villages because there is no clause in the government's LaSLA contract requiring the investor to produce a specific percentage for the local market. These investors are businessmen, so what can we expect. (Key Informant # 3)

Both the men's and women's FGDs revealed increasing land scarcity driven by the influx of migrant workers. According to an opinion leader in the group, the land shortages forced about 32% of men to search for land in other villages like Mchombe, Mngeta, and Mbingu to grow food crops. One elder interviewed stated:

> Now, I have borrowed money to lease a small plot in another village to grow food crops to feed these children [pointing at five children sitting in front of the door]. We leave these small kids at home because we have to walk three hours to the farm. My wife is always worried because she thinks something bad can happen to them while we are away. (Interviewee # MK 24)

Farmers also faced a significant challenge in obtaining water for farming. Because the investor had blocked the road to the main river, households had limited access to water and had to travel long distances searching for water. Most farmers (94%) relied exclusively on the river as a water source for their farms during the dry season. Some respondents also believed that the runoff from the investor's farm had contaminated the river's tributaries. A few fishermen complained of the declining fish population in the river. As one explained,

> When we go fishing these days, all we find are dead fishes floating on the river, and we wonder why, but it was not like this at first. Now we come home empty-handed, and my wife cannot cook a delicious meal because we do not have fish. My children like fish very much. (Interviewee # MK 88)

The forests and pasture are critical to all Mkangawalo residents. Almost all respondents (97%) relied on forest resources such as fruits, nuts, seeds, roots, and leaves during food scarcity. The FGD revealed that the village obtains traditional medicines, fuelwood, and building materials from the forest. They expressed grievances stemming from the clearance of the forest for the LaSLA project without consulting them first. Some FGD participants expressed anger and resented the investor for encroaching on the forest and bringing hardship to the village. The female participants referred to the increased burden due to an additional 7–12 km for each trip fetching firewood, which is traditionally the responsibility of women. Making such trips is particularly strenuous during the rainy season when it is hard to find any drier firewood. The reduction in access to grazing land also exacerbated household insecurities. Hostility appeared to develop between the villagers and the investor. As one woman expressed,

> How can they [referring to the investor and the local government] expect us to survive with no land and no water. Even my goats and sheep have no place to graze. We just do not know what we will do or where life will take us. Two of my children are sick; they need to eat, but we do not have food. (Interviewee # MK47)

Financial capital

The findings show that households in the affected and unaffected villages are statistically similar in terms of their off-farm income, savings, and access to loans (Table 2). However, compared to the unaffected village, the affected village's access to loans improved slightly (13%). Still, their savings and off-farm income declined by 8.15% and 8.33%, respectively, although these declines were statistically insignificant. More importantly, their farm income declined by 21.18%. Households gave several reasons for these declines. First, the displacement and loss of access to communal pasture forced them to sell off their livestock, resulting in reduced income. Particularly for women, milking cattle and selling dairy products are vital income-making activities. These events compelled women to work as day laborers for the investor, typically getting paid less (TSH 9502.53 ≈ US$4.11) and working long hours under unsafe conditions as compared to men.

Second, contract farmers in both FGDs said they felt locked into working for the investor because of the advance payment and compulsory deduction for savings. According to the farmers, the investor reached an agreement with them to purchase their rice, provided the rice meets the required standards. They complained that the investor breached the arrangement and refused to buy their rice as initially agreed. All farmers conveyed discontent with the contract farming's rigidity, claiming that the investor did not allow engaging in other off-farm activities like petty trading and the sale of firewood, charcoal, local food, and drinks to diversify their income. One contract farmer explained,

> I used to go to nearby towns to do casual labor in construction and also supplement our expenses by raising poultry, but I have lost all my livestock because the investor was very demanding. I regret joining the contract farming, and I plan to quit because I am not earning enough. I cannot only depend on this job alone. (Interviewee # MK 09)

Third, compensation was promised to affected households, although it is yet to materialize. During all of the FGDs, it was established that those displaced did not receive any form of compensation. Participants mentioned that they were expecting to receive direct monetary compensation from either the investor or the government for losing their farmlands. In addition, for the past five consecutive years, the investor had failed to make an annual payment to the village development fund of TSH 50,000,000 (US$22,800).

Nevertheless, some participants noted the investor offered loans, which helped them purchase farming equipment to support their livelihoods and children's education. Yet, the investor denied those seeking loans who did not have collateral security. Some households (17%) could not afford farming inputs to increase their crop yield. When asked about LaSLA's contribution to villager's financial capital, the TIC officer said,

> Tanzania has to catch up with the rest of the world. LaSLA provides a great opportunity to do that. Smallholders support the country, but we [referring to the government] must bring in commercial farming to create more opportunities. This is why we have created a conducive investment climate. We provide potential investors with various tax breaks; we have abundant water, affordable land, and an efficient investment process.

Human capital

There are claims that LaSLA develops human capital, especially in rural areas. Thus, I investigated the extent to which the LaSLA project has affected households' health, education, training, and skills. The results (Table 2) show that both the study and control village are statistically similar in terms of their health, education, and skills, except for training. However, compared to the control village (Chita), households' health and training opportunities in the affected village (Mkangawalo) deteriorated by 15.0% and 11.9%, respectively. A few factors account for this. First, tenure changes resulting from the LaSLA project altered household labor allocation, which, in turn, caused the physical and mental health of women, particularly, to deteriorate due to their increased workload. In the women's FGD, they described how the reduction in the consumption of meat and milk products due to decreased livestock numbers had affected their ability to produce breastmilk for their babies. One woman commented,

> those days [referring to before the LaSLA project], my family would kill a fat cow, share with other households, and sell some for money. I used to milk the cows every day, and we ate healthy and nutritious foods. We have to look good for our husbands, you know! But now, we only eat meat occasionally and have to buy milk sometimes. Life is getting harder and harder each day.

Second, both the household interviews and FGDs pointed to declining health owing to the intense workload and hazardous working conditions on the investor farm. Some female-headed households stated that the displacement had overwhelmed them with responsibilities. One participant described a range of tasks in a typical day. They wake up at dawn to fetch firewood, engage in petty trade for additional income before heading to the investor's farm to work longer hours in the sun, and then go fishing at night, a chore usually reserved for men. The household interviews revealed that some female laborers were regularly exposed to pesticides while mixing, loading, and cleaning the pesticide equipment. Approximately 7% of respondents complained of stinging eyes, rashes, blisters, and dizziness after working on the investor's farm. During the women's FGD, a pregnant woman stood up and said:

> Look at my hands and legs [showing it to the group], my skin has changed, and people continue to ask me why. Now, I always cover my hands and legs before I go out, even to my neighbor's house.

During the key informant interview, the HAKIARDHI officer cited a lack of adequate environmental and social impact assessment of the LaSLA project and weak monitoring and enforcement of labor rights and health (safety) standards by the Tanzania government as reasons for health problems in the affected village. I did not find any evidence of training or transfer of knowledge from the investor to the people. However, the investor's representative explained that the technologies they use are beyond the villagers' knowledge and capabilities. The village chairperson commented on the decline in education, saying,

> Because some parents now have to farm outside the village and leave their children unsupervised, the children become truant from

> school and work as casual laborers for the investor. (Interviewee # MK 75)

Social capital

I examined the potential impacts of LaSLA on social capital, including social networks, trust, quality of relationships, and access to external services. The results (Table 2) show that compared to Chita, Mkangawalo's social networks and trust within the village deteriorated significantly, by 26.97% and 20.11%, respectively. Similarly, relationships declined slightly by 9.55%. The FGD revealed escalating disputes and tension between villagers and the investor over forest encroachment. Some participants were threatened with arrest by the local government; hence, they remained quiet. It was apparent that trust and reciprocity among households had deteriorated because of different opinions about the investor. Some female participants accused the migrants of fighting with their husbands over laborer jobs. One woman expressed her concern:

> Right now, we cannot depend on and trust each other like we used to do some time ago. We do not share our food and drinks because of these migrants [pointing at the investor's site]. I am even afraid that something will happen to me one day, and no one will try to help. (Interviewee # MK 44)

The household interviews revealed there was no meaningful consultation and involvement of the village in the project negotiation. Approximately 75% of households were unaware the government had given their land to the investor until he arrived with bulldozers to clear the land. Most farmers expressed strong resentment for being coerced and intimidated by the district authorities to harvest their crops and leave the land. When asked during the key informant interview, the district officers stated that they were acting under the central government's authority to support the investor. Some households expressed anger and distrust in the village leadership about the gender imbalance in decision-making on land tenure. The participants in the women's FGD expressed a deep concern for breaking up their families due to outmigration. Some also mentioned that they suffer significant separation distress, seeing their husbands migrate away in search of employment and never return.

Moreover, farming in other villages meant that households had little time to return to their village for assembly meetings, social gatherings, and ceremonies. Additionally, households expressed concern about the influx of migrants to the village, stating that young women regularly encounter sexual harassment, and teenage pregnancy was increasing. A mother of two children said,

> Sometimes when my husband goes in search of a job, I have no option than to leave these children [pointing at Mposi (5-year boy), Haki (4-year boy), and Mwamba (2-year girl] here alone to go to the farm to bring foodstuffs. If not, we will sleep with an empty stomach that day. (Interviewee # MK 51)

Physical capital

A potential benefit of LaSLA is the development of rural infrastructure. Thus, I investigated how LaSLA has shaped farmers' access to irrigation schemes, health facilities, farming inputs, and roads. The results indicate that Mkangawalo and Chita are similar in terms of access to irrigation schemes, health facilities, and livestock raising. However, Mkangawalo households reported a statistically significant decline of 36.79% in access to roads and transportation. Findings regarding irrigation indicated that, although households reported a decrease in access to water, most contract farmers had access to water throughout the year because of the investor's irrigation system that supplied water to their farms. All households agreed that the investor had built a health clinic, making it easier to access health services rather than traveling about 98 km (61 mi) to Ifakara, the district capital.

Again, households agreed that the improvement in their access to farming inputs was because they could easily purchase farming equipment and inputs at a much lower price from the investor. During the study, field observation confirmed the decline in access to roads and transportation in Mkangawalo because of overuse. During the rainy season, the roads to various market centers become flooded and impassable, forcing farmers to leave their high-value perishable crops on the farm to rot. Although the investor has promised to improve the feeder roads linking Mkangawalo to the main road, this has yet to happen. However, the villagers noted that the investor contributed bags of cement and school desks to support the village primary school's construction.

Discussion

The SLA allows for the evaluation of LaSLA's effects on rural livelihoods. It helps us understand how the external environment—both the natural environment and the policy and institutional context—affects household livelihood systems (assets, strategies, and outcomes). After comparing Mkangawalo and Chita, the results reveal that the LaSLA project, overall, degraded Mkangawalo households' livelihoods, making them insecure and vulnerable to poverty. When considering vulnerability, we can acknowledge that LaSLA acted as an external shock and stress that affected Mkangawalo's livelihood assets. The LaSLA project caused principal changes in household assets through displacement, relocation, and reduction in land holdings, facilitated by GoT. This is a typical example of how disabling policies and institutions (i.e., transforming structures and processes) can produce adverse livelihood outcomes for rural households by limiting their access to vital resources. Additionally, displacing people with inadequate or no compensation constitutes a violation of fundamental human rights (Künnemann & Suárez, 2013; Wisborg, 2013). This act goes against Article 10 of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), which states,

> Indigenous peoples shall not be forcibly removed from their lands or territories. No relocation shall take place without the free, prior and informed consent of the indigenous peoples concerned and after agreement on just and fair compensation and, where possible, with the option of return. (United Nations, 2008, p. 6)

Regassa et al. (2019) indicate that the politics of coercive sedentarization legitimizes pastoralist communities' eviction from grazing land to make way for corporate investors in Ethiopia. Similarly, Gironde and Golay (2015) report how government policies and regulations usually favor investors and violate local communities' human rights—the right to access land and water. This literature confirms the study's findings regarding how GoT offers incentives and relaxes investment policies to attract investors. Thus, it is not surprising to find weak monitoring and poor enforcement of safety and health standards on investors' farms in Tanzania. In Mkangawalo, households traveled long distances for water, and the infertility of the relocated land affected their farm outputs. Hajjar et al. (2020) have reported similar results in western Ethiopia. According to Breu et al. (2016), access to water is now recognized as a prerequisite for poverty reduction because it is a crucial production asset. In this line of thinking, Allan (2012) has argued for institutional reforms that shift away from a top-down water management approach to a bottom-up approach in LaSLA deals.

Both government and private organizations institute policies and legislations that affect the financial capital of households. The shocks described above compelled people in the study area to work as laborers for the investor to earn a living. Whereas LaSLA advocates hold an optimistic view of employment opportunities, my findings reveal numerous negative consequences. The LaSLA project shifted households' livelihood strategies, transforming them from being mostly self-sufficient smallholders to being dependent on the investor. Mollett (2016) and Oram (2014) note that it is almost impossible for governments and investors to pursue LaSLA without adversely affecting the local population's market shares, incomes, or jobs. In Mkangawalo, I found that:

(1) the investor paid low wages and locked households into the contract farming scheme via advance payment and compulsory deduction for savings,
(2) the investor failed to purchase the rice the contact farmers produced after reaching an agreement with them, and
(3) the rigidity of the contract farming prevented households from growing other crops to improve their food security and

from engaging in different livelihood strategies (off-farm activities) to diversify their income.

These results show how weak institutions—GoT's lack of monitoring and enforcement of agriculture investment laws—puts households' financial security in investors' hands. Smalley and Corbera (2012) have concluded that investors have used households as cheap labor sources in Kenya's Tana Delta, paying them substantially low wages for long working hours. As in Mkangawalo, meager wages put households on the bottom rung of the rural poverty ladder. On the other hand, in some parts of SSA, research indicates that contract farming plays a crucial role in integrating smallholders into agribusiness chains, increasing their income and local spending (Oya, 2012).

The debate on the potential of LaSLA to improve human and physical capital in developing countries through infrastructure and training is still ongoing. Pesticide poisoning is a particularly prevalent threat in SSA. Costantino (2016) claims that laborers on investors' farms have higher risks of health problems due to chemical exposure and limited recourse to compensation. Like the study's findings, the same story of farmers' exposure to pesticides resulting in Acute Pesticide Poisoning (APP) has been recorded in several villages in the Arusha region of Tanzania (Lekei et al., 2014). In the study area, farmers' lack of knowledge in handling pesticides aggravated these risks. Li (2011) provides examples of cases where investors bring along labor from their home countries, limiting employment opportunities and skill development of the local population. Similarly, Arora and Rada (2017) reveal that increasing labor burdens on women has negatively affected their physical and mental health as well as their farms' productivity.

There is no question that access to certain types of infrastructure tremendously improves livelihood strategies and outcomes. In Mkangawalo, the lack of access to all-weather roads prevented households from transporting their produce to market centers, leaving them to rot on the farm. The investor promised to improve and build roads, but this is yet to materialize. The same story of broken promises is frequently cited in Tanzania and across SSA (Byerlee et al., 2011). The issue of broken promises and investor failure to adhere to the LaSLA contract raises concerns about SSA governments' capacity to negotiate better deals or even to enforce existing agreements.

LaSLA engages governments, investors, and locals and usually influences institutional structures and social processes involving power relations and decision-making. Meaningful involvement of locals in LaSLA negotiation and implementation can prevent adverse livelihood outcomes like forced eviction. In Mkangawalo, the lack of household involvement in the planning and implementation of the LaSLA project led to disputes and disapproval. More importantly, households' lack of formal land titles facilitated the appropriation of their land. Studies indicate that weak land tenure underlies smallholders' displacement in rural Africa (Anseeuw et al., 2012). Again, research shows that local resistance, conflicts, and violence are not exceptions but are rather systemic features of LaSLA deals that lack locals' approval (Gingembre, 2015; Hall et al., 2015). Furthermore, several studies have documented the negative impacts of LaSLA on trust and reciprocity relationships that serve as informal safety nets for the rural poor. Rivera et al. (2019) and Johny et al. (2017) have indicated that the disruption of intravillage social networks negatively affects household income diversification strategies. My findings reveal that the lack of land and employment opportunities prompted Mkangawalo men to leave the village searching for jobs. This outmigration of males broke up families and severely affected households' social capital.

A comment about the potential limitations of this study and future directions for research are in order. First, although the study controlled for demographic effects, personality can influence respondents' perceptions of impact. Second, retrospective data quality is often questionable as it typically suffers from recall bias and lost intra-period variation. Nevertheless, this should be equally true in both the affected and control villages. The study's use of various data sources helps address the inherent weaknesses associated with retrospective data. Third, the study may only be representative of Tanzania and thus not generalizable. However, the findings may be valid beyond the Tanzanian context because the current realities of rural households in Tanzania are everyday experiences across SSA and other parts of the world.

Conclusion

The recent interest in farmlands, especially in SSA, offers an opportunity to shape old debates with new evidence and address some empirical blind spots that researchers have overlooked in the literature. I have described two competing perspectives on LaSLA as a practice: one that considers LaSLA as a development opportunity, and one that considers LaSLA a threat to development. Whereas advocates argue the need for LaSLA to meet development goals, critics view LaSLA as ruthless exploitation of the poor and reminiscent of colonialism in SSA. Given this context, I evaluated the impacts of the Kilombero Plantation Limited project on the livelihoods of Mkangawalo in the Kilombero district of Tanzania.

The analyses yielded several significant results. First, I find that LaSLA acts as an external force that negatively impacted households' livelihood assets. Households in the affected village have suffered losses in various livelihood capital, including access to land, water, forest, pasture, farm income, and training. Second, the policy and institutional context disadvantaged households and further worsened their access to vital resources needed to escape poverty. Third, to compensate for the decline in livelihood assets, households employed different strategies such as leaving the village and searching for employment elsewhere. Fourth, LaSLA negatively affected households' livelihood outcomes, including reduced income, food security, trust, and social networks. In Mkangawalo, displacement, lack of access to different capital assets, low wages, limited employment, lack of compensation, lack of involvement of local people, and the investor's rigid contract farming policies prevented the positive spillovers from LaSLA.

Under the present conditions, the risks outweigh the benefits of LaSLA in Tanzania. LaSLA in the case study area is exacerbating already precarious livelihoods. Nonetheless, there are potential benefits should the Tanzanian government implement LaSLA carefully. In the end, the critical question is how can we address the risks associated with LaSLA projects and promote their potential benefits. LaSLA outcomes are highly variable, context-specific, and dependent on factors that are not always fully explored in research. These conclusions affirm the need for more nuanced, context-specific analyses of LaSLA that consider land tenure security, access to capital, and local involvement in LaSLA processes. This study opens new doors for public policy and investment guidelines for national governments on the critical role of LaSLA in meeting development priorities. Currently, the dominant policy vision for agriculture in SSA is to transition from smallholder to modern LaSLA farms. Future research can investigate how this can happen. I put forward the following policy recommendations for consideration by Tanzania and SSA countries.

(1) **LaSLA Business Model:** Governments should carefully screen and scrutinize LaSLA deals, ensuring that investor business models align with the local population's long-term vision. Rigid contact farming arrangements without regard to livelihood diversification should be discouraged. LaSLA is causing family separation and putting children and teenage girls at risk due to males' outmigration searching for employment. Public policies should strengthen customary land tenure to ensure households' access to land. This also necessitates that policymakers and investors rethink LaSLA and facilitate greater crop diversity within the local economy to improve household food security.

(2) **Environmental and Social Impact Assessments (ESIA):** It is critical to conduct a comprehensive ESIA and monitor whether investors follow investment laws or seek to do the bare minimum. An independent body should approve the ESIA before LaSLA operations begin. Such a body should, for example, consider labor and working conditions, ecosystem conservation, health and safety, resettlement, and compensation (Chiarelli et al., 2021; D'Odorico et al., 2017).

(3) **Principle of Free, Prior, and Informed Consent (FPIC):** Governments should adhere to the normative framework of free, prior, and informed consent (FPIC) recognized in the United Nations' Declaration on the Rights of Indigenous Peoples (UNDRIP) and embedded within the universal right to self-determination. Here, the government should work with local people and build their capacity to negotiate the conditions for implementing and monitoring contract farming.

(4) **Engagement with Communities:** There should be meaningful involvement of locals in LaSLA negotiations to represent their interests adequately. This requires that negotiations be transparent, inclusive, and accessible to all. Doing this will provide local people opportunities (e.g., through open forums) to offer feedback and suggestions throughout the negotiations to address various concerns before a LaSLA project is approved.

(5) **Monitoring and Enforcement of LaSLA Contracts:** NGOs, civil organizations, and governments should hold investors accountable for breaches of human rights, environmental responsibilities, and promises to the local people. This is only possible if there are clearly defined, formal procedures by which governments and locals can hold investors accountable to their obligations.

(6) **Displacement and Compensations:** Governments should explore all feasible alternatives to avoid the arbitrary eviction of locals altogether. Eviction leads to violations of economic, social, civil, and political rights, with particularly harsh consequences for women and children. Where displacement is inevitable, the government should provide adequate compensation to victims and promote other livelihood activities to enable displaced communities to earn an income.

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Resurgence, refusal, and reconciliation in a food movement organization: A case study of Food Secure Canada's 2018 Assembly

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Abstract
Indigenous food systems have been sites of deliberate and sustained disruption in the service of the settler colonial project on Turtle Island. The revitalization of traditional foodways is a powerful and popular means through which Indigenous Peoples are practicing cultural and political resurgence. We are at a crucial moment of societal reckoning reinforced by recent anti-racist uprisings and Indigenous Land Back actions. In this context, food movements have an important role to play in addressing ongoing colonial impacts on Indigenous food systems by supporting Indigenous Food Sovereignty as a way to advance reconciliation

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between settlers and Indigenous Peoples. Since its founding in 2005, Food Secure Canada (FSC) has become a national leader in food movements in Canada and its biennial Assembly is arguably the largest food movement event in the country. Despite its sustained engagement with Indigenous Peoples and significant efforts toward inclusion, its 2018 Assembly saw Indigenous people, Black people, and other people of color expressing important concerns, culminating in a walk-out on the last day. To understand how these events might guide transformative reconciliation in and through food movements, we analyzed 124 post-Assembly qualitative questionnaires, held 10 interviews, and analyzed organizational archives, in addition to conducting participant observation throughout the following year. This research portrays the actions taken at the Assembly to be a refusal of settler structures and processes, and the creation of a caucus space for Indigenous people, Black people, and other people of color as an act of resurgence. Engagement with FSC by a number of those involved with the protests throughout the year that followed, and the resultant commitment to center decolonization in FSC's work, reveal the intimate connection between resurgence and reconciliation. These acts of generative refusal and resurgence are an essential part of efforts toward reconciliation without assimilation, aligned in a shared struggle toward the decolonized futures at the heart of food sovereignty for all.

Keywords

Food Movements, Indigenous Food Sovereignty, Social Movement Organizations, Reconciliation, Resurgence, Refusal, Settler Colonialism, Ethical Space, Organizational Development

Introduction

Food systems are networks of relationships, connecting different peoples to each other and to the land (Whyte, 2017). Because all food systems are inherently land-based[1], they have been powerful sites of interference and disruption in the service of settler colonialism (Leblanc & Burnett, 2017; Matties, 2016; Turner & Spalding, 2018). Food systems build interdependence across communities, and as such, they are also places where both resurgence and reconciliation come to life in practice (Coté, 2016; Delormier et al., 2017; Hoover, 2017; Jäger et al., 2019; Kamal et al., 2015; Levkoe et al., 2019; Martens, 2015; Morrison, 2011). Food activist and scholar of community sustainability, Kyle Whyte (Potawatomi) (2017), describes this property of food as being "hub-like, in the sense of a centripetal force pulling certain people, nonhumans and ecosystems together in ways that promote collective action" (p. 10). His work on Indigenous Food Sovereignty (IFS) movements shows that food systems engage Indigenous peoples and settlers[2] in relationships of interdependence with each other and with the Earth.

The social movements that coalesce around food engage these cross-cultural relationships in support of many social and environmental goals. Food movements bring together a diverse collection of actors, practices, and discourses which food systems scholar, Gail Feenstra (2002), describes as "a collaborative effort to build more locally based, self-reliant food economies—one in which sustainable food production, processing, distribution, and consumption [are] integrated to enhance the economic, environmental, and local health of a particular place" (p. 100). While they have long sought more sustainable ways of relating to the land (Blay-Palmer, 2010; Feenstra, 2002), in the past decade food movements have increasingly begun to address social inequalities reproduced in movements that have been dominated by White, middle-class actors (Garzo Montalvo, 2015; Guthman, 2008; Kepkiewicz & Rotz, 2018; Matties, 2016; Moore & Swisher, 2015; Slocum, 2006).[3] Food movements

[1] We use the term land inclusively to refer to territory, soils, air, waters, and all the life they support.

[2] We use the word "settler" inclusively to refer to all non-Indigenous peoples living on Turtle Island, as proposed by Regan (2010) and developed by Lowman and Barker (2015). In using this term, we do not wish to reproduce a binary that centers whiteness to the exclusion of recent immigrants, Black people and other people of color; rather, we want to highlight that unless these peoples are subscribing to Indigenous laws and protocols, they are citizens of the settler state.

[3] It is to make space for the diverse sites of struggle of those most often excluded from white-dominated food movements that we refer to food movements in the plural.

provide particularly poignant sites for the work of reconciliation for two reasons. Firstly, we believe that the long history of colonial interventions in Indigenous food systems has left a legacy for which settlers must take responsibility. Secondly, food movements' paired goals of working for sustainability on the land and justice between peoples parallels what political scientist James Tully (2018) calls the two interrelated projects of reconciliation: reconciling Indigenous Peoples and settlers to each other and reconciling all peoples to the land.

In this article, we examine how relationships of interdependence between Indigenous Peoples and settlers make food systems a potentially powerful site of transformative reconciliation, despite a long history of colonial interference. As White settlers—a graduate student and food movement activist and two academic researchers, working for food sovereignty, we focus on communities of which we are a part, and to which we ourselves are accountable, focusing on a particular "moment of reckoning" that occurred at Food Secure Canada's 2018 Assembly and the subsequent response elicited. Food Secure Canada (FSC) is an influential national food movement organization in Canada. Although many, if not most, of the 124 Assembly participants who completed the post-Assembly questionnaire (out of about 800 total participants) shared positive experiences of the Assembly, a number of Indigenous people, Black people and other people of color[4] raised significant protest, ranging from the disruption of a prominent public plenary to a walk-out on the final day, followed by two separate letters of concern sent by groups of food movement practitioners (Indigenous people, Black people and people of color).

At FSC's 2018 Assembly, protesters refused what reportedly felt like settler-oriented structures and processes. In this article, we use this particular moment of refusal to gain insight into the challenges, tensions, and disconnects of doing the work of reconciliation. We understand refusal not only as the refusal of colonialism, but as the concomitant generation of a reality which centers the material and spiritual needs of Indigenous communities (A. Simpson, 2014) and, as such, as part of the movement of Indigenous resurgence. By resurgence we broadly refer to practices of Indigenous self-determination and cultural revitalization (Asch et al., 2018; Corntassel, 2012). Our use of reconciliation is in relation to the reconciliation of settlers and Indigenous Peoples, as well as the reconciliation of all people with the land (Asch et al., 2018). Using these understandings, we examine the dynamic tension between resurgence and reconciliation in practice at FSC. We accomplish this by first situating this particular moment in the context of food movements and IFS. We consider the theoretical framework of resurgence (Alfred, 2009; Coulthard, 2014; L. B. Simpson, 2017) and how it is being enacted through the revitalization of Indigenous food systems, as well as the frameworks of reconciliation (Asch et al., 2018; Regan, 2018) and ethical space (Ermine, 2007). To show how this is happening in practice, we share case studies of the few food movement organizations who have, like FSC, attempted to bring reconciliation to and through their work. After establishing this groundwork, we describe recent protests at FSC and their context, as well as FSC's ensuing response. In our discussion, we identify resurgence and its assertion of difference as necessary to create the ethical space needed for reconciliation to be transformative and avoid the pitfalls of assimilation, for which reconciliation frameworks are often critiqued (Alfred, 2009; Ladner, 2018; L. B. Simpson, 2017). Settler colonialism undermines the foodways of Indigenous Peoples, Black people and other people of color, albeit in different ways (Penniman, 2018; Wolfe, 2016), and the protests at FSC's Assembly involved all groups. However, the limited scope of this paper and the distinct histories of and impacts upon each group limit our focus primarily to the concerns of Indigenous Peoples and, as settlers,

[4] Where possible, we use the racial identity used by participants themselves. However, we use the term "people of color" for situations involving people of differing racial identities (who self-identify as being "non-white") to acknowledge a shared experience of racism. In recognition of the prevalence of anti-Black erasure and the separate history of Indigenous Peoples, we specifically name Black people and Indigenous Peoples outside of this term.

our distinct and treaty-bound responsibilities with them.[5]

For this research, we took guidance from the Teioháte Kaswenta, known in English as the Two-Row Wampum, a treaty created in 1613 between representatives of the Dutch government and the Haudenosaunee confederacy (which includes the Kanien'kehá:ka, in whose territory the events analyzed here took place). The Teioháte Kaswenta outlines a relationship of two nations coexisting side by side without interference, but with mutual respect, peace, and friendship (Powless, 2000). Since its creation, this treaty has held enormous cultural, spiritual, and political significance that extends far beyond the Haudenosaunee to represent more broadly the framework for right relationships between settlers and Indigenous Peoples in North America (Hansen & Rossen, 2017; Hill, Sr. & Coleman, 2018). We use the treaty here as a conceptual framework that makes space for both resurgence and reconciliation to coexist.

The protests at FSC's 2018 Assembly illustrate the importance of working toward reconciliation in food movements; they also bring to light the discomfort and fundamental challenges of doing so. Because of FSC's history of sustained, if fraught, engagement with Indigenous Peoples, the events at FSC's 10th Assembly and the response thereafter provide a compelling opportunity to understand the challenges and potential of reconciliation within and through food movements in Canada. The concerns brought forward reveal the intimate connection between resurgence and reconciliation, showing that the refusal of settler processes and structures to make space for resurgence can create the conditions needed for reconciliation as transformation, rather than assimilation. From this perspective, settler-led initiatives may need to make space for Indigenous resurgence not as conflicting with, but as part of the work of reconciliation. The lessons learned apply widely across community organizations, advocacy groups, and social movement spaces as well as public and private institutions working toward reconciliation and decolonization.

Literature Review

Background and Context

Indigenous Peoples around the world have been practicing their own versions of food sovereignty for millennia. They have developed a wide range of hunting, gathering, fishing and cultivation practices that "have shaped, supported and sustained [their] distinct cultures, economies and ecosystems… [and are] based on [their] responsibilities to uphold [their] distinct cultures and relationships to the land and food systems" (Morrison, 2011, p. 97). According to Indigenous Food Sovereignty activist Dawn Morrison (Secwepemc) (2011), there can be no single definition of Indigenous Food Sovereignty (IFS), because it is based on processes specific to each nation:

> Indigenous food sovereignty describes, rather than defines, the present-day strategies that enable and support the ability of Indigenous communities to sustain traditional hunting, fishing, gathering, farming and distribution practices, the way we have done for thousands of years. … In this context, an Indigenous food is one that has been primarily cultivated, taken care of, harvested, prepared, preserved, shared, or traded within the boundaries of our respective territories based on values of interdependency, respect, reciprocity, and responsibility. (pp. 97–98)

This description emphasizes relationships and processes, rather than end products. Through this lens, the devastating impact of the disruption of Indigenous food systems on Indigenous Peoples can be understood: while end products can be substituted, relationships must be nurtured, are specific to place, and are central to nationhood. Kyle Whyte (2017) compares such commodity products as commodity cheese, Spam, and micro-

[5] Numerous Indigenous scholars and activists argue that early treaties between European nations (and later, the Canadian State) and Indigenous Peoples should form the foundation for renewed political relationships, a concept known as "treaty federalism" in Canada (Asch, 2018; Hansen & Rossen, 2017; Ladner & Dick, 2008; Simpson, 2008; Starblanket, 2019; Turner, 2006).

wave meals to traditional foods, such as *Manoomin* (wild rice) and sturgeon for Anishinaabek, and corn for the Diné to emphasize the importance of relationality. He argues that the long relational history of these foods /relatives empowers them to convene these nations for cultural, political, and ecological renewal in a way that other, imported foods such as commodity cheese or microwave meals cannot. He shows that food has value "that extends beyond its taste and nutrient content. For communities with comprehensive practices associated with particular foods, immediate threats to those foods are also threats to the fabric of the communities" (p. 8).

From the earliest settlement on Turtle Island,[6] through to the creation of the Canadian state and its over 175-year history, colonial powers have disrupted Indigenous food systems in support of the settler colonial project. Insisting on the relevance of this history to Indigenous food insecurity today, scholar and self-described "actionist" Joseph Leblanc (Anishinaabe) and historian Kristin Burnett (2017) point to some of the most damning colonial policies. The relocation and forced sedentarization of many communities, often on reserves distanced from their traditional territories, cut off or reduced their access to the lands they had cared for and which had supported them for centuries. The Indian Act of 1876, and its 50 major amendments over the next century banned important traditions central to Indigenous food systems, in particular the potlatch, and other giveaway ceremonies. Turner and Spalding (2018) emphasize that:

> an under-recognized function of the potlatch is its role in regulating resource use, production, and dissemination. In other words, the potlatch embodied a political institution that oversaw and directed people's land use and occupancy, and their proprietorship over lands and resources. (pp. 274–275)

Residential schools, operating from the 1870s through to 1996, sought to restrict the intergenerational transmission of cultural knowledge and practices, including language and foodways, and replace them with Euro-Canadian ways (Tait Neufield, 2020). Although residential schools are now closed, this intergenerational disruption continues, with more Indigenous children currently in the child welfare system than at the height of residential schools (Kassam, 2017). To Leblanc and Burnett's list, we add the explicit policy of Canada's first Prime Minister, John A. Macdonald, to extirpate the buffalo population (Daschuk, 2013). Buffalo were a key food source for many Indigenous Peoples of the Plains and central to their way of life; this policy had the express purpose of 'clearing the plains' of Indigenous Peoples to make space to expand settlement. For more recent forms of colonial disruption, we point to the impacts of large-scale development projects on Indigenous lands and foodways. For example, Thompson and Pritty (2020) document the impacts of hydro development megaprojects on the ability of the O-Pipon-Na-Piwin Cree Nation to practice food sovereignty, and specifically to meet food security needs. Author Lee Maracle (Sto:lo) (2017) highlights how the genocide of missing and murdered Indigenous women, girls, and two-spirit people continues to undermine IFS, as these populations have traditionally been, and continue to be central to food systems. Priscilla Settee (Cree) (2020) expands this list beyond the borders of the Canadian state, arguing that the ongoing disruption to IFS stems from "the larger neoliberal socio-political systems that gave rise to the many free trade agreements that currently dominate and set the terms and conditions for trade, resource extraction, and human rights the world over" (p. 215).

The impacts of these policies and actions weigh heavily on Indigenous Peoples. The recent First Nations Food, Nutrition and Environment Study (2019), conducted as a collaboration between

[6] Turtle Island is a term used to refer to the Indigenous lands currently occupied by the Canadian and American settler states, making reference to Haudenosaunee and Anishinaabe creation stories. Because we are writing in unceded Kanien'kehá:ka territory (part of the Haudenosaunee confederacy), we use the term here with the intent to shift the focus from colonial narratives of erasure to ongoing Indigenous presence and ontologies.

the University of Ottawa, the Université de Montréal, and the Assembly of First Nations, found that a full 48% of Indigenous households were food insecure, compared with only 12% as the Canadian average, with 77% of Indigenous households unable to access as much traditional food as they would like. Indigenous people also suffer from significantly shorter life expectancies and a disproportionate burden of chronic and acute diseases compared with non-Indigenous people in Canada (National Collaborating Centre for Aboriginal Health, 2013). The impacts on spiritual and community well-being as well as Indigenous nationhood have been particularly devastating. As foodways "form the basis for Indigenous individual and community well-being—physical, mental, emotional, and spiritual—as well as Indigenous identities" (p. 94), Leslie Dawson (2020) connects the disruption of Indigenous food systems to social, mental, and spiritual intergenerational trauma. Despite this heavy history of colonial oppression, Indigenous Peoples have maintained their foodways and continue to adapt to changing realities (Beaudin-Reimer, 2020; Morrison, 2011). Indeed, foodways have become a major site of investment in the wider project of Indigenous resurgence (Kamal & Ithinto Mechisowin Program Committee, 2020), a phenomenon we explore further below.

Resurgence, Refusal and Reconciliation in Canada

Resurgence and reconciliation are the two major schools of thought with respect to Indigenous-settler relations in Canada today, describing different pathways to relational futures on shared land (Asch et al., 2018). Over the last two decades, these terms have become popularized, but also criticized in many fields, both in theory and in practice. For some, resurgence requires self-determination outside of settler structures and paradigms and is seen as a form of refusal: refusing the politics of recognition of the settler state (Coulthard, 2014). This refusal allows Indigenous Peoples to turn inward for renewal and revitalization on their own terms instead of responding to settler agendas, structures, and processes (Coulthard, 2014; A. Simpson, 2014; L. B. Simpson, 2017). Political scientist Taiaiake Alfred (Kanien'kehá:ka) is a strong proponent of the return to traditional Indigenous values and governance with a clearly articulated separatist view: "If we are to emerge from this crisis with our nations intact, we must turn away from the values of the mainstream of North American society and begin to act as self-determining Peoples" (2009, p. xii). In her "radical resurgence project," author and activist Leanne Betasamosake Simpson (Anishinaabe) (2017) describes resurgence not only in the negative terms of refusal, but also as being generative in its own right. According to her, refusal can shift energy away from Indigenizing the structures of settler colonialism to instead investing in the place-based values and ontologies of Indigenous nationhood. This rejectionist resurgence thesis may not be accepted by the majority of Indigenous people—Alfred claims that only 5% of Indigenous people embrace it (cited in Poelzer & Coates, 2015, p. 45)—however, it provides an important counterweight to the theories of reconciliation.

While resurgence must self-evidently be led by Indigenous Peoples, reconciliation is primarily a settler responsibility (Antoine et al., 2018; Asch, 2018). The framework of reconciliation has received significant national attention through the Truth and Reconciliation Commission of Canada (TRC). Coming out of the Indian Residential School Settlement Agreement in 2008, the TRC published its final report in 2015, and has defined for many—Indigenous Peoples and settlers alike—what reconciliation should look like in Canada. The TRC defines reconciliation as "coming to terms with the events of the past in a manner that overcomes conflict and establishes a respectful and healthy relationship among people moving forward" (TRC, 2015, vol. 6, p. 3). Paulette Regan (2018), a settler scholar and commissioner for the TRC, describes how the TRC expanded the scope of how it viewed reconciliation beyond the dark history of residential schools to "encompass the whole settler colonial project" (p. 211), as well as "reconciliation with the natural world" (TRC, 2015, vol. 6, p. 13, cited in Regan, 2018).

The framework of reconciliation has been adopted widely by public, private, and community institutions, but the differences in how it is applied have been a source of much contention (Asch et al., 2018; Regan, 2010). Some proponents of resurgence argue that state-centered approaches seeking to reconcile Indigenous Peoples within the settler state are just another face of assimilation and ongoing colonialism, and seek to reconcile Indigenous people to the settler colonial status quo (Coulthard, 2014; Ladner, 2018; A. Simpson, 2014; L. B. Simpson, 2017; Starblanket & Stark, 2018). Others suggest that reconciliation is a continuation of a long history of relationality between settlers and Indigenous Peoples and as such, it is congruent with Indigenous ontologies and practices and not necessarily at odds with resurgent approaches (Asch, 2018; Borrows, 2018; Ladner, 2018; Mills, 2018). Indeed, Native Studies scholar Gina Starblanket (Cree/Saulteaux) and political scientist Heidi Kiiwetinepinesiik Stark (Ojibwe) (2018) insist that reconciliation comes from the "resurgence of relational modes of being" (p. 178). Law scholar Aaron Mills (Anishinaabe) (2018) goes further to say that in their refusal to engage in relationships with settler society, those who espouse the resurgence paradigm can reproduce an ontological settler form: disconnection. In their recent volume, Asch, Borrows, and Tully (2018) argue for a "transformative" reconciliation, "empowered by robust practices of resurgence" (p. 5). They seek to do away with the binary between reconciliation and resurgence to show that resurgence is necessary for reconciliation to be able to meaningfully address the ongoing violence of settler colonialism and change the status quo.

To deepen our understanding of transformative reconciliation, we draw on ethicist Willie Ermine's (Cree) (2007) concept of ethical space as a framework for enabling cross-cultural engagement. Relevant to our discussion is Ermine's insistence that ethical space requires the recognition of difference without one trying to subsume the other. Ethical space, he writes, "is initially conceptualized by the unwavering construction of difference and diversity between human communities. These are the differences that highlight uniqueness because each entity is moulded (*sic*) from a distinct history, knowledge tradition, philosophy, and social and political reality" (p. 194). This insistence on upholding difference explains in part the importance of resurgence for the project of reconciliation: resurgence strengthens nationhood, generating a place of power from which to establish relationships while resisting efforts at assimilation.

Indigenous Resurgence Through Food Systems

Indigenous Peoples are practicing cultural and political resurgence across North America. One key form that this resurgence has taken is the revitalization of Indigenous food systems (Kamal & Ithinto Mechisowin Program Committee, 2020). The popularity of this approach is widespread, manifest in the growth in associated scholarship over the past decade, principally led by Indigenous scholars (see, for example Bagelman, 2018; Coté, 2016; Cyr & Slater, 2019; Delormier et al., 2017; Hoover, 2017; Kamal et al., 2015; Martens, 2015; Rudolph & McLachlan, 2013; Settee & Shukla, 2020). Two studies provide a particularly helpful survey of the field. For her Master's research, food activist Tabitha Martens (Cree-Métis) (2015) describes 24 Indigenous food initiatives in Western Canada. She uses a circle metaphor to describe four elements that she found to be key to IFS: history, connection to the land, relationships, and identity, all of which situate IFS very much in line with Indigenous resurgence. Scholar and food activist Elizabeth Hoover (Kanien'kehá:ka/ Mi'kmaq) (2017) similarly describes 34 IFS projects across the United States, linking resurgence of Indigenous political sovereignty with the revitalization of Indigenous food systems. She cites food activist Winona LaDuke (Anishinaabe) as saying: "you can't say you're sovereign if you can't feed yourself" (p. 62). LaDuke's assertion aligns with L. B. Simpson's (2017) insistence that cultural resurgence is always tied to political resurgence. Simpson argues that the separation of the two is a colonial construct seeking to limit the threat that this resurgence presents to the settler state. She argues that "within Indigenous thought, however, the cultural and the political are joined and inseparable, and they are both generated through place-based practices—practices that require land" (pp. 49–50).

There are many examples of cultural and political resurgence in IFS initiatives. Michelle Daigle (Mushkegowuk Cree) (2019) examines everyday acts of resurgence used by Anishinaabe in Treaty 3 territory (Ontario) to protect and renew their food harvesting grounds, waters, and foodways. She finds that this resurgence centers "Indigenous political and legal orders that, in one way, shape everyday practices of protecting and regenerating Indigenous foodways and, in another way, are simultaneously cultivated through food practices" (p. 2). Charlotte Coté (Nuu-chah-nulth) (2016) describes her people's efforts to develop food policies that actively restore and strengthen their spiritual and cultural bonds with their *ha-huulhi* (ancestral homelands) as forms of decolonization and sustainable self-determination in practice. Aligned with Daigle and Coté's work, Whyte (2017) shows that using food systems as a site for resurgence is common practice among Indigenous communities, describing the revitalization of Indigenous food systems as a strategy of negotiating settler colonial erasure for political, cultural, and ecological renewal. In applying L. B. Simpson's lens to IFS work, these examples show that the revitalization of Indigenous foodways is both cultural and political resurgence in practice.

Reconciliation Through Food Systems

Compared with the rich scholarship on the revitalization of IFS, our literature review found the publications addressing reconciliation between Indigenous Peoples and settlers through food systems to be fairly sparse, generally consisting of case studies co-authored by the settler and Indigenous scholars and practitioners involved. Influential author and activist Dawn Morrison (Secwepemc) (2011) shares her experience developing the Working Group on Indigenous Food Sovereignty in response to the need to create space for Indigenous voices within the largely settler-led B.C. Food Systems Network. Morrison sees food sovereignty as a potential site for reconciliation as it provides a "restorative framework for identifying ways that social and political advocates from the settler communities can work to support IFS in a bottom-up approach" (p. 104). Levkoe, Ray, and McLaughlin (2019) provide another example of the creation of such a 'restorative framework' by sharing their experiences with the creation of the Indigenous Food Circle as separate from, but supported by, the Thunder Bay and Area Food Strategy:

> Considering the ongoing strain on Indigenous-settler relationships in the Thunder Bay area, the Indigenous Food Circle presents a unique opportunity to demonstrate ways that food can be used as a tool for reconciliation and resurgence. The Indigenous Food Circle was built on the idea that Indigenous peoples should have control of their food systems and is rooted in the theory and practice of food sovereignty, emphasizing self-determination and a re-connection to land-based food systems. (p. 11)

A third example of a promising approach to reconciliation through food is found in the Indigenous Foods Knowledges Network (IFKN). This network connects Indigenous communities to researchers across the Arctic and the U.S. Southwest to collaborate on research and community capacity-building related to IFS, basing their approach to working together upon the concept of relational accountability (Jäger et al., 2019). According to Shawn Wilson (Opaskwayak Cree) (2008), relational accountability reflects the centrality of relationships to Indigenous ways of being and knowing, and the responsibility of upholding good relationships based on respect, reciprocity, and responsibility. For the IFKN, relational accountability guides the ways that they gather (placed-based, hosted to the benefit of local Indigenous communities) and the ways that they work together (emphasis on storytelling, Indigenous ways of knowing, and Indigenous languages). Though their work is far from over and consensus on the way forward has not necessarily been reached by all involved, these three examples help give shape to what transformative reconciliation might mean for food movements.

In this context of colonial disruption to Indigenous food systems and its ongoing impacts, as well as the resiliency and revitalization of Indigenous food systems and Indigenous Peoples, we see the importance of transformative reconciliation through food, and by extension, food movements. We also see the challenges inherent to doing this in a good way that this fraught legacy carries forward.

As settler food movement activists and scholars, we turn to our own communities to take on the responsibility to address this colonial context in the present and work to make our movements accountable to Indigenous Peoples as a foundation for reconciliation moving forward.

Methodology and Methods Used

This research emerges from our own positionalities as White settlers working for food sovereignty each in our own ways. Heather has been doing food movement work over the past fourteen years, during which time she has co-founded and co-managed a cooperative vegetable and meat farm, coordinated networks of collective gardens, and co-managed a cooperative farmers market. This research was done as part of her master's thesis at Concordia University. Monica has supported the creation of community-led protected areas in Eeyou Istchee through her research as a strategy to enhance Eeyou (Cree) authority over decisions about development while also fulfilling Cree responsibilities to care for their lands and waters. An ethnobotanist and researcher, Alain has worked to support the revitalization of Indigenous medicines in Cree and Inuit communities, among others.

From these social locations, we follow settler social work scholars Susan Strega and Leslie Brown (2015) in their suggestion for academics to "reverse the gaze," by shifting the focus from Indigenous Peoples themselves to the settler society and movements of which we are a part. Our methodology is based on participatory action research (Adelman, 1997) and informed by Elizabeth Carlson's (2017) work on anticolonial methodologies for use by settlers. We follow Kim Tallbear's (Sisseton Wahpeton Oyate) (2014) call for academics to study the communities in which they are invested and for which they care in a process that she names "studying across." This is very much applicable to food movements for us. We ourselves have struggled to do our work in a good way and have been repeatedly confronted by our own Eurocentric blind spots. It is therefore with appreciation, care, and humility that we offer this uncomfortable and personally invested research.

Within this framework, we established a research agreement with FSC in the fall of 2018. FSC has encouraged this work from its conception and participated with transparency throughout in order to gain a better understanding of the concerns raised and how to move forward. Our research received ethical approval from Concordia University's Office of Research in February 2019, with certification number 30010746. Shortly after establishing the research agreement, the primary author analyzed the 124 responses to the post-Assembly qualitative questionnaires designed by the FSC board of directors (hereafter referred to as the "board") and sent to all registered Assembly participants (794 people in total) in the week following the Assembly. Of the 16 questions in the questionnaire, nine sought to unpack personal experiences and suggestions regarding the Assembly, and seven sought to understand the respondents' identities and background experiences with FSC and food movements. We explain our methods in detail here in order to establish our method of thematic analysis as being trustworthy, that is to say, credible, transferable, dependable, and confirmable, according to Nowell and coauthors' (2017) definition.

Questionnaire responses were anonymized and coded using NVivo software according to a modified grounded theory (Perry & Jensen, 2001) in which we used both deductive codes supplied by the FSC board for its own evaluative purposes and inductive codes generated through the analysis itself. Eleven of the 14 codes used focused on specific themes (*subcodes in parenthesis*): Advocacy, Communication, Convening, Logistics (*Space & Location; Schedule*), Membership, Organizational Governance, Representation, Sessions (*Facilitation, Format, Content*), Sharing, Social, Safety (*Accessibility, Accountability, BIPOC, Decolonization, Gender, Microaggression, Racism, Tokenism*). The remaining three were qualifiers based on the researchers' subjective interpretations—Positive, Negative, and Change—in order to get a broad sense of the strengths and difficulties of the Assembly, as well as where respondents felt change was needed at future Assemblies. This initial analysis was the basis of a report produced for FSC's board, co-authored by the primary author and Joyce Liao (2019), which was shared with all Assembly participants in November of the same year.

To gain depth and a background perspective to Assembly events, we used the initial questionnaire coding, as well as the lead author's participant observation, to guide 10 semistructured interviews with past and present FSC staff, members of FSC's board, and other academic and community partners (whom we will refer to here inclusively as "participants" to protect confidentiality). Interviewees were selected initially based on their involvement with Assembly organizing and the events in question, and then through snowball sampling (Reid et al., 2017) as we were referred to others. Consent forms were shared with interview participants, who were offered full confidentiality (which most participants requested) as well as full ownership of their transcript and its use in accordance with our research ethics protocol. We recorded and transcribed all interviews, then read and sorted the relevant data into five codes and eight subcodes that we established inductively: Organizational accountability (*Stakeholders; Process of accountability*); Relational accountability (*Enacting values; Personal work; Conflict; Consultation*); Policy; Convening (*Leadership; Capacity-building*); Solidarity across movements. We finished with a second reading to ensure consistency in the coding process.

From this process of sorting both the questionnaire responses and interview transcripts into codes, we moved on to a thematic analysis to identify themes and patterns with which to structure our analysis. Guided by Aronson's (1995) description of how themes can be identified from disparate data, we combined and catalogued the data previously sorted into various codes into recurring themes. The lead author's own participation in the Assembly enabled us to begin with several pre-identified themes, but most were established inductively from similar experiences showing up across codes. After themes were identified, we grouped them into what Aronson calls "patterns," which we triangulated to our literature review and by checking back with research participants for feedback. These patterns are the three overarching concepts that structure the analysis we share below: refusal, resurgence, and reconciliation.

In addition to these two sources of data, the lead author conducted participant observation consistent with what Adler and Adler (1994) call an "active-member researcher" at the 2018 Assembly and other public food movement events (22 events from October 2018 through October 2019). Her observations were informed by concomitant analyses through her various involvements as participant, organizer, or volunteer. In addition to public events, participant observation at FSC consisted of three levels: (1) Meetings and discussions with various staff and board members outside of formal interviews; (2) Reading newsletters and other public communications (Facebook, blog posts); and (3) Reading internal notes and summaries of staff and board meetings. We used the observations noted at these events and from these documents to triangulate the questionnaire and interview data and the resultant analyses. In line with our constructivist orientation—that is to say, our understanding that "concepts, models, and schemes [are invented] to make sense of experience" (Schwandt, 2021, p. 38)—we understand the themes as insights generated through our own interactions with research participants, with the partner organization, and with the events themselves. To validate our interpretation of events, we shared drafts of this article with research participants and representatives of the partner organization, and with five participants and five FSC staff and board members contributing to the analysis presented here. The many complex experiences of Indigenous Peoples and settlers working together at FSC cannot be fully described in a study of this scope, although when combined the questionnaires and interviews represent a meaningful proportion of Assembly participants (approximately 15%). Nevertheless, this research points to important if often hidden dynamics to which we draw attention to help guide the unsettling work of transformative reconciliation.

Food Secure Canada

Food Secure Canada is a pan-Canadian alliance of food movement actors and organizations in Canada. Its biennial Assembly convenes producers, community organizers, activists, and industry and governmental representatives, among others, from across the country in the largest food movement event in the country. The groundwork for FSC's creation was laid in 2001 at the Civil Society Input for Food Security in Canada conference hosted by Ryerson University in Toronto, where the need for a national Canadian Food Security Network was identified (Food Secure Canada, 2018a). After hosting its first Assembly in 2004, FSC was officially launched at the 2005 Food Security Assembly with the goal of bringing together "all the very different perspectives of groups working on food issues … to create a coherent food movement in Canada that could strengthen local projects and support a national food policy for a just and sustainable food system" (Kneen, 2011, p. 80). FSC's strategic plan seeks to mobilize and build the capacity of food sovereignty movements in order to engage decision-makers and affect policy at the national level. Throughout its sustained history of engagement with Indigenous Peoples and its significant efforts toward inclusion, tensions around governance, representation, and the sometimes-competing interests of stakeholders, complicated by interpersonal conflicts, have co-existed with productive collaborations in an uneasy balance. These tensions came to the fore at FSC's 10th Assembly in November 2018, forcing the organization to contend with colonialism internal to the organization and to the food movements it convenes.

Results: A Moment of Reckoning at Food Secure Canada

Although FSC is a predominantly settler-run organization, it has prioritized working with Indigenous Peoples from its very beginnings. At its first annual general meeting in 2005 there was consensus to focus on building relationships with Indigenous Peoples (Kneen, 2011). In 2009, an informal circle of Indigenous leaders, thinkers, and activists got together to convene discussions and ceremonies about food sovereignty, often in conjunction with FSC's biennial Assemblies. This circle also served in an informal advisory role to the organization for almost a decade. While this group, known as the Indigenous Circle, was active, FSC provided logistical and occasional financial support. At a 2016 strategic retreat of the circle, some of the circle's leadership made moves to "constitute itself as an independent body, the Indigenous Food Sovereignty Learning Circle, with the aim of moving beyond an advisory role in FSC to an autonomous equal relationship" (Food Secure Canada, n.d.), although we were told by one participant that this was not a decision agreed upon by all present. However, due to a lack of financial resources, divisions within the group related to internal governance, and estranged relationships between some Indigenous leaders and FSC, the circle has been more or less inactive from 2017 until recently.

FSC played an active role in the People's Food Policy Project (PFPP) from 2008 to 2011. The PFPP was a grassroots process—initiated by members of FSC, but remaining independent—to develop a food sovereignty policy for Canada that mobilized approximately 3,500 people across the country (Kneen, 2012). The PFPP emphasized Indigenous partnership through a distinct, parallel process led by the Indigenous Circle. Through this process, the circle contributed the first chapter, on Indigenous Food Sovereignty, in the resulting policy document entitled *Resetting the Table: A People's Food Policy for Canada* (Food Secure Canada, 2015). The PFPP was a positive experience of engagement for several of the Indigenous participants we consulted. FSC subsequently formally adopted the PFPP's proposals in their entirety as its policy platform. During the 2013 visit of the United Nations' Special Rapporteur on the Right to Food, one participant shared their appreciation for FSC's efforts to uplift Indigenous voices. More recently, FSC has focused on improving the representation of Indigenous Peoples in the organization by specifically recruiting Indigenous board members, by hiring Indigenous consultants to curate and increase Indigenous content at its Assemblies, and by forefronting Indigenous concerns in its public communications and articles.

Food Secure Canada's 2018 Assembly

Inclusion and diversity were explicit goals held by both FSC staff and its board for their 2018 Assembly. The Assembly is a major event—arguably the largest food movement event in Canada. The 2018 edition hosted around 800 people, with a total of 127 activities spread over four days of events[7] and

[7] Program available at http://archives.foodsecurecanada.org/2018.resettingthetable.ca

three scheduled blocks where eight to 10 sessions were offered concurrently, grouped into 12 thematic streams. To enable participation from more diverse attendees for whom cost might otherwise have been a barrier, a full 30% of the Assembly budget was reserved for bursaries, with at least 52% of total bursaries going specifically to Indigenous participants. The stream of sessions and events focused on IFS was the largest of the 12 Assembly streams, and the only one for which a specific curator was hired (an Onondaga food activist and scholar). The Assembly also began with a Kairos Blanket exercise, an experiential workshop teaching the history of colonialism in Canada, and Indigenous presenters had an exclusive space reserved for a full day of networking. In addition to these efforts, linguistic diversity was and continues to be a priority for FSC, at least as far as colonial languages go. In fact, 55% of programming at the 2018 Assembly was either bilingual or in French, with the balance offered in English.

In many respects, these efforts were successful, with several participants describing it as the most diverse Assembly to date; seven questionnaire respondents noted appreciatively this diversity. One research participant insisted that it was actually because the efforts toward inclusion and diversity were so successful that longstanding tensions erupted to the surface at this particular Assembly. They told us that though present ubiquitously in food movements, "these tensions don't come up very often because Indigenous people and BIPOC [Black, Indigenous, and people of color] just don't show up because it's not a safe space." (Participant _02). For them, the very fact that these tensions came up is a good sign, showing that FSC's efforts to increase diversity had been effective; so effective, in fact, that it was no longer acceptable to run an Assembly in the same ways as for a mostly White, settler audience.

The post-Assembly questionnaire showed that many respondents had overall positive experiences at the Assembly (52 of 124 respondents). Appreciation was shared for the opportunity to network with others from across the country and to share strategies and hear different perspectives (10 respondents). Many participants (14 respondents) noted that the Assembly helped them understand the impacts of systemic racism in food systems and increased their awareness about Indigenous food issues (10 respondents). Alongside these positive experiences, a significant number of respondents shared experiences of racism, marginalization, and feeling unsafe (23 respondents). Five respondents decried the exhausting and extractive experience of Indigenous people, Black people, and other people of color presenting at the Assembly who felt that they were expected to retell their painful experiences with food and colonization to a mostly White audience. Four respondents commented that there was a siloing of Indigenous concerns and that most panels tended to ignore how their content intersected with colonialism. Five respondents expressed concern that communities were being discussed without the opportunity to represent themselves. One participant denounced the Assembly's refusal to accommodate Indigenous diets through offering entirely vegan meals (chosen by staff in recognition of the environmental impact of meat), causing at least three Indigenous people to source more culturally appropriate foods (i.e. meat) elsewhere.

The ways in which racism and colonialism were present at the Assembly are in no way unique; as two participants pointed out, they were a specific manifestation of systemic patterns present across food movements in their experiences. A member of Meal Exchange's Racialized Student Caucus told us that in their experience, "the tokenizing of BIPOC folks [in food movements], it's a continual thing. I think because it was bigger—I mean it was gathering people on a national scale—that it [tokenism] was painfully obvious to some people, but not a rare occurrence I would say" (Participant_04). Another participant shared a related experience of tokenism and told us that "we deal with this on a daily basis at work. I work for an environmental organization—it's a constant problem. We're still a mostly White organization doing White environmentalism which is based on settler colonialism. I deal with agriculture which is fundamentally about land. This is all over the place" (Participant_07).

The Assembly was a valuable space of learning for settlers in particular; this learning became unsettling—in both the sense of emotional discomfort as well as in the sense of challenging to settler colonization—for some through two significant public protests. In the first, an Indigenous woman interrupted the public plenary on IFS to insist that the long-seated conflict between settler farmers and Indigenous Peoples needed to be addressed before these groups could work together as part of a same movement. While this was a very impactful intervention, it did not represent an approach that all Indigenous Assembly participants supported. Two Indigenous research participants described how much effort went into organizing that plenary in order to hold that very conversation in a way that non-Indigenous Assembly participants could receive. As one told us, "to come out in this call-out framing to say 'You all, how dare you?'… You know, people were already in tears during the panel. We'd already gotten to that space in a more articulate way" (Participant_03).

In the second significant protest, a group of about 15 people—food movement leaders that were Indigenous, Black, and people of color, and their allies—walked out on the final day of the Assembly. After three days' immersion in what protesters described as a white settler-oriented event, these food movement leaders refused to offer their scheduled workshops or talks, they refused to participate in the day's schedule, and they refused to continue to bear the burden of change. Leaving the Assembly in protest, they reconvened elsewhere to create a caucus space to connect to others who shared some of their experiences and build relationships of support with mentors and allies in a way that they felt the Assembly had not enabled.

Marginalization at the Assembly and in the Organization

The creation of this alternate space responded to the sentiment expressed to us by five research participants that despite the diversity of Assembly participants, elements of the event still catered to a White, settler audience. Accordingly, we were told that this spoke to a wider tendency by FSC to marginalize Indigenous people, Black people, and other people of color in their work. One Indigenous participant put it this way: "If they're only going to represent the food movement of upper middle-class White neighborhoods, then just say so. Stop telling people that you're representing people who are hungry in my community" (Participant_01). Another Indigenous participant explained that, in their experience, it seemed that FSC prioritized their relationship with federal officials over them and other Indigenous People and dismissed concerns that they raised. They went on to insist that making space for the concerns of Indigenous Peoples is necessary for the organization: "It's these relations that empower that organization to even come close to saying 'We're the voice for the movement' or 'We're a legitimate community entity'" (Participant_03).

This perceived dismissal of concerns by FSC and the conflicting interests of some of its stakeholders have undermined relations with the Indigenous Circle, contributing to feelings of marginalization. Listing four Indigenous leaders doing food sovereignty work, one participant told us that "all of those relations are strained, from that act of respecting our knowledge base when it was comfortable and then when it was something uncomfortable, seeing it as conflict" (Participant_03). One Indigenous participant told us how this pattern leads them to self-censor and not bring up their concerns: "It's painful and I just have to shut my mouth and not look like an irate Indian" (Participant_05).

In the context of these estranged relationships, although the walk-out during the Assembly's final day was unexpected, it was understandable to every research participant we consulted. For some participants with a long-term involvement in FSC, it was consistent with past dynamics; for some new to FSC, their experiences at the Assembly were enough to explain the need to walk-out. The protests at the Assembly brought these issues up in a way that could not be ignored; the public nature of these protests insisted on a public reckoning. One participant told us that in order to maintain legitimacy as a national food movement organization, FSC needs to contend with the limits of its approach to inclusion and reorient itself to center reconciliation and anti-racism at the heart of all of its work.

Centering Reconciliation

In numerous communications and events since the

Assembly, it appears that FSC is indeed in a process of reorientation. For example, in a letter written to all Assembly participants immediately following the event, FSC's board wrote that 'dismantling systems that perpetuate inequality and discrimination should not be understood as additional work for the food movement; as a Board and organization we recognize that this *is the work"* (Food Secure Canada, 2018b, emphasis in original). It is notable that refusal and resurgence were not named explicitly by any research participants, nor addressed in any events we attended. Reconciliation, on the other hand, was discussed by three participants and named explicitly as a goal at FSC's 2019 annual general assembly.

Getting to this point has been a process that has evolved throughout our research timeframe and is still in evolution. In a second letter, sent to all Assembly participants exactly one year after the first, FSC's board and executive director offered an explicit apology 'for creating an assembly where people felt unheard, hurt, and unsafe' (Food Secure Canada, 2019) and shared some of the work being done to address the issues raised. This work has included meeting individually with many of those who raised concerns and in wider stakeholder meetings to document and unpack issues stemming from the Assembly, and from collaboration with FSC more broadly. This work has also included several board meetings to explore using reconciliation and responsibility to relationships as a guide for all of FSC's work, as outlined by the Indigenous Circle in the People's Food Policy Project (2015). Education at both personal and organizational levels is a key component of the work, and FSC is implementing more dedicated anti-oppression trainings for staff, as well as continuing to learn through readings, discussions, and events.

Structural changes to the organization are also in the works. Board members and staff have insisted that the 2018 Assembly will be the last of its kind, and that going forward the organization will prioritize smaller, more regional meetings, including appropriate gatherings focused on Indigenous concerns. Additionally, these gatherings would seek to provide more space for discussions, rather than the academic panel format that has previously dominated not only FSC Assemblies, but many conferences in the West.[8] There is also a commitment to restructure the organization's governance to center the experiences of, and relationships with, Indigenous Peoples, Black people, and other people of color. FSC has proposed the creation of an Anti-Racist Advisory, subject to available resources, and is supporting the re-emergence of the Indigenous Circle; both initiatives are part of a larger exploration into the possibility of a new cross-cultural governance framework for the organization. Since the 2018 Assembly, FSC has been supporting leaders from Indigenous communities in their efforts to reconvene the circle, bolstered by the renewal of relationships and new connections that the walk-out enabled. In addition to personal engagement with a number of those involved, FSC's support for the circle has included funding to send its Indigenous board members (as well as potentially other members of the circle) to participate in regional IFS gatherings. Two Indige-

[8] In November 2020, after this paper had been submitted for publication, FSC hosted its first major gathering since the 2018 Assembly, which the primary author attended, along with over 1,200 other participants—50% more than in 2018. It was held entirely online and consisted of 19 events spread over five days. According to Gisèle Yasmeen, FSC's current executive director, the gathering had three objectives: (1) Build consciousness and capacity for anti-racist and decolonized approaches in food systems work; (2) strengthen allyship within the food movement; and (3) showcase the work of Indigenous, Black, and racialized food leaders. Although an evaluation by participants and a formal analysis of the event's impacts still needs to be done, the organizational learning and structural and procedural change underway at FSC were evident. Rather than two isolated streams among many in 2018, racial justice and decolonization were central to every event, whether it was the specific topic of discussion or the lens through which food system issues and practices were discussed. Although the gathering events mostly retained a panel-discussion format, opportunities for personal reflection were built into the program, separate spaces were created for Indigenous and Black people to debrief and discuss, and individual therapy sessions were offered to all. A number of those involved with protests in 2018 were present, including one who expressed gratification, saying that although she has worked with FSC for over 15 years, FSC has finally "stepped up" and "did a great job in organizing this gathering in a way that meaningfully centers our experiences." She insisted, however, that there is still more work to do at the organizational level, in particular adhering to the terms of reference for engagement created by the Indigenous Circle in 2016. For this person, FSC could show a path to the rest of society as to how ethical engagement could go.

nous members of the board also supported the circle in convening a formal gathering that was slated for August 2020. The board acknowledges the need to shift power in its governance model and is working to understand what ethical space could look like in this context. Rather than rush to bring in "settler solutions-oriented thinking" (Participant_08), the board is taking the time to restore relationships with the Indigenous Circle in order to seek guidance on how governance could be shared in a good way.

For one Indigenous participant, cogovernance with Indigenous people is the change that will allow FSC to meaningfully translate its talk of reconciliation and decolonization into action. This participant suggested that cogovernance of the organization would be a recognition of and commitment to "the primary relationship that gave birth to the sharing of the land. And that, of course, is the Indigenous-Western relationship" (Participant_06). They told us that the creation of ethical space is needed as a foundation for cogovernance: "If you have two disparate societies, ethical space is the way that you negotiate, that's part of it." This participant went on to insist that "if you're calling yourself a Canadian organization, all governance should be developed with Indigenous Peoples and built to respectfully share those responsibilities of the governance of the organization. ... I call it a polishing of the wampum belt. ... So that's where FSC ultimately has to go."

Discussion

> *People seeking harmony and balance must embrace the process of contention.*
>
> —Taiaiake Alfred (2005, p. 76)

The protests at the 2018 Assembly, and the walkout in particular, were a rejection of settler paradigms and practices in food movements in general and at FSC in particular. Although research participants did not explicitly refer to it in this way, we interpret the Assembly protests as a refusal in the sense described by author Audra Simpson (Kanien'kehá:ka) (2014) as the rejection of the terms of engagement set by colonial authorities. To this we apply Leanne Betasamosake Simpson's (2017) conception of "generative refusal," linking the act of refusing settler paradigms and practices to that of resurgence, although this term was also not used explicitly by research participants. In our interpretation of the Assembly protests, this small but impactful action fits what Daigle (2019) calls the "everyday acts of resurgence" (p. 1). She argues that these day-to-day cultural practices—in the case of the Assembly making space to honor the relationality integral to IFS—renew Indigenous political and legal orders because they are "based on Indigenous ontologies and respectful and reciprocal relationships with the human and non-human world" (p. 2). The cultural space created outside of the Assembly has been connected to Indigenous political resurgence at FSC through the resultant re-invigoration of the Indigenous Circle. From this resurgence, and the position of increased strength it has generated, we see the possibility of reconciliation, which was named explicitly as a goal by staff and board members at FSC and discussed by three research participants. FSC's board has committed to shifting the organization's governance model to create the ethical space needed to work across Indigenous and settler ways of being, doing, and knowing. According to one research participant, cogovernance between the FSC Board and the Indigenous Circle is the practical framework that would create the ethical space in which both of these constitutive groups' histories and practices could co-exist and enrich each other. This appears to be in line with the circle's intention in 2016 to re-establish itself as the Indigenous Food Sovereignty Learning Circle, independent of FSC, in order to move to an "autonomous equal relationship" (Food Secure Canada, n.d.) with the organization.

The refusal at the Assembly, as conflict-laden as it may have felt, did not represent the cutting of ties with the organization. While not all those who raised concerns have maintained a relationship with FSC, many people have continued to engage through phone calls, the exchange of letters, stakeholder meetings, and even as board members. This commitment to engagement with FSC is consistent with the relationality that Morrison (2011) and others have described as integral to IFS, as well as with the basis for transformative reconciliation (Asch et al., 2018). This ongoing engagement demonstrates that despite Mills' (2018) warning that resurgence can reproduce the settler ontology of disconnection, refusal to engage with settler structures *on settlers' terms* can also create space for renewed relationality from a place of Indigenous strength, on terms that make transformative reconciliation a possibility.

As of this writing, almost two years since the 2018 Assembly, FSC is still in the midst of an ongoing journey toward understanding and enacting what reconciliation means for its work in supporting not just IFS, but food sovereignty for all. But perhaps the journey is part of the work. Perhaps, as FSC has suggested, it is itself the work. Indeed, as Hoover (2017) found in her survey of IFS projects in the United States, for Indigenous Peoples, food sovereignty is a process, not an end result. The experiences described here have outlined the importance of care and attention to relationships in attempting to do this work together. As Morrison (2011) has described, at the heart of Indigenous food systems are the values of interdependency, respect, reciprocity, and responsibility—the very same values Wilson (2008) attributes to relational accountability. Starblanket and Stark (2018) maintain that reconciliation depends on this "resurgence of relational modes of being" (p. 178). As described by one of our research participants, upholding these values by being accountable to the many relationships inherent to foodways is a way to uphold our shared treaty responsibilities. In describing this relational accountability as "polishing the wampum belt," he uses symbolism derived from the oldest known treaty (1613) between Europeans (the Dutch) and Indigenous Peoples (the Haudenosaunee confederacy) in North America, the Teioháte Kaswenta (known as the Two-Row Wampum in English). Polishing the wampum belt is another way to describe reconciliation and is a poignant metaphor, particularly for those of us doing food movement work in Haudenosaunee territory. This participant powerfully reminds us of our treaty commitments and gives an example of what honoring these commitments could look like in practice: cogovernance of our organizations and institutions.

Through this examination of the "moment of reckoning" sparked by FSC's 2018 Assembly, and the resulting engagement in the years that followed, we glimpse at what *resurgence and reconciliation,* together, might look like in practice. As Asch, Borrows, and Tully (2018) argue, "robust resurgence infuses reciprocal practices of reconciliation in self-determining, self-sustaining, and inter-generational ways such that 'transformative reconciliation' cannot exist without robust practices of resurgence" (p. 5). We are hopeful that the resurgence through Assembly 2018 events will strengthen the efforts toward reconciliation at FSC, enabling it to avoid the pitfalls of the dominant narrative of reconciliation that Kiera Ladner (Cree) describes as "predominantly a settler project and one that is typically grounded in denial" (Ladner, 2018, p. 246). With Caroline Dick (2008), Ladner has argued that "true reconciliation" must begin with recognition of Indigenous Peoples as partners in Confederation—the process by which early colonies united to form one country in 1867: Canada—and of the fact that this relationship continues to this day. As one research participant insisted, establishing cogovernance with Indigenous food movement leaders at FSC would be a way to recognize this ongoing treaty partnership with Indigenous Peoples, and the work of apology, engagement, learning, and gathering differently will provide the groundwork needed to support this fundamental shift. We support the board's intention to start by rebuilding relationships with Indigenous leaders, allowing for the terms of engagement to be established by Indigenous Peoples themselves.

While the focus of this research has been on the particular relationships and responsibilities of settlers and Indigenous Peoples, important concerns were raised at FSC's Assembly by Black people and other people of color that must also be attended to and which are being addressed in a parallel process at FSC. We extend this analysis elsewhere (Elliott, 2020) by discussing settler colonialism as a root cause of the disproportionate food insecurity experienced by Indigenous Peoples, Black people, other and people of color and examine the particular responsibilities of White settlers in food movements in taking it on. We hope that others will expand the analysis presented here to address the overlaps and differences in experiences of Black people and other people of color in future work. We suggest bringing in the lenses of organizational change and management studies to examine if and how meaningful change takes root at FSC. These perspectives could add a valuable contribution to understanding the longer-term potential of the strategies for change, used by both protesters and the organization, that we have described here.

Conclusion

Food will be what brings the people together.

—Secwepemc Elder Jones Ignace, cited in Morrison (2011)

Revitalization of their foodways is a powerful and popular way that Indigenous Peoples are practicing cultural and political resurgence across North America. As Indigenous Peoples continue to invest in the restoration of their nationhood and relationships to their homelands through the revitalization of their foodways, settlers have the responsibility of reconciling their food systems and movements to the reality of Indigenous sovereignty and self-determination. Revitalizing Indigenous foodways and tending the relationships of interdependency, respect, reciprocity, and responsibility they put forward can be the basis for reconciliation, not just for Indigenous Peoples, but for all inhabitants of North America—Indigenous, settlers, and all of our nonhuman relations as well.

To get there, some will choose resurgence as refusal and invest their energies toward their own nations outside the often-contentious relationships with settler society. This is understandable, and for some, the way to honor and restore the relationships and responsibilities denied by settler colonial structures, as L. B. Simpson (2017), Coulthard (2014), Alfred (2009), and others have suggested. Whether resurgence takes the form of renewed relationality with settler neighbors or takes the form of refusal, settler-led organizations would do well to support it, for as the case of FSC has shown, resurgence may guide reconciliation to ensure that reconciliation can reach its transformative potential. Although reconciliation may be a settler responsibility, as FSC is modeling, settler-led organizations must take the lead from Indigenous Peoples as to defining the terms of engagement. As the differences in approaches exemplified in the disruption to the FSC public plenary demonstrated, there is no consensus on the single best way forward, nor need there be.

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Visitors and values: A qualitative analysis of agritourism operator motivations across the U.S.

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Abstract

Owners of small- and medium-sized farms are increasingly interested in engaging in agritourism and direct sales in order to increase income, provide family employment, and educate the public about agriculture, among other reasons. Prior research on agritourism operator motivations largely focuses on economic goals and benefits, while acknowledging the strong influence of non-economic factors. However, more research is needed to better understand the nuances and breadth of non-economic motivations underlying agritourism operator decisions. In addition, research on U.S. agritourism tends to be at the state level, which raises questions about overall national trends and inter-study comparability. To address these gaps, we analyzed transcripts from semistructured interviews with small- and medium-sized farm owners engaged in agritourism from five states across the U.S. We examined the results through the theoretical lens of Allport's "contact

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hypothesis" in order to further understand how agritourism helps operators meet stated goals. Our results suggest that consistent with previous literature, nonmonetary motivations are high priorities for farmers engaged in agritourism. In particular, motivations related to community engagement/leadership and quality-of-life emerged as forceful and reoccurring themes. We found that although Allport's contact hypothesis holds some important explanatory power for understanding agritourism operators' community-related goals—including reducing prejudice and increasing understanding between farmers and consumers in relation to agriculture—increased inter-group contact also has potential to create new conflicts between farmers and neighbors related to tourism. These findings have important implications for future research as well as for policies and programs aimed at supporting agritourism.

Keywords
Agritourism, Direct-to-Consumer Sales, Farm Tourism, Farmer Goals, Motivations, Qualitative Analysis, Semistructured Interview, Contact Hypothesis

Introduction and Literature Review

As small- and medium-sized farms worldwide struggle to remain viable, many farmers look for alternative revenue sources to sustain their enterprises and support their communities. Agritourism, including direct-to-consumer sales on farms, has a rich history across the globe. Though not formally defined or recognized by policy in the U.S., agritourism is an increasingly popular diversification strategy and a growing income source for many farmers and ranchers (Busby & Rendle, 2000; Schilling et al., 2012; Whitt et al., 2019).

U.S. rural communities have long been moving away from natural resource extraction-based economies to tourism- and service-based economies (Ashley et al., 2007; Laville-Wilson, 2017; Yonk, 2020). Farm communities thus face a range of new or intensifying economic pressures. Many farms have sought to introduce additional revenue streams to their operations via diversification into direct-to-consumer sales, vacation rentals, farm tours, and other forms of agritourism (Kloppenburg et al., 2000). A study found that small farms with an income diversification strategies, on average, report higher household incomes than those without (Khanal & Mishra, 2014). In addition, renewed interest in food systems and local food has provided the opportunity for farmers to invite the general public to their farms, creating both educational and economic value (Chase & Gubinger, 2014; Martinez, 2010). More recent research suggests that agritourism supports local food systems and enhances direct-to-consumer sales not only by directly influencing tourists' purchasing behavior but also by more generally promoting a broader interest in agriculture (Brune et al., 2020).

While increasingly popular, not all farmers are engaging in agritourism. Past research has shown that variation in comfort with risk and uncertainty, family context, styles of farming, management styles, and stewardship priorities all play into decision-making in farm diversification (Darnhofer & Walder, 2013). The most recent agricultural census data reports that agritourism operators are more likely to be women and to be older (U.S. Department of Agriculture, National Agricultural Statistics Service [USDA NASS], 2019). In addition, farms that already process or sell food for human consumption are more likely to participate in agritourism, as are farms and ranches with cattle and horses (Whitt et al., 2019).

Farmers engage in diversification strategies, including agritourism, for a variety of reasons. Much of the existing literature on agritourism operators' motivations focuses primarily on economic benefits (McGehee & Kim, 2004; McGehee et al., 2007; Nickerson et al., 2001; Ollenburg & Buckley, 2007; Schilling et al., 2012). Recent U.S. census data show increasing revenue opportunities from agritourism: from 2012 to 2017, despite a small drop in the number of farms participating in agritourism, the income from agritourism and recreational services increased from US$704 million to US$949 million (USDA NASS, 2019). But past studies also reference other social and personal motives which lead farms to engage in agritourism, from personal interest to goals around consumer education, supporting family members on the farm, and enjoying companionship with visitors. Although these non-economic motivations have received some attention in past research, further study is needed to better understand myriad motivations for engagement in agritourism and how agritourism operators balance competing priorities (McGehee & Kim, 2004; Nickerson et al., 2001). This level of analysis can help to better meet farmer needs, given operators' economic and non-economic motives, through adapting extension programming and also guide further academic investigation into agritourism constraints and opportunities in light of these motives.

In addition, more research is needed to understand why agritourism operators engage in agritourism, in particular, to meet their business and personal goals and how agritourism helps further non-economic farm agendas. As the number of U.S. farmers decreases, consumers are increasingly disconnected from their food and the people who grow it—i.e., the "food from nowhere," a concept coined by farmer-activist José Bové (Bové et al., 2002). The divide between urban and rural community priorities is a well-documented obstacle to rural development, and farmers face conflicts over land use, environmental concerns, and food safety (Sharp & Smith, 2004; Smith, 1969). As Sharp and Smith suggested, "social capital among farmers and nonfarmers at the rural-urban interface is likely to have several benefits for the farmer and the larger community, including increased awareness and appreciation of diverse stakeholder interests and increased trust and confidence that the actions of a community member (such as the farmer) respect the interests of other community members" (2003, p. 926). Indeed, Schilling et al. (2006) reported agritourism operators' interest in improving community relationships and reducing farmer/nonfarmer conflict. In a subsequent paper, they call for further research into the link between agritourism operator motivations and Allport's "contact hypothesis" (1954) for increasing tolerance between majority and minority groups, suggesting that farmers may engage in agritourism in order to preempt or mitigate right-to-farm issues and build positive community relations (Schilling et al., 2012).

This study uses qualitative research methods to respond to the following questions: What are the motivations and goals of agritourism operators across different U.S. states and types of agritourism operations? Do agritourism operators engage in agritourism in order to attempt to decrease conflict and increase cooperation with nonfarmers? In addition to explicitly focusing on non-economic benefits under-studied in previous research, this study also fills a gap a there has been little research on agritourism motivations at a national level, raising questions regarding inter-study comparisons of agritourism in diverse food system contexts across the U.S.

Defining Agritourism

Though it is generally agreed that agritourism in the U.S. was growing steadily until the 2020 COVID-19 pandemic, the word "agritourism" in the U.S. is not formally defined—neither by terminology (other words such as "farm tourism," "agritainment," and "farm-based tourism" are sometimes used instead) nor by activities associated with the term (Philip et al., 2010). The lack of consistent definition, which has been well-documented in the literature, has considerable consequences for operators, visitors, researchers, and policymakers (Arroyo et al., 2013). For example, while most definitions of agritourism set a "working farm" as the primary locus of agritourism activities, there is a broad range of activities that can be considered agritourism, primarily as it relates to the authenticity or legitimacy of a working farm and close connection to agricultural production (Carpio et al., 2008; McGehee, 2007; Ollenburg & Buckley, 2007; Phillip et al., 2010; Tew & Barbieri, 2012). In addition to creating a marketing challenge for producers and confusion among consumers, the lack of a consistent definition of agritourism creates discrepancies among academic studies attempting to quantify and qualify the impact of agritourism activities, hindering the ability of policymakers to prioritize support for agritourism sector development (Arroyo et al., 2013; Chase et al., 2018).

In 2002, the U.S. Department of Agriculture began to include "recreational services" in the National Agriculture Statistics Service's (USDA NASS) Census of Agriculture and since 2007 expanded their terminology to "agri-tourism and recreational services," which includes "income from recreational services such as hunting, fishing, farm or winery tours, hayrides, etc." (USDA NASS, 2019). Though the Census definition of agritourism is more constrained than definitions typically seen in academic literature, it still encompasses the largest and most widely-used data set associated with agritourism in the U.S. and represents a significant step forward in formalizing the term.

Building on previous scholarship, Chase et al. (2018) created a more comprehensive conceptual framework that organizes agritourism activities into core and peripheral activities based on where they take place (on- or off-farm) or the degree to which they are directly related to agricultural activities: "core activities take place on a working farm or ranch and have deep connections to agricultural production," while "peripheral activities lack a deep connection to agricultural production, even though they may take place on a working farm or ranch" (p. 17). For example, core activities might include product sales and experiences such as farmstands, u-pick, farm tours, overnight stays, or farm-to-table meals. Peripheral activities might include off-farm farmers markets, weddings, music events, or outdoor recreation. The framework also organizes activities into five main categories: education, direct sales, entertainment, outdoor recreation, and hospitality. For the purposes of this study, agritourism includes but is not limited to all core and peripheral agritourism activities taking place on-farm, in all categories.

Motivations and Goals for Agritourism Operators

There is a wealth of literature examining motives for diversifying into different types of agritourism offerings across many different locations (recent studies summarized in Table 1). In one of the earliest studies concerning motives for agritourism, Nickerson et al. (2001) examined motives for diversification of Montana ranchers based on eleven categories and clustered them into social reasons, economic reasons, and external influences, concluding that operators were primarily motivated for economic reasons, although social reasons were a strong second. Other studies have since found support for this general conclusion, suggesting that income generation is a primary motivator for agritourism development (Barbieri & Mahoney, 2009; Brelik, 2011; Khanal & Mishra, 2014; McGehee & Kim, 2004; Tew & Barbieri, 2012). In a more recent assessment of the current state of agritourism research in the U.S., Rich et al. (2016) concluded, "Four of the [nine definitions of agritourism used by researchers] incorporated an income component either as a means of income generation and/or as an economic activity. This is worth noting because it is often assumed farmers engage in agritourism endeavors as a means to supplement farm income" (p. 4). Thus, for small farms which feel increasing financial pressure and "struggle to remain economically viable in the face of changing global markets, urbanization pressures, structural changes in the food retailing system, and

Table 1. Recent Literature on Agritourism Operator Motivations and Goals in the U.S.

Study	Date	Methods	Subject Focus	Key Findings
Halim et al.	2020	Mixed qualitative methods	Female agritourism entrepreneurs in North Carolina	Themes constituting women's self-definition of success: being constantly on the move, ensuring customer satisfaction, having family support, creating broad impact, gaining recognition and respect, securing financial sustainability, pursuing happiness, debating work-life balance, and perpetuating the family farm
Chiodo et al.	2019	Case studies	Agritourism operators in mountainous regions in the U.S., Brazil, Italy, and France	Top motivations: creativity & innovativeness, social interaction, awareness about farm operations, support local producers, income generation, autonomy, contribute to the local economy, environmental conservation
Khanal & Mishra	2014	Analysis of NASS census data	U.S. farmers	Income influences diversification strategies among small farms

perpetual vagaries of weather, diseases, and pests," agritourism is a valuable coping strategy (Schilling et al., 2012, p. 200).

Other studies have indicated other motives beyond income, several finding agritourism income to be small in comparison to total farm income, highlighting the importance of nonmonetary goals of agritourism such as personal goals, employment opportunities for family members, social interaction with guests, and educating the public about agriculture (Busby & Rendle, 2000; Schilling et al., 2012; Tew & Barbieri, 2012). Hansson et al. (2013) examined motives for starting ventures outside of conventional agriculture among farmers in Sweden and assessed family farm roles in influencing these motivations. They found operators have two underlying motives: business development to reduce risk and use idle resources, and business development for social and lifestyle reasons, noting that their findings differed from previous studies "both in respect to the number of underlying motives and the nature of these motives" (p. 247). The authors concluded that considering disaggregated motives outside of a broader family or firm context may fail to capture operator goals fully. Diversification, they argued, can be better understood by considering "more overarching motives related to the management and development of the business and the situation of the farmer and his/her family" (p. 248). Ainley and Kline (2014) similarly advocated for more exploratory research methods that "fully appreciate the complex intertwining of multiple factors underlying the phenomenon [of agritourism]" (p. 405). In addition, Telfer (2002) examined agritourism in an Indonesian community using principles of sustainable community development. He found that while agritourism does not always meet the goal of economic self-reliance, it is a powerful tool for community control and building community culture, while others find that agritourism can serve as a tool for farmers to resist urban stereotypes and regain control over their own representation among nonfarmers (Nazariadli et al., 2019).

In addition, the scope of most U.S. agritourism research is limited by geography. While there are several national agritourism studies of Europe, Canada, and South America, very little agritourism data exists on a national or multistate level in the U.S. Rich et al. (2016) note: "While three national surveys exist which provide insight into agritourism or farm visits…the focus of these studies was not agritourism; rather agritourism was a small component. In order for valid comparisons and generalizations to be made agritourism-focused survey data at a national scale is greatly needed" (p. 4). This multistate research project builds on previous research at the state level while also providing much-needed insights into what common themes emerge when considering the multitude of other factors that influence farm decision-making based on geographic region.

A review of the existing literature thus suggests that while quantitative research has been instrumental in creating a blueprint for understanding why U.S. farmers are embracing agritourism, there is an opportunity to probe deeper and "add flesh to the bones of what is currently understood [about agritourism motivations]" (Ainley & Kline, 2014, p. 405) using more interpretive, qualitative methods.

Theoretical Framework

In his 1954 work, *The Nature of Prejudice*, social psychologist Gordon Allport hypothesized that face-to-face encounters between people of different groups would reduce inter-group hostility: "[Prejudice] may be reduced by equal status contact between majority and minority groups in the pursuit of common goals. The effect is greatly enhanced if this contact is sanctioned by institutional supports (i.e., by law, custom, or local atmosphere), and provided it is of a sort that leads to the perception of common interests and common humanity between members of the two groups" (p. 281). Under these four conditions—equal status, institutional support, common goals, and common humanity (or inter-group cooperation)—Allport argued that bringing together majority and minority groups could reduce prejudice and increase inter-group cooperation.

Further study has provided support for Allport's hypothesis. Most notably, Pettigrew and Tropp's 2006 meta-analysis of intergroup contact theory found that inter-group contact typically reduces inter-group prejudice. They also asserted that the theory holds true in addition to racial and ethnic encounters, as originally hypothesized, and can be extended to other groups, including people of different ages, gender identity, sexual orientation, and physical and mental ability.

Pettigrew and Tropp (2006) concluded that Allport's optimal contact conditions typically lead to a greater reduction in prejudice, but are not essential for reducing prejudice. More recent literature has since focused on *when* and *how* contact is most likely to reduce prejudice, as well as the impact of indirect contact, such as extended contact (knowing or observing an in-group contact who has an out-group friend) and imagined contact (Hewstone & Swart, 2011). This research suggests the effects of contact are greatest when contact involves inter-group and interpersonal factors, such as cross-group friendships, and that contact works to reduce prejudice by reducing inter-group anxiety and increasing empathy. Allport and others defined contact as "face-to-face interaction between members of clearly defined groups" (Pettigrew & Tropp, 2006, p. 754). In the context of agritourism, this could include many offerings, such as farm tours, on-farm direct sales, classes, and tastings.

To date, no research has applied Allport's contact hypothesis to the study of farmer motivations, and yet there is reason to suspect that farmers engaging in agritourism might be motivated at least in part by a desire to increase contact in order to improve relations with customers and other nonfarmers. In an early study, Johnston and Bryant (1987) examined farmer adaptation to the changing rural-urban interface and identified three types of farmer adaptations: positive, such as adding an enterprise; neutral, such as adopting agricultural technology; and negative, such as leaving farming. A more recent study by Smith and Sharp (2003) proposes an additional adaptation focused on improving neighborly relations, including building social capital with both local neighbors and more distant farm clientele. Agritourism reflects several of these adaptations simultaneously, as a potential new enterprise that also increases social capital.

Applied Research Methods

Qualitative methodologies were chosen for this study to better capture the nuances, depth, and breadth of producer experiences in agritourism.

Recruitment and Sampling Strategy

The sample used for this study was obtained from a larger selection of farmers and ranchers engaged in agritourism and direct sales. The U.S. project collaborators collected information about the sample subjects from five states: Vermont, Minnesota, California, West Virginia, and Oregon. These states were chosen due to the growing or ongoing interest in agritourism and direct sales by farmers in those states, and based on the expertise of the key informants working in agricultural extension and tourism.

From a list of 80 farmers and ranchers compiled via the criterion sampling method, six were selected from each state using a maximum variation sampling method (Lindlof & Taylor, 2011). This sampling method was chosen because criterion selection yields information-rich data from which researchers can learn deeply about farmer and rancher experiences, while maximum variation sampling ensures that a wide variety of experiences is explored and represented (Lindlof & Taylor, 2011; Polkinghorne, 2005). Farmers and ranchers were organized by geographic location within their state, agritourism and direct sales activities, farm size, number of years in business, agricultural products, race, and gender. Based on the literature on firm characteristics and business performance, geographic region diversity was prioritized for selection, then race and gender, then agritourism and agricultural offerings (Barbieri & Mshenga, 2008).

We used email communication to recruit farmers and ranchers within their assigned state. To participate, a person had to be 18 or older and identify as an agritourism operator. Participants were offered a US$50 incentive for their time and participation. Potential participants were sent three invitations to participate. Recruitment continued for four months until we obtained at least three interviews per sampled state and at least 20 interviews total.

Sample Information

Of the 23 interviewees included in this study, six are operators in Vermont, five in Oregon, five in California, four in Minnesota, and three in West Virginia. The discrepancy in the number of interviewees per state is due to the relative ease or difficulty with recruitment in each state due to time constraints during agricultural growing seasons.

Given our study's focus, all the farms or ranches were classified as small or medium by USDA standards; 57% of farms and ranches were small, and 43% were medium-sized. Sixty percent of the interviewees were women, although the majority of participants operated in a family context. One study that compared diversified farms to agritourism farms reported that diversified farms, in general, had more women principal operators compared to all U.S. farms—33% versus 11% (Barbieri, 2009). However, this was reported before the most recent changes to the agricultural census determining how women are counted as decision-makers on farms and ranches, and therefore most likely underrepresents the number of women farmers in the U.S. (USDA NASS, 2019). Ninety-one percent of interviewees were white, and 9% were Asian. We attempted to interview Black, Latinx, Hispanic, and indigenous American operators; however, we could not do so due to time and sampling constraints. Many different farm products were represented, from diversified livestock to dairy to diversified crops to value-added products.

Interviewee responses were categorized based on the conceptual framework developed by Chase et al. (2018). Eighty-seven percent of farms and ranches offered direct sales, 83% offered education, 48% offered hospitality, 26% offered outdoor recreation, and 87% offered entertainment. All farms and ranches offered at least two agritourism activities, 78% offered more than two activities, and 39% offered four or more agritourism activities. This is consistent with the literature on diversified farms and ranches as a whole, which have been reported to have, on average, 3.8 diversification categories per farm (Barbieri et al., 2008).

Interview Strategy

The interview protocol was co-constructed with project collaborators. The first author prescheduled and conducted semistructured interviews over the phone, which lasted approximately 60-90 minutes. All interviewees were emailed a consent form and the interview protocol to review in advance. The interviews contained 16 open-ended questions (Appendix); semistructured interviews follow a preconceived interview script but also gave the interviewer or interviewee "freedom to digress" to explore emergent themes (Berg & Lune, 2004, p. 61).

Interviews were transcribed verbatim using speechpad.com, an online transcription service, resulting in 500 single-spaced pages. Transcripts were reviewed for accuracy. All farmer and farm names were changed to protect and maintain confidentiality.

Analytics Strategy

Two team members (the first author and a second team member and author) initially conducted a thematic analysis of the first three interviews. These interviews were chosen to capture a diverse set of perspectives. We used constant comparative analysis, a cyclical and continuous method of processing, reducing, and explaining (Lindlof & Taylor, 2011), to identify themes in the data inductively. We used Braun and Clarke's (2006) hallmark thematic analysis method to code themes within and across interviews. The six-step framework includes: (a) familiarizing ourselves with the data by reading transcripts and listening to audio recordings; (b) generating initial codes; (c) searching for themes; (d) reviewing themes; (e) defining and naming themes; and (f) analyzing the resulting coded data (Braun & Clarke, 2006, p. 87).

We used Owen's (1984) criteria of recurrence, repetition, and forcefulness to generate initial codes. Owen defines recurrence as when "at least two parts of a report had the same thread of meaning, even though different wording indicated such a meaning" (p. 275). Repetition refers to the explicit repetition of certain words, not just implicit meaning, and forcefulness refers to "vocal inflection, volume or other dramatic pause which serve to stress and subordinate some utterances from other locutions" (p. 275). Our transcriptions were verbatim and included pauses and other vocal inflections. We coded for recurring, repetitive, and forceful themes within interviews, as well as across interviews.

After coding the first three interviews separately, we met to discuss, refine and collapse codes. Codes were entered into NVIVO software and analyzed for intercoder reliability using a Kappa coefficient. Codes with a Kappa coefficient of less than 80% were reviewed and re-coded until consensus was met. Then the first author coded the rest of the interviews independently, continuing the process by adding new codes where needed, re-coding previous interviews with new codes, and refining codes as the process continued.

Based on the emergent themes, we focused on five specific questions related to decision-making in agritourism and then specifically on one question focused on defining and measuring success in agritourism. The answers to this question served to illuminate participant motivations and goals for agritourism.

Results and Discussion

As expected, based on previous literature, financial goals were a forceful and recurring theme. However, they were closely intertwined with two other types of goals: community-related goals and personal/family goals. These themes were fairly consistent throughout different parts of the country and different types of agritourism operations. (Because of the study design, emergent themes are not necessarily representative but are meant to help inform further study at the national level.) That results echo previous studies suggests that, in the area of motivations and goals, location is not a strong influence. In this section, findings involving general themes of motivation expressed through interviews with agritourism operators are described, then these themes are analyzed through the lens of Allport's conflict hypothesis.

Financial Goals

All participants discussed the importance of financial profit; however, the importance of agritourism enterprise financial solvency varies on a wide spectrum. For some, agritourism is not the main income source for the farm but occupies another vital role. For others, agritourism and direct sales are the sole sources of income. Regardless of an enterprise's overall financial contribution, almost all participants agreed that it was crucial for their enterprises to at least pay for themselves. One farmer from California stated, "I think that measure of success, it can come in different forms, but if somebody is losing money, they're not going to be able to sustain it." Another rancher in Oregon confirmed, "Obviously, money, it has to pay its way. Everything we did in value-added could never threaten the resources base. It had to enhance it." Participants acknowledged that while money was not always the top priority, losing money on a venture is not tenable.

Even among those farmers for whom agritourism is considered very important financially, agritourism decisions do not always match professed goals. For example, one flower farmer in Oregon said, "I think if it's sustainable for us, it's gotta be economically sustainable." She explained how they run a tour train through their fields for people who have difficulty walking:

> And it costs us money to run. But the personal touch for those…you know, it costs them five bucks to ride it and it's a half-hour tour. But it's that personal touch and being able to talk to them; it's not economically sustainable [on its own as an offering]. But I always insist that we keep doing it because of that personal touch, and you know, talking to people.

Thus, for some participants, exceptions are made and financial goals are de-prioritized in favor of other community or family-related goals.

Personal and Family Goals

The second significant thematic category that emerged centered around personal or family goals. For all participants, quality of life is important, which is consistent with past research (Chase et al., 2013). Participants talked about minimizing burnout, spending time with and finding employment for family members, and getting to enjoy what they do. They emphasized making strategic decisions about what enterprises to engage in and trying to enter into partnerships wherever possible to share responsibility. On family farms, minimizing stress and interfamily conflict is important. For some, agritourism facilitates these goals by allowing them to remain on-farm to live and work. A maple sugar-maker in Vermont explained how agritourism allowed him and his wife to homeschool their children: "My wife, she's like 'When my kids were sick I got to take my hand on his forehead, and check on him every hour, and give him a kiss on the forehead. I got to see all that instead of hearing it from daycare.'" A livestock farmer with small children explained how, despite initial challenges, having visitors to a cabin on their farm allows them to remain working on-farm. Their Airbnb felt time-consuming and the farmer was resentful: "But then I keep reminding myself, 'Well, it's either this or find a job off-farm.' So this is my job." For this farmer, remaining on her farm while her children were young facilitated easier management of competing family and economic priorities.

Another theme related to quality of life involves customer interaction and feedback. For many operators, having visitors to their farms breaks up rural isolation and provides positive encouragement. A dairy farmer aid, "You know, you can laugh, but one form of measurement [of success] is the hundreds of Christmas cards that we get here every year." Similarly, a grower in West Virginia explained:

> It's rewarding to just have people come and see the farm. And it is both, of course, fiscally rewarding because they give you money for it, but to see the way they interact and hear positive things that they say about the farm is nice because it just kind of reinvigorates your purpose. It's affirming, and it's an ego boost.

While not all participants live in rural areas, agricultural work often demands long hours without much financial compensation or cultural prestige. For many agritourism operators, feeling appreciated and valued is a considerable benefit of opening their land and businesses to visitors.

Community-Related Goals

A third emergent theme concerns goals focused on education and community leadership. Participants told us that a major way they define success is through their roles as educators. They see themselves as intermediaries between the general public and the "private" world of agriculture. As public figures, they consider themselves advocates for and teachers of their version of agriculture and a direct connection between consumers and food sources. Participants also found that the connection between their farm and consumers differs among generations. A West Virginia farmer explained, "The older population, it brings back memories from their childhood of, you know, doing something with their grandparents. And then you have the younger population or millennials that might not have been familiar with that, but they're really trying to get connected to their food source." A California farmer described how their farm connected with school groups over time: "Success for us was in the return of schools. We have many schools that have been coming for ten years." They worried that the school groups, which were charged a fee, would not have funding to return during an economic downturn. "Most of the schools, they cut all the other field trips, but they kept coming to our farm. So, our school business remained the same…To me, the success is that people found us and came back to us, I think. That makes us feel good."

They also observed a U.S. population increasingly disconnected from its food sources, fewer farmers integrated with the nonfarming community, fewer farmers in general, and increased public concerns about food safety and agricultural practices. A rancher in Oregon told us:

> It's more than profits. It's really important today if you have the attitude to do it, it's really important to open your door to people who aren't in farming and ranching, to help them see the truth about the good work that farmers and ranchers do. You need to school yourself about GMO conversations, predator conversations, pesticide conversations, all the issues that people that don't know about ag, they're frightened by. It's really important that the voice of the ranchers and farmers, real people that do the work, be heard by the majority of people who aren't. We're less than 2% of the population. We don't even count on the census statistics, you know, so how are people gonna know if they don't come out and see you?

This sentiment of visibility also emerged in the theme of community leadership. Participants discussed seeing themselves as community leaders both for the public and for other farmers. They described being models for other farmers in their region and the benefits of building relationships in their community. A diversified vegetable grower in Minnesota told us about the advocacy role that comes with being a public-facing business:

> The path we're taking is very public. It's not like we're hiding in the corner and growing vegetables…which I think is good because you can advocate then for farms and say 'Well, come up.' And you can see how much work it is, and just bring farms and farming to the front of people's minds. Because honestly, there are people in this area that do not believe you can even grow anything up here, which is absurd.

In this leadership capacity, participants find value and meaning in engaging with visitors, and agritourism becomes more than a financial diversification mechanism.

Motivations for Agritourism Engagement in Relation to the Contact Hypothesis

As described above, among community-related goals, agritourism operators emphasized that consumer education is a crucial aspect of agritourism engagement. Interviewees discussed the importance of visitors seeing what they do for myriad reasons, including promoting awareness of the importance of food production, educating consumers on product value (this was particularly emphasized by farmers engaged in alternative agriculture, whose price points tend to be higher, as well as those participating in direct sales), and providing transparency around consumer concerns regarding land management, pesticides, GMOs, and animal welfare. In this respect, the contact hypothesis helps us understand agritourism operator motivations, as they are in many cases engaging in agritourism at least in part to build positive relationships with consumers and their communities.

Nevertheless, in some ways agritourism may exacerbate community conflict related to tourism while reducing community conflict related to farming. Three main challenges expressed by interviewees about their agritourism enterprises were friction with authorities over regulations for hosting visitors, concerns about liability for visitor injury or accidents, and disputes with neighbors over increased local traffic and noise. A dairy farmer in West Virginia advised, "You may even want to talk to your neighbors. Make sure they're OK with hundreds of cars coming past their property onto your property." Increased visibility also comes with the potential for increased public scrutiny. A diversified fruit and vegetable grower in Oregon described the trade-off in this way:

> I guess if a person is into [agritourism], there's the notoriety, you get to be known in the community. There's some drawbacks to that also because it does increase your public profile. . . . All of a sudden instead of, you know, I'm not anonymous anymore, you know, when I'm in my local community. I have to be careful, sometimes I'd better not, you know, have that drink or I better not do this, I better not do that.

Thus, the conflict hypothesis is a valuable framework for understanding why agritourism operators prioritize non-economic goals, and further research is needed to ascertain whether face-to-face interactions between farmers and visitors do actually improve intergroup relationships.

Conclusions

Much of the existing literature on the motivations of producers engaged in agritourism in the U.S. focuses on potential economic benefits, with the underlying assumption that farmers and ranchers in the U.S. are primarily concerned with making money. Our results show that, at first glance, financial considerations are indeed a key motivator for considering diversification into agritourism, consistent with some previous findings. However, when probed deeper, participants suggested that ongoing participation in agritourism provides many other nonfinancial benefits, some of which are equal to or even take priority over financial goals. Through this lens, for many operators an agritourism enterprise's profitability is a necessary but not sufficient condition for engaging in agritourism.

Our findings mirror and build upon the results of work by McGehee and Kim (2004), who reported the top three motivations for agritourism as gaining additional income, fully utilizing resources, and educating the consumer. Our findings are also consistent with Nickerson et al. (2001), who found income and resource utilization as the primary motivators, followed by coping with the variability of agricultural livelihoods. The nonfinancial themes related to running an agritourism business that most clearly emerged from this study centered around community building and engagement, consistent with recent literature on agritourism and motivations (Chiodo et al., 2019; Halim et al., 2020).

Even in the realm of personal goals, many of the goals circled back to some form of community interaction. As Telfer (2002) and Nazariadli et al. (2019) observed, our results suggest that, for our study participants, agritourism provides a level of transparency that allows them to better control the narratives regarding their businesses and allows community members to participate in the agricultural process, thereby gaining further community control. Agritourism also aids in building community culture around food, the natural environment, and cultural heritage. Understanding agritourism operator motivations through the lens of Allport's conflict hypothesis helps build upon these findings. Community building is not only important for its own sake, but also for improving relationships and increasing understanding between majority (nonfarmers) and minority (farmer) groups.

With this framing in mind, our results are broadly applicable and add to a growing body of work that can be used to help agritourism operators succeed. Accurately identifying farmer motivations and goals can help provide better programming and support for producers at the outreach level and more accurately steer the focus of future academic research. Although a recent study suggests that there are areas in which agricultural extension agents are failing to fully meet farmer needs (Ferreira et al., 2020), research shows that when agricultural educators have a greater understanding of the diversity of farmers' perceptions, beliefs, and actions, they are "more likely to succeed in supporting farmers' application of knowledge and skills, resulting in improvements to farming practices and production" (Eckert & Bell, 2005, p. 8). This study sought to better capture the depth and breadth of these farmer motivations, and critically highlights the role of community engagement and leadership of agritourism operators alongside financial viability goals. Thus, for those working to support farms that might benefit from engagement in agritourism, using a broader community development lens or toolkit may more likely engender success for both producers and consumers.

Limitations and Future Research

The time-intensive nature of the interviews necessarily limited the number of responses, so although theoretical saturation was reached, associations cannot be drawn between agritourism operator motivations and other characteristics. Further research would benefit from a larger sampling of agritourism operators from all 50 states in order to draw broader conclusions. Additionally, the scope of this project was focused on small- and medium-sized farms in the U.S., and thus does not represent the whole of U.S. agriculture. While 90% of farms in the U.S. are small, 44% of the value of production comes from large farms, which thus represent a significant, but distinct, category of farm type (Economic Research Service, 2020).

Nevertheless, this study has added nuance to the discussion of farmer motivations for agritourism and has opened up avenues for future research, such as survey-based work informed by these findings and further testing of Allport's theory.

Finally, as emphasized in this study, at a policy level agritourism operator goals—and subsequent benefits—can be conferred from producers to consumers and the community at large. Schilling et al. (2012) emphasize "the economic multiplier effects of agritourism, namely the impact on other local businesses, local employment, and tax revenues" and that "the preservation of rural amenities, as well as historic and cultural values, also contributes to the desirability of a community to potential residents and businesses by creating a sense of place. … Through its contribution to farm retention, agritourism similarly helps communities manage or limit dis-amenities that may be associated with uncontrolled development (e.g., congestion, pollution, loss of scenic viewscapes)" (p. 204). Thus, the success of meeting agritourism operator goals may not only benefit the operators themselves, but also their surrounding communities—making the interaction between producer goals, community goals, and local and regional policy frameworks an important area for further agritourism research.

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Appendix. Interview Protocol

1. Let's start with a little bit of history about your farm or ranch.

2. Our project is focused on 5 categories of agritourism:

    - Direct sales (e.g. on-farm sales, farmers markets, CSA, U-pick, etc.)
    - Education (e.g. classes, workshops, student visitors)
    - Hospitality (e.g. camping, airbnb/bnb, lodging/other rentals, retreats, farm-stay or guest ranch)
    - Outdoor recreation (e.g. hunting, fishing, horseback riding, biking, hiking, skiing)
    - Entertainment (e.g. music, events, weddings).

    Can you tell me about what kinds of visitors you have on your farm or ranch?

3. How has your use of those five categories of agritourism changed over time?

4. What key lessons have you learned about agritourism? When you first started in agritourism, what do you wish you knew then what you knew now?

5. How important is agritourism to your farm or ranch?

6. How do you define and measure "success" in agritourism?

7. In what ways does agritourism bring other benefits?

8. What are the key factors to success in agritourism that you have identified?

9. What are the risks associated with agritourism and how do you have adapted to those risks?

10. What infrastructure or resources are needed for success in agritourism? How does your management change with agritourism use?

11. What external resources contribute to or inhibit success in agritourism?

12. To what extent does agritourism contribute to your quality of life?

13. How does your farm connect with your local community? Tourists and visitors from other places?

14. To what extent are agritourism activities profitable?

15. What advice would you have for farmers or ranchers interested in bringing agritourism to their farm or ranch?

16. What role do you think agritourism plays in 'sustainable development'?

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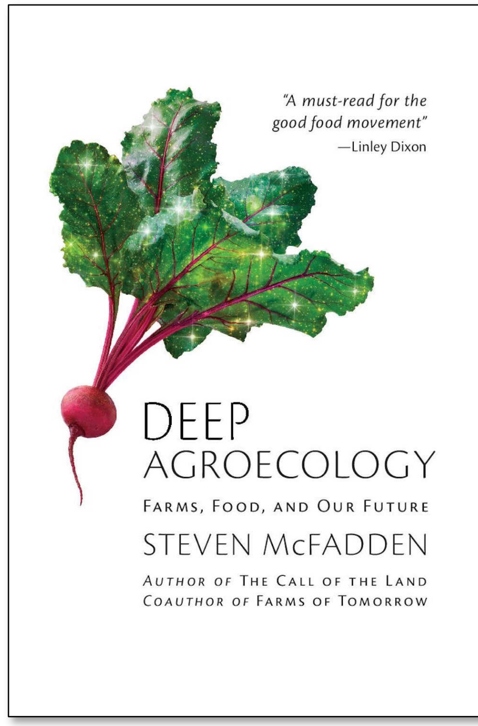
The encyclopedia of agroecology and Indigenous wisdom: Reflections on McFadden's *Deep Agroecology*

Review by Alissa Boochever *
University of Vermont



Review of *Deep Agroecology: Farms, Food, and Our Future,* by Steven McFadden. (2019). Light and Sound Press. Available as paperback and Kindle; 294 pages. Author's website: https://deepagroecology.org/

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Presenting an array of facts and an encyclopedia of ideas, *Deep Agroecology: Food, Farms, and Our Future,* by journalist Steven McFadden, urges the reader to activate their 'spiritual understanding' of agriculture in order to elevate all life on Earth. The author calls for nothing short of a spiritual awakening of all human beings to prevent further deterioration of the planet. As our climate falls into chaos, oceans warm, deserts grow, and the ice poles melt, McFadden argues, infusing and sustaining greater spirituality in farming practices is essential for the food system and farmers, for our culture, and for the health of the planet. McFadden's goal with this book is not just to explore agroecology but to advocate for an additional "realm of critical mystery" (p. xiii) in our conception of farming.

McFadden advances the argument that agricul-

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ture, being necessary for life and the basis for human civilization, also offers an opportunity to make more meaningful personal change by asking how each of us can contribute to a healthy, more spiritually compatible food system. What follows, however, is a laundry list of concepts, what McFadden calls the "right names" (p. 3) with which to explore agroecology—*Anthropocene, climate chaos, second notice, generational threat, damaged food systems, sixth extinction, our strongest lever, oligopoly, corporate colonialism, deaths of despair, ethos, harmony, and sanity*—that leads the reader on a disjointed and patchy exploration of industrial agriculture trends, the agroecological movement, and 'deep agroecology.'

Eclectic and wide-ranging, the ideas introduced in this initial chapter, like every chapter of this unconventional book, are pieces of a puzzle that do not quite fit into a cohesive picture. In fairness, McFadden warns from the outset that his intention with this book is less to explain the concepts underlying deep agroecology than to challenge readers to discern for themselves what is important in his presentation.

Using accessible and at times prophetic prose, McFadden advocates an idealistic, and necessary, paradigm shift toward 'deep agroecology' by incorporating the teachings and knowledge of Indigenous Peoples. In fact, one of the distinguishing features of the book is the reflection of Native American perspectives, customs, and ideologies. The author clearly has had many significant interactions with Native elders and activists across a diversity of tribes, regions, and generations—Joanne Shenandoah (Oneida Nation), Winona LaDuke (Ojibwe Nation), Loraine Canoe (Mohawk), and Barbara Alice Mann (Seneca Nation) to name a few—whom he draws on to communicate the spiritual realization that there is life within everything. Mixed in with this ancient wisdom are scientific concepts and discoveries that make the required paradigm shift toward spirituality more relevant and urgent.

Unfortunately, this is not enough to overcome the overriding lack of organization and ineffective stitching together of information in the book, in addition to glaring omissions. For example, in attempting to mobilize change through a more thoughtful, holistic approach to agriculture, the author neglects to address specific capitalistic, racist, sexist, or classist structures preventing the kind of paradigm shift for which he is advocating. In the chapter "Industrial Farms and Food," exploring Your Choice (p. 30), he writes "each individual holds primary responsibility for his or her own health," (p. 30) which fails to acknowledge that many Americans have no choice but to eat the kinds of highly processed foods linked to illness because of the structural racism and classism that affect their access to nutrition sources and information. There is not much depth of discussion offered in the book at all beyond a narrow recitation of loosely related ideas.

Though well-intentioned, there is also a tendency to romanticize Native cultural teachings without mentioning the violent and less desirable truths affecting Native populations today. McFadden briefly mentions the 150th anniversary of the Morrill Act of 1862 as the premise for a USDA-sponsored panel he attends, but nowhere does he mention the violent history behind that act's dispossession of Indigenous lands and colonization of Indigenous People. He does, however, acknowledge an "epidemic of lifestyle disease" (p. 133) in Indigenous communities that is linked with drug and alcohol abuse and results in a life span five years shorter than the average American, although he provides no context for or explanation of the structural racism and classism that have allowed this phenomenon to occur.

For readers who are already familiar with the urgent need for a radical shift in thinking about agroecology and are looking for guidance on how to accomplish this in the framework of traditional Native wisdom, the nonlinear exploration of key concepts in *Deep Agroecology* will fall well short. At a time of major ecological unrest and the need to reassess life-sustaining systems, including food, this book will expose the reader to some Native teachings and ideas behind regenerative agriculture practices. However, it will be up to the reader to connect the dots and make sense of why some ideas are explored, and others are not. If one is feeling up to the challenge, and interested in an encyclopedia of all things McFadden finds relevant to spiritually intelligent, regenerative agriculture, this could be the book.

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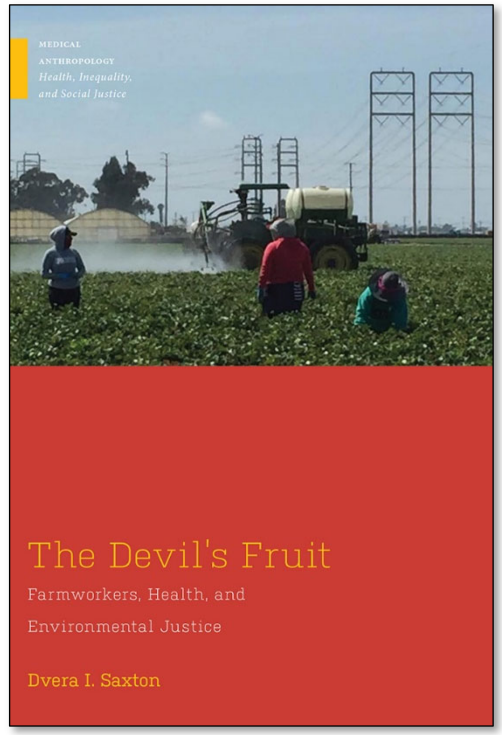
Reimagining solidarity with strawberry farmworkers in the United States



Review by Emily Nink *
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Review of *The Devil's Fruit: Farmworkers, Health and Environmental Justice,* by Dvera I. Saxton. (2021). Rutgers University Press. Available as paperback, hardcover, PDF, and EPUB; 252 pages. Publisher's website: https://www.rutgersuniversitypress.org/the-devils-fruit/9780813598611

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Shortly after finishing Dvera I. Saxton's *The Devil's Fruit: Farmworkers, Health, and Environmental Justice*, I awoke to the rare occurrence of farmworkers making national headlines. H.R. 1603, the Farm Workforce Modernization Act of 2021—providing a path to citizenship for undocumented agricultural workers—had just passed the U.S. House of Representatives (for the second time). Supported by agricultural trade organizations and a small handful of farm labor groups as a compromise measure (Farmworker Justice, 2021), the bill is also opposed by farmworker advocacy groups such as the Food Chain Workers Alliance for its failure to provide stronger protections (Food Chain Workers Alliance, n.d.).

For anyone seeking to understand the division over this legislation and the current-day complexities of both undocumented and resident farmworkers' lived realities, Saxton's book is a wonderful place to start. As a medical anthropologist, Saxton takes an "activist ethnographic" approach

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to her research, meaning that her labors of care and accompaniment were inseparable from her role as a data collector and witness to the struggle of strawberry farmworkers in California's Central Valley region. While accessible to lay readers and academics alike, the book may be especially useful to anthropology students, as Saxton explores, in first-person narrative, both research methods and the challenges of embedding oneself in a community facing multilayered vulnerabilities.

In Chapter 1, Saxton begins with dispelling myths about immigrant and migrant farmworkers in the United States, including the misconceptions that they are replacing Americans in the labor market, that they are accessing and draining nonexistent safety-net benefits, and the racist notion that farmworkers are inherently better suited to physically demanding labor. I was particularly challenged by her explanation of the erosion of labor protections since the breakup of farmworker unions in the early 1980s and the passage of the North American Free Trade Agreement in 1994; we like to imagine American history as a slow march of progress toward justice and equal rights (Rothstein, 2017), so it is difficult to grapple with the reality that farmworker wages are lower today than 30 years ago, with fewer labor protections and a riskier immigration environment.

In Chapter 2, Saxton discusses industrial reliance on toxic pesticides and agricultural labor shortages, relying heavily on the work of scholar Julie Guthman but grounding the analysis in her ethnographic findings. In fact, Saxton wrestles with the particular issues now surrounding the Farm Workforce Modernization Act of 2021, criticizing the idea that activists should engage with agribusiness to address labor shortages when this capitalist framework does not address the issues of mechanization nor externalized environmental and health costs, including chronic occupational injuries, diseases, and stresses (pp. 81–83). Diverging from Guthman, Saxton does not urge environmental justice activists to compromise with agribusiness, based on her observations that they are considerably embedded in farmworker communities and active participants in the visioning and creation of alternative agricultural solutions. She sees these personal relationships and efforts to create alternative futures outside of agribusiness as "tensions and complexities" (p. 82) that justify activists' resistance to aligning with industry in advocating for more labor-intensive, nontoxic farm jobs (e.g., on large organic berry farms).

Chapter 3 walks readers through the "toxic layering" of flawed systems that contribute to pesticide exposure in the strawberry industry, including the shortfalls of the premarket safety and evaluation analyses and the failures of reporting procedures and workers' compensation systems. As a researcher who supports the work of public health programs and policies, I was asking myself throughout Chapters 1–3, "where are the public health people?" My stomach sank as Saxton opened Chapter 4 with a description of a local fair at which community-based organizations and local public health practitioners offered diabetes screenings and used a culturally inappropriate system of "passport stamps" to engage farmworkers—many of whom lack actual passports and have endured risky border crossings—at their tables. Offering diabetes screenings is an example of "secondary prevention" in public health—focusing on preventing a disease from progressing rather than preventing it from happening in the first place—and more concerning in this context, an approach that puts the onus squarely on individual health behaviors rather than social determinants of health. Despite our ongoing efforts in public health to shift our work "upstream" to the root causes of disease and develop culturally relevant engagement strategies, the scene was all too familiar and a grave reminder of the work that remains ahead to transform and strengthen public health systems.

Ecosocial solidarities—such as an alliance between teachers and farmworkers who have parallel occupational exposures—are explored in Chapter 5. According to Saxton, these alliances are vital not just for the small concessions they may wring from agribusiness, but for the important work of imagining and building alternative food systems grounded in environmental justice. A brief section on cross-border organizing discusses solidarity with striking farmworkers in Mexico, but does not fully explore the context of international trade issues at the time of the 2015–2016 strikes (the U.S. was about to join the Trans-Pacific Partnership, which would have eliminated tariffs on strawberries by Japan, Vietnam, and the United States if it had been ratified) (McMinimy, 2016). I wonder what this trade deal might have meant for strawberry farmworkers in both California and Mexico, and how the alternative agreement reached by countries other than the United States has affected working conditions in the industry.

Saxton concludes her book by asking: "How can you apply myth busting, or following and defamiliarizing objects, ideas, policies, or everyday assumptions in your community? What kinds of commitments—emotional, professional and otherwise—are necessary for identifying and reacting to toxic layering and invisible harm where you live and work?" (p. 177). I used these questions as journal prompts and wrote about two of the harmful assumptions baked into the Farm Workforce Modernization Act of 2021: that farmworkers owe a fine of US$1,000 for their existence in this country (a steep barrier for families living in poverty) and that they should be required to continue working in an industry that is toxic to their health for 4 to 8 years before "earning" a path to citizenship. After reading *The Devil's Fruit,* I am re-energized and recommitted to dismantling these assumptions and supporting the leadership of environmental justice and labor groups addressing farmworker health and safety, across their various strategies and compromises made along the way.

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