

Journal of Agriculture, Food Systems, and Community Development

Volume 14, Issue 1
Winter 2024-2025



<https://FoodSystemsJournal.org>
ISSN 2152-0801 (online only)

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



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Journal of Agriculture, Food Systems, and Community Development

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The *Journal of Agriculture, Food Systems, and Community Development*, ISSN 2152-0801 (online only), is published quarterly (Summer, Fall, Winter, Spring) with occasional supplements by the Thomas A. Lyson Center for Civic Agriculture and Food Systems, a project of the Center for Transformative Action (a nonprofit affiliate of Cornell University). Editorial office: 26 Elm Street, Floor 1, Westerly, Rhode Island 02891 USA. Administrative and financial office: Center for Transformative Action, P.O. Box 760, Ithaca, New York 14851 USA. The publisher assumes no responsibility for any statements of fact or opinion expressed in these published papers.



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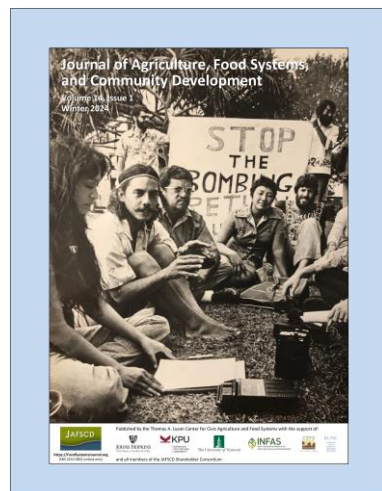
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Permanent link for this entire issue: <https://doi.org/10.5304/jafscd.2025.141.033>

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Photo by Terry Luke that appeared in the Honolulu Star-Bulletin story about the press conference. The original photo was given to Leimomi Apoliona by the photographer and is used with her permission.



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Tribal Food Systems
Research Fellowship



FIRST NATIONS
DEVELOPMENT INSTITUTE

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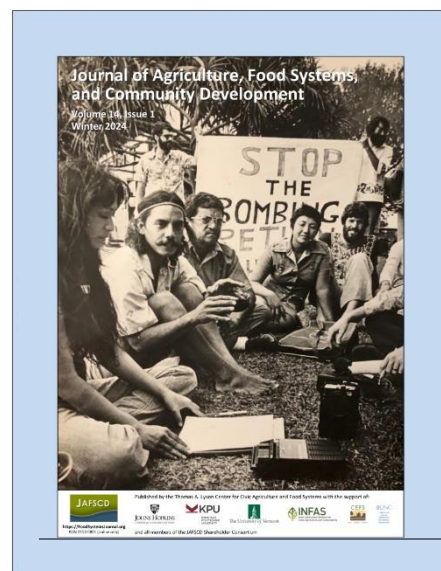
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IN THIS ISSUE
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food systems forefront

Published online January 28, 2025

Citation: Hilchey, D. (2025). In this issue: Indigenous knowledge at the food systems forefront [Editorial]. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 1–4. <https://doi.org/10.5304/jafscd.2025.141.032>

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Welcome to the winter 2024–2025 issue of JAFSCD! On our cover, we share a photo from the article *Hāloa: The long breath of Hawaiian sovereignty, water rights, and Indigenous law*, by Puanani Apoliona-Brown. The historical photo depicts a Protect Kaho‘olawe ‘Ohana (aka PKO or ‘Ohana) press conference at the Bishop Museum in Honolulu, Hawaii, on January 31, 1977. PKO was a small group of Native Hawaiian activists who organized to stop the bombing of a sacred island that the U.S. Navy had used for target practice since World War II. Featured in the foreground are Leimomi Apoliona (at the left) and Dr. Emmett Aluli (at the right). The article’s author, Ms. Apoliona-Brown, is the daughter of Leimomi Apoliona and one of the research fellows whose work is shared in this issue.

We are pleased to feature a special section of articles produced by the Tribal Food Systems Research Fellows of the First Nations Development Institute. These emerging Indigenous scholars include **Danya Carroll, Lynn Mad Plume, Nicole Redvers, Puanani Apoliona-Brown, Daniel Hayden, Amber Hayden, Stafford Rotehrakwas Maracle, Jennifer Tewathahá:kwa Maracle, Stephen Lougheed, and Jasmine Jimerson.**

A thematic analysis of this special collection of papers is provided in our first Indigenous Food Sovereignty column, authored by **Mapuana Antonio, Joseph Brewer, Richard Elm-Hill, Michael Kotutwa**

On our cover: A photo from the article *Hāloa: The long breath of Hawaiian sovereignty, water rights, and Indigenous law*, by Puanani Apoliona-Brown. The historical photo depicts a Protect Kaho‘olawe ‘Ohana (aka PKO or ‘Ohana) press conference at the Bishop Museum in Honolulu, Hawaii, on January 31, 1977. Featured in the foreground are Leimomi Apoliona (left) and Dr. Emmett Aluli (right). The article’s author, Ms. Apoliona-Brown, is the daughter of Leimomi Apoliona and is a Tribal Food Systems Research Fellow with the First Nations Development Institute.

Photo by Terry Luke that appeared in the Honolulu Star-Bulletin story about the press conference. The original photo was given to Leimomi Apoliona by the photographer and is used with her permission.

Johnson, Tabitha Robin, A-Dae Romero-Briones, Lois Stevens, and Keith Williams. We see this column and the first special collection of papers as the beginning of an ongoing effort to solicit and publish the work of Indigenous food system researchers, and we are grateful for the support of First Nations Development Institute to make this happen. A special debt of gratitude goes to **Keith Williams** for his Herculean work serving as associate editor for this special section, including mentoring authors and editing their manuscripts. Keith is very generous with his time and values helping young and emerging Indigenous researchers. We are privileged to have him engaged with JAFSCD!

Our regular content for this issue begins with **John Ikerd's** Economic Pamphleteer column, *Government regulation: Too much or too little*, in which he explores farm scale and government regulation. Next are two commentaries: *Policy implications for nutritional health and food security among transgender and gender-diverse individuals in the United States*, by **Heather Schier** and **Carolyn Gunther**, and *Food recalls: An unnecessary and preventable factor of food waste*, by **Rubén Morawicki**.

These are followed by two policy and practice briefs: *Sustainable agriculture impacts in urban settings make the case for federal investments*, by **Hagan Capnerhurst, Hannah Quigley**, and **Jason Hawes**, and *Racial equity and the USDA's Office of Urban Agriculture granting program and urban offices*, by **Kristin Reynolds, Cédric Gottfried**, and **Tamarra Thomas**.

Our open call papers cover the gamut of food system issues. We start with a group of papers focused on value chains. In our first value-chain paper, **Caroline Krejci, Amy Marusak, Anuj Mittal, Narjes Sadeghiamirshahidi**, and **Sue Beckwith** explore the formation of regional transportation cooperatives and the development of information and communication technology infrastructure to help facilitate collaboration in *Transportation barriers in local and regional food supply chains*.

Next, **'Erali' Tracie Miller, Kathleen Schroeder, Bhuwan Thapa**, and **Elizabeth Shay** identify eight specific challenges to the value chains that could link food producers to early childhood programs in *Barriers to access to local produce in an early childhood setting in rural Appalachia*.

In *Exploring barriers and facilitators to direct-to-retail sales channels: Farmers' perspectives on wholesaling produce to small food retailers in Charles County, Maryland*, **Audrey Thomas, Emma Lewis, Lisa Poirier, Stacey Williamson, Yutong Xie, Alexis Lightner**, and **Joel Gittelsohn** highlight the scale and logistical challenges of linking local farmers to small grocers. They conclude that the mobile app they piloted, Baltimore Urban food Distribution (BUD), that facilitates value-chain relationships, may prove feasible.

Next, **Micaela F. Lipman, Domonique Griffin, Erik Woyciesjes, Gabriella Hall**, and **Samina Raja** draw on community coalition action theory (CCAT) to explore the critical need for addressing underlying structural racism, in *Equitable food value chains through collaborative action [in an inequitable landscape]: Insights from Buffalo, New York*.

In *U.S. farmers market attendance and experiences: Descriptive results from a national survey* **Laura Witzling, Bret Shaw**, and **Darlene Wolnik** explore consumer motivations and challenges in attending farmers markets and discover the top challenge for farmers markets is that consumers simply forget to regularly patronize them.

In our final value-chain paper, **Zeynal Topalcengiz, Sujata Sirsat, Jennifer Acuff**, and **Kristen Gibson** identified various barriers to implementing farmers market food safety standards and practices in their scoping review entitled *Farmers market food safety: A comprehensive review of training needs in the U.S.*

Next, we offer several papers on community gardens. In *Garden access and barriers for low-income community members*, **Cherish Duerst, Robert Williams, Jose Lopez**, and **Douglas LaVergne** identify the challenges food pantry users face in growing their own food and find that there are public policies and actions by local government that could make it easier.

Similarly, in *Growing together or growing apart? A study of food donation community garden programming during the COVID-19 pandemic*, **Moses Timbiti Wanyakha, Nancy Grudens-Schuck**, and **Ann Oberhauser** find that not only did the pandemic impact the flow of food, but government restrictions that impacted critical volunteer engagement compounded the challenges.

Supporting new gardeners: Perspectives of gardeners and garden leaders, **Alyssa Beavers, Rebekah Ray, Kristin Lacy, Eva Coringrato, Ashby Lavelle Sachs, Za'Nyia Kelly, Hannah Buchenau, Erin Decker, Lara Wirtz Fahnstock, Pallas Quist, James Hébert, Jill Litt, and Katherine Alaimo** identify the gulf between the needs of new gardeners and the bandwidth of garden managers to support them.

Next, we have several papers drilling down into community food security and food system planning. In *Empowering local food security: A systematic review of community grain banks*, **Vaishali Sharma** concludes that community grain banks (largely found in the Global South) not only offer immediate relief during food shortages but also empower women, stabilize farmers' income, reduce debt burdens, foster social trust, and enhance community resilience.

Joshua Gruver, Kimberly Lee, and Emily Hayes then present the struggle Virgin Islanders are experiencing in adapting to the challenges of climate change, politics, and a difficult economic climate in *Food insecurity in paradise: An exploration of food system resilience in the U.S. Virgin Islands*.

In *Formative assessment of community health center Food is Medicine programs during COVID-19 in Northern California*, **Cristina Moraga Franco, Edye Kuype, and Reina Engle-Stone** explore the barriers and facilitators of Food is Medicine (FIM) programs during the pandemic and identify options for improving the same.

Lailà Lokosang, Leonard Kirui, Joyce Maru, Joseph Karugia, Sirak Bahta, and Dolapo Enahoro found a lack of coherence in responding to the pandemic and call for immediate reformulation of national strategies across multicountry regions in *Research brief: Analysis of policy responses to seed, fertilizer, food and fuel shocks in three African Regional Economic Communities*.

In *Setting the table for rural food access: Models from Appalachia and the Deep South*, **Abigail Darwin, Nicole Nunoo, Jung Sun Lee, Abigail Borron, and Jennifer Jo Thompson** identify four program archetypal models being implemented in the region: the charity model, support model, restructure model, and market model, each with unique opportunities and challenges.

Tianzhu Liu next explores the differences in small local and larger regional agrifood initiatives and find critical strengths and weaknesses of each in *What scale for local food system planning? Insights from French case studies*.

In their reflective essay entitled *Regional food system sustainability: Using team science to develop an indicator-based assessment framework*, **Serge Wiltshire, Brian Beckage, Chris Callahan, Lisa Chase, David Conner, Heather Darby, Jane Kolodinsky, Jana Kraft, Deborah Neher, Walter Poleman, Taylor Ricketts, Daniel Tobin, Eric von Wettberg, and Meredith Niles** proffer a new approach to assessing the sustainability of food systems.

In *Experiences from a land-based learning project focused on local food interventions*, **Abbey Palmer, Phil Warsaw, Aaron McKim, R. Bud McKendree, Maezie Nettleton, Tiffany Marzolino, and Haley Brasier** find that delivering farm-to-school content within a land-based learning framework allows for greater flexibility in the construction of the program, along with additional educational benefits not commonly discussed in the farm-to-school literature.

Next, **Tanu Altomare and Colleen Payton** present a case example of a student-led food waste project in *A research brief describing a logic model framework for planning a Food Recovery Network chapter at an undergraduate university*.

And in our only nonfood content paper, entitled *First-year hemp farmers' motives and resources to cultivate hemp*, **Blake Colclaus, Jason Caldwell, Tyler Granberry, Christine Rost, and Bailey Gasseling** conducted interviews with a sample of growers to explore their motivations and sources of information and to identify the need to develop more effective hemp training programs.

In our single book review, **Anna Marchessault** reviews *Agroecology and Regenerative Agriculture: Sustainable Solutions for Hunger, Poverty and Climate Change*, by Vandana Shiva.

We would like to recognize **Matthew Hoffman**, JAFSCD Associate Editor for book reviews, for his management starting in March 2020 of JAFSCD book reviews—a surprisingly complicated process! He also provides valuable guidance and feedback to book review authors to make the reviews informative to our readers.

In wrapping up, let me reiterate JAFSCD's commitment to empowering new and young Indigenous scholars. We are very proud to now place a special emphasis on Indigenous food sovereignty and look to these researchers to provide leadership in finding ways our food systems can contribute to a more resilient world. JAFSCD endeavors to be a leading publishing vehicle for this critical new and yet time-tested knowledge.



Yours in regeneration,

A handwritten signature in dark ink that reads "Duncan Hilchey".

Duncan Hilchey

Publisher and editor-in-chief

INDIGENOUS FOOD SOVEREIGNTY: PATHWAYS FOR NATIVE SCHOLARS

Tribal Food Systems
Research Fellowship

Revitalizing Indigenous food systems through research and knowledge-sharing



FIRST NATIONS
DEVELOPMENT INSTITUTE

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Published online January 28, 2025

Citation: Antonio, M. C. K., Brewer, J. P., II, Elm-Hill, R., Johnson, M. K., Robin, T., Romero-Briones, A-D., Stevens, L., & Williams, K. (2025). Revitalizing Indigenous food systems through research and knowledge-sharing [Column]. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 5–10. <https://doi.org/10.5304/jafscd.2025.141.031>

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Introduction

This inaugural column by the Indigenous Food Sovereignty Editorial Circle (IFSEC) in the *Journal of Agriculture, Food Systems, and Community Development* (JAFSCD) introduces a dedicated section of articles on Indigenous food sovereignty in partnership with First Nations Development Institute (FNDI). The column and the IFSEC reflect both our mission to work toward a more equitable and just food system, and JAFSCD's long-standing commitment to Indigenous food sovereignty, illustrated by the 2019 special issue¹ on "Indigenous Food Sovereignty of North America." An Indigenous-led editorial circle as part of JAFSCD, IFSEC uplifts Indigenous values and community food system aspirations in academic publishing. As an intro-

duction to the IFSEC, this column will briefly outline the centrality of food, place, and learning in Indigenous lifeways, the main differences between Indigenous and Western approaches to the food system, and some thoughts on the role of Indigenous ways of knowing and being for the collective flourishing of humanity and all our relations, human and otherwise. The cycle of themes, along with other emergent topics related to Indigenous food systems, will thread throughout future columns. The current geographic focus includes the continental United States, Hawai'i, and Canada. The geographic scope is determined by the territorial affiliations of IFSEC members and may broaden to include other nations and regions over time.

¹ See the special issue, JAFSCD volume 9, supplement 2, at <https://doi.org/10.5304/jafscd.2019.09B.024>

Food, Education, Territory, and Indigenous Ways of Life

Indigenous food systems in the territories presently known as the United States and Canada have been, and continue to be, drastically impacted by the leg-
islated erosion of Indigenous cultural practices, the imposition of European gender roles, loss of lan-
guage, and restricted access to traditional hunting, gathering, and agricultural sites (Daigle, 2017; Reader & Dew Johnson, 2017). This has resulted in significant food insecurity and a decline in nutri-
tional health among many Indigenous communi-
ties, contributing to higher rates of diet-related dis-
eases such as diabetes and heart disease. The emer-
gence of Indigenous food sovereignty is crucial for contributing to the overall wellness of Indigenous communities, improving food security, and revitalizing cultural practices.

The contemporary Indigenous food sov-
ereignty movement—a resurgence of traditional food systems knowledge and practices—serves to coun-
ter the ongoing state-sanctioned biopolitical manip-
ulation of Indigenous Peoples through various instruments of surveillance and control (Monaghan, 2013; Rotz & Kepkiewicz, 2018). For instance, almost one thousand Indigenous youth, interred in Canadian residential schools from 1942 to 1952, were purposely malnourished as unknow-
ing participants in state-sanctioned nutritional research (Mosby, 2013). The establishment of both the reserve system (in Canada), and the reservation system (in the United States), as well as residential schools in both Canada and the U.S., had a devas-

tating impact on Indigenous food systems through the assimilationist agenda of the education system (Partridge, 2010) and the isolationist agenda of the reserve/reservation system (Barman et al., 2011). IFSEC's support of Indigenous food systems ap-
plied scholarship is one of many sites of resistance to the ongoing colonial project on Turtle Island and beyond.

Until recently, in many parts of North Amer-
ica, Indigenous foodways were thought to be almost exclusively based on the migratory hunting and gathering of wild foods (Deur & Turner, 2005). Research over the past two decades has demonstrated that Indigenous peoples throughout North America practiced a form of agriculture that was so unrecognizable to Western eyes that it took anthropologists hundreds of years to identify (Anderson, 2006; Deur & Turner, 2005). Traditional Indigenous agriculture on Canada's west coast and boreal regions included such techniques as nutrient management via fire and organic amendments, pruning of berry bushes, plant breed-
ing, and others (Deur, 2005; McDonald, 2005; Turner et al., 2013). Of course, many Indigenous nations, especially in southern Canada and south of the arbitrary border separating present-day Canada from the U.S., grew the Three Sisters: corn, beans, and squash (Cornelius, 1998). Contrary to long-held beliefs, contemporary research has shown that Indigenous peoples across North America devel-
oped diverse and sophisticated agricultural systems.

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Still, there is need to challenge and re-evaluate Eurocentric narratives about Indigenous knowledge and practices to demonstrate how those colonial views are still impacting Indigenous communities. Indigenous agriculture did not necessarily manifest as rectilinear plots, there were no fences, and the crops managed were not familiar to the European settlers (Anderson, 2006). Yet pre-contact North America was a managed landscape. The unwillingness of early explorers and settlers to acknowledge the presence of Indigenous agriculture, or their inability to perceive it, led to the convenient declaration of North America as *terra nullius* (unused or empty land) (Culhane, 1998). The Catholic Church's Doctrine of Discovery decreed that any *terra nullius* discovered that was uninhabited by Christians could be taken and its occupants subjugated (Reid, 2010). While it is an ancient piece of legislation, *terra nullius* was cited by U.S. Supreme Court Justice Ruth Bader Ginsberg in 2005, in a ruling against tribal sovereignty for the Oneida Indian Nation (Pieratos et al., 2021). By denying the restoration of sovereignty to repurchased lands, the ruling reinforced a colonial framework that systematically invalidates Indigenous sovereignty and perpetuates the theft of Native lands, and prioritizing settler governance over tribal authority. Contemporary industrial food systems, and the laws and economic structures that prop them up, are the latest iteration of the harmful imposition of food systems—associated colonial relationships with both place and the myriad beings that co-inhabit place with us. The grassroots resurgence of Indigenous foodways both “talks back to empire” (Ashcroft et al., 2003) and more importantly creates a container, or basket, for collective healing.

Healing from the trauma of colonization necessitates a profound understanding of the interconnectedness between Indigenous thought, territory, and the ongoing struggle for decolonization. Osage scholar Robert Warrior (1999) provocatively suggests that Indigenous thought is fundamentally based on *topos* (place or territory), whereas Western paradigms are founded on *logos* (reason). The centrality of territory to Indigenous thought is also emphasized by Joe Sheridan and Kanyen'keha:ka thinker Dan Longboat (2006), who specify that human thought is not an abstract concept but

rather emerges from, and is inextricably connected to, place. Tuck and Yang (2012) famously asserted that “decolonization is not a metaphor” (p. 3). Colonization is fundamentally predicated on the unlawful appropriation of land, and in that way, decolonization must include redress and reparation for the Indigenous territories that were unlawfully taken. It is clear that decolonizing our minds, our social institutions, and our relationships with each other and with the more-than-human—including those beings we call food—must start with territory.

A Network of Support: The Tribal Food Systems Research Fellowship

First Nations Development Institute (FNDI) aims to uplift and sustain the lifeways and economies of Native communities through advocacy, financial support, and knowledge sharing. Established in 1980 as a national Native-led nonprofit organization, FNDI recognizes that responses to and resolutions for Native issues must emerge from Native communities and their worldview rather than being imposed by the Western world. In *On the Matter of Foundation Giving: Examining the Inequity of Private Philanthropy's Investment In Native Communities*, they report that Native people and organizations have been driving change in the philanthropic sector for years. Advocacy takes many forms, from research to standing up and fighting for Native voices and perspectives in philanthropic spaces. Still, the overall share of philanthropic resources supporting Native organizations and causes is less than 1% (First Nations Development Institute, 2024, p. 13). In other words, only a small portion of philanthropy funding reaches Native communities directly, and an even smaller share is dedicated to academic research, illustrating the urgent need to strengthen support for Native-led scholarship.

The Native Agriculture and Food Systems Investment (NAFSI) program at FNDI exists to honor Native food sovereignty and food security and empower tribal food economies and the living relationship between community, place, and food. In 2022, FNDI received a US\$1,700,000 grant from the W. K. Kellogg Foundation to support the NAFSI program. One of the key objectives of the grant was to launch the Tribal Food Systems

Research Fellowship (TFSRF) and increase the amount of Native-led published research. The initiative entrusts Native scholars to contextualize their theories, ways of knowing and understanding, and datasets in critical areas such as community food systems, the socio-cultural importance of food, and intergenerational food relationships. By making this research accessible, the fellowship provides Tribes and Native communities with valuable resources to advance their work in food sovereignty.

The TFSRF embodies a commitment to diverse representation with intergenerational and intertribal knowledge sharing, a vision brought to life through its distinguished recipients, including Puanani Apoliona-Brown, who is Native Hawaiian; Danya Carroll, representing the White Mountain Apache Tribe and the Navajo Nation; Andrew Curley from the Navajo Nation; Becca Dower from the Turtle Mountain Band of Chippewa Indians; Elsie Dubray from the Cheyenne River Sioux Tribe, Mandan, and Hidatsa; Daniel Hayden, who is of the Comanche Nation of Oklahoma, Pawnee, and Muscogee; Heidi Ilima Ho-Lastimosa, who is Native Hawaiian; Jasmine Jimerson, who is from the Oneida Nation; Stafford Maracle from the Tyendinaga Mohawks of the Bay of Quinte; and Jill Falcon Ramaker from the Turtle Mountain Band of Chippewa Indians. Each fellow received a US\$30,000 fellowship award to support their efforts as Native scholars, balancing their academic pursuits with meaningful contributions to their work and communities.

Native students report they felt visible when in a dedicated space or engaged in community and academic activities with other Native students (American Indian College Fund, 2019). Native advisors—Anita Frederick, Turtle Mountain Band of Chippewa Indians, president of the Tribal Nations Research Group; Devon Mihesuah, Choctaw and Chickasaw, professor in the Humanities Program at the University of Kansas; and Keith Williams, who has ancestry from Tyendinaga, a Mohawk community in Canada, assistant professor in the Faculty of Humanities at Athabasca University—provided invaluable perspectives and networked support for the fellows. John Phillips, chief of staff at the American Indian Higher Education

Consortium, evaluated the project. Throughout the program, this team explored technical topics, such as selecting manuscript types, organizing information, and developing synopses, and specific subjects relevant to Native scholars, including the Tribal review process, the significance of Indigenous voices in higher education, and navigating the challenges of student and professional life. Gatekeepers are concerned about their jobs, promotions, profit, and power. Most scholars are concerned about those things, but the major difference between the groups is that Native and non-Native scholars fighting the status quo are concerned about the welfare of tribes, empowerment for Indigenous Peoples, inclusive stories of the past and present, and overturning the colonial structure, including the gatekeepers (Mihesuah & Wilson, 2004, p. 33).

Building deeper relationships with one another was a focus during many of the sessions with fellows and advisors. In our Native writers' calls, we asked, "Why do I write?" Puanani Apoliona-Brown shared, "I write because the current path that mistreats land and people is unsustainable. Indigenous values, which teach us that land is our ancestor and our 'Ohana, are restorative. 'Āina is 'that which feeds.' This means we must care for the earth. The fate of land and people is intrinsically tied, and so I write to amplify the brilliance of my ancestors, to share what is at stake, and to raise consciousness about harm that is too often invisible."

The JAFSCD Indigenous Food Sovereignty Editorial Circle special section features the work of five TFSRF scholars. In *Food access interventions in American Indian and Alaska Native communities: A scoping review*, **Dayna Carroll, Lynn Mad Plume, and Nicole Redvers** examine community food access through the Social Ecological Model (SEM), identifying key social and environmental factors to guide future interventions in Native communities. Similarly, in *Hāloa: The long breath of Hawaiian sovereignty, water rights, and Indigenous law*, **Puanani Apoliona-Brown** explores efforts led by Native Hawaiians to protect sacred lands and waters as acts of resistance to settler colonialism, emphasizing the role of the Hawaiian Renaissance in reclaiming cultural pride and rights. In *A framework to guide future farming research with Indigenous communities*,

Daniel Hayden and **Amber Hayden** advocate for a collaborative research framework that integrates Indigenous farming principles such as polycultures, seedkeeping, and sustainability while respecting Indigenous knowledge systems. In *Understanding Indigenous knowledge of conservation and stewardship before implementing co-production with Western methodologies in resource management: A focus on fisheries and aquatic ecosystems*, **Stafford Rotehrakwas Maracle**, **Jennifer Tewathahá:kwa Maracle**, and **Stephen C. Lougheed** stress the importance of recognizing Indigenous knowledge as a distinct framework for enhancing conservation efforts, particularly in fisheries and aquatic ecosystems. Finally, in *Restoring an Onkwehonwehnéba ecosystem*, **Jasmine R. Jimerson** reflects on the work of the Akwesasne Freedom School to create a community that fosters sustainable living through the integration of Haudenosaunee language, culture, and traditional practices, offering a model for strengthening connections to land, food, and overall well-being.

Together, these studies emphasize the indispensable role of Indigenous knowledge in food systems in academia. A common yet significant theme that emerged was the instinctive incorporation of personal experience into scholarly work. Native scholars demonstrate that they are not detached from their research; rather, their personal, ancestral, and non-human connections are legitimate parts of their academic contributions. As interest in academic research related to Native food

systems increases, studies conducted by non-Native scholars and funded by non-Native organizations and institutions are likely to be limited to mainstream understandings. To ensure that Indigenous wisdom, philosophies, and scholarship are fully recognized as equal and valid in an academic worldview heavily built on the framework of Western science, we must not only support Native intellectuals but also work to reconstruct the systems that allow Native experiences and the natural world to have a voice.

Conclusion

The Indigenous Food Sovereignty Editorial Circle exists to empower Indigenous People in the food systems applied research sphere, with a special emphasis on academic publishing. We will continue to collaborate with partners like First Nations Development Institute and the Tribal Food Systems Research Fellowship to realize our vision. The published work of IFSEC supports Indigenous communities working to revitalize Indigenous food systems and their associated language and cultural knowledge. Under the wing of JAFSCD, this critical work exemplifies structural approaches to decolonization of the food systems that have, for far too long, contributed to the colonial erasure of Indigenous Peoples. We call on Native scholars interested in pursuing this path to contribute their perspective to shape our future through an Indigenous lens.



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Food access interventions in American Indian and Alaska Native communities: A scoping review

Tribal Food Systems
Research Fellowship



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Submitted March 5, 2024 / Revised May 10 and May 29, 2024 / Accepted May 30, 2024 /
Published online January 28, 2025

Citation: Carroll, D., Mad Plume, L., & Redvers, N. (2025). Food access interventions in American Indian and Alaska Native communities: A scoping review. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 11–28. <https://doi.org/10.5304/jafscd.2025.141.020>

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Abstract

American Indian and Alaska Native (AI/AN) communities in the United States represent culturally

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rich food landscapes and traditions. Yet, food access in AI/AN communities remains a public health issue. Food access is influenced by a myriad of factors that may interact at different levels of the social ecological model (SEM). Using a scoping review methodology, we aimed to map the existing Indigenous community food access literature in the U.S. to the SEM to identify common SEM impact

Author Note

This paper was part of a dissertation portfolio for Danya Carroll (2023).

Conflict of Interest Statement

The authors declare no competing interests.

Funding Disclosure

This article was made possible with research funding from the First Nations Development Institute through the inaugural Tribal Food Systems Research Fellowship.

Author Contributions

Conceptualization, D.C., and N.R.; Methodology, D.C., and N.R.; Investigation, D.C., L.M.P., and N.R.; Data Curation, D.C.; Writing – Original Draft Preparation, D.C.; Writing – Review and Editing, D.C., L.M.P., and N.R. All authors have read and approved the manuscript.

levels that food access interventions are targeting. We further reflected on AI/AN community food access intervention gaps to inform future intervention targets. A systematic search strategy was developed and carried out in the following electronic databases with search dates from 1988 to 2023: PubMed, CINAHL, SocIndex, Academic Search Premier, ERIC, and Google Scholar. We then carried out deductive content analysis through the lens of the SEM using qualitative software. Intervention targets were identified based on what changes were highlighted in articles at each SEM level. Fourteen articles met the inclusion criteria for the review. Interventions targeted the ‘intrapersonal’ and ‘community’ SEM levels the most, while the ‘institutional’ and ‘public policy’ levels were the least targeted. Food access was promoted in various intervention formats, including supporting community and/or school gardens; providing seeds; providing traditional foods at school, family, and community events; and providing meals to families. Our review found that valuable research has been conducted on AI/AN food access interventions with many interventions targeting multiple levels of the SEM. Our review highlights the importance of leveraging strengths in AI/AN communities to enhance food access, including through culturally aligned programs and traditional foods. Further collaboration between AI/AN communities and researchers may lead to the development of more informed multi-level interventions that further integrate Indigenous methodological and culturally based approaches to improving food access.

Keywords

food access, food insecurity, interventions, social ecological model, SEM, American Indian, Alaska Native, food sovereignty, Indigenous Peoples, scoping review

Introduction

American Indian and Alaska Native (AI/AN) communities in the U.S. represent culturally rich food landscapes and traditions. Yet food access in AI/AN communities remains a public health issue. Food insecurity is a social determinant of health (Blue Bird Jernigan et al., 2017) with higher social determinant burden a known reality in AI/AN

communities (Nikolaus et al., 2022). AI/AN households are therefore at higher risk of food insecurity (Blue Bird Jernigan et al., 2017; Nikolaus et al., 2022; Stotz et al., 2022), as demonstrated by over seventy percent of American Indian (AI) individuals living more than a mile from a grocery store (Kaufman et al., 2014). Food insecurity is associated with a plethora of chronic health conditions, including diabetes, heart disease, cancer, and many other diseases (Blue Bird Jernigan et al., 2017). Factors contributing to AI/AN food insecurity include water insecurity, land loss, forced relocation, and environmental pollution—with all these noted factors impacting traditional food practices in Tribal communities (Stotz et al., 2022).

Historical and current public policies stemming from colonization have influenced food access throughout AI/AN communities (Coté, 2016). Colonization, including the forced removal from traditional homelands, forced cultural assimilation, and urbanization have contributed to Indigenous health disparities and inequities (Blue Bird Jernigan et al., 2020) and the prevalence of historical trauma (Coté, 2016). Diet-related diseases such as diabetes and hypertension that have a higher prevalence in AI/AN communities are also directly related to the ability to access healthy food (Coté, 2016). AI/AN food access itself is further impacted by barriers, including distance to food vendors and high cost (Chodur et al., 2016); however, food access does vary between rural and urban AI/AN populations. Tribal reservation areas, for example, often have much fewer healthy food vendors, including grocery stores and produce markets (Chodur et al., 2016). Regardless, food insecurity affects AI/ANs residing in both rural and urban areas. Seventy percent of AI/ANs reside or live near urban areas (National Council on Urban Indian Health [NCUIH], n.d.), yet the food insecurity challenges facing urban AI/AN populations are lacking in the literature (Stotz et al., 2022). Factors affecting food access for urban AI/ANs that have been identified include socioeconomic barriers, lack of transportation, and a need for more food access programs to improve the resources available for healthy food (Stotz et al., 2022).

Food access is influenced by a myriad of factors that may interact at different impact levels.

Individual health behaviors, for example, are affected by the interdependence and interaction between multiple levels of influence across the social and physical environment (Stotz et al., 2022). Given this, understanding food access from a holistic perspective may give better insights into formulating more effective intervention points. It is currently unclear, however, whether interventions conducted across AI/AN communities targeting food access have been addressing one or more levels of influence. Ecological models such as the Social Ecological Model (SEM) recognize that identifying different types of social and environmental influences is key to developing appropriate interventions. The SEM developed by McLeroy et al. (1988) has become the standard for public health and health promotion as it employs a comprehensive approach to addressing health behavior. The SEM levels include intrapersonal factors, interpersonal processes and primary groups, institutional factors, community factors, and public policy (McLeroy et al., 1988). Examining food access in AI/AN communities through the SEM may provide greater insights into current areas of impact.

There is evidence that some food interventions carried out in AI/AN communities have targeted different levels of the SEM (Ahmed et al., 2020; Kapayou et al., 2023; Morshed et al., 2016). For example, the CHILE (Child Health Initiative for Lifelong Eating and Exercise) randomized control trial intervention that was carried out with AI and Hispanic children attending Head Starts in rural New Mexico (Morshed et al., 2016). The CHILE study specifically aimed to increase healthy food access and nutrition at the family, institutional, and community levels. In another community-based program, a multidisciplinary team developed a community science approach to develop a collaborative research agenda with four Mid-western AI Tribes (Kapayou et al., 2023). The project aimed to promote community-level capacity to increase the growing of culturally important foods such as the Three Sisters through intercropping and soil health (Kapayou et al., 2023). The Eat Fresh intervention was conducted on the Flathead Reservation in Montana, and it aimed to improve food access through weekly fruit and vegetable boxes and in-person education sessions that targeted individuals

and families (Ahmed et al., 2020).

The SEM may be one avenue to explore food access interventions in AI/AN communities as it opens up the ability to identify various levels of influence while being able to assess for intervention gaps present in current food access programs (Sallis et al., 2008). Identifying the most targeted levels within the SEM as it pertains to AI/AN food access interventions may be critical to better understand how communities are formulating impact. Progress has been made in working to address food access issues through programming, resources, and interventions in Tribal communities; however, gaps still exist. Therefore, there is a need to better understand the existing food access interventions in AI/AN communities to help inform future efforts. Although there are established food access programs anecdotally in many AI/AN communities, there is a lack of clarity on how such programs are implemented, what levels of impact they may be targeting, and the types of interventions that have been commonly employed for food access. Given this, a scoping review methodology was engaged to gain a better understanding of the food access landscape in AI/AN communities through the lens of the SEM. The objectives for this research were to:

1. Map the existing Indigenous community food access literature to the SEM to identify common SEM impact levels that food access interventions are targeting, and
2. Reflect on AI/AN community food access intervention and SEM impact gaps to inform future intervention targets.

Positionality

There is substantial need for more acknowledgement and recognition of Indigenous knowledge systems and methodologies that include the platforming and highlighting of the positionality of those writing by, with, for, or about Indigenous Peoples (Lock et al., 2022; Roach & McMillan, 2022). Therefore, the authors of this review position themselves as Indigenous scholars committed to working to improve the health outcomes of Indigenous Peoples and communities. The first author (DC) is from the Diné and White Mountain

Apache Tribal Nations in the U.S. The second author (LMP) is a member of the Aamskapi Pikuni (Blackfeet Nation) in the U.S., and the senior author (NR) is an Indigenous health scholar and a member of the Deninu K'ue First Nation from Denendeh in northern Canada.

Methods

The framework outlined by Arksey and O'Malley (2005) was engaged for this scoping review, and the scoping review protocol was registered on the Open Science Framework (OSF) (Carroll & Redvers, 2022). We chose a scoping review format specifically due to its strengths in being able to scope the existing literature landscape on the given issue including the identification of key gaps. Additionally, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) reporting guidelines were followed for this review as it provides standardized guidance (e.g. a checklist) and enhances reporting quality (Tricco et al., 2018).

Search and Sampling Strategy

A systematic search strategy was co-developed with a research and education librarian from the University of North Dakota School of Medicine and Health Sciences. The following electronic databases were searched for relevant articles: PubMed, CINAHL, SocIndex, Academic Search Premier, and ERIC. Google Scholar was additionally searched through a review of two pages at a time until there were two pages with nothing of relevance found. Manual searches were conducted in the International Journal of Indigenous Health; the Journal of Agriculture, Food Systems, and Community Development; the Journal of Indigenous Wellbeing; Te Mauri-Pimatisiwin; and the UNM Native Health Database (see Table A1 in the Appendix for example search terms). Search terms were used that encompassed varying concepts in relation to food insecurity as well as interventions with AI/AN Peoples (see Appendix). All articles identified in the search strategy were exported into the Covidence (Covidence software, 2023) review software to facilitate the article screening process. Reference lists of key articles were additionally reviewed for relevant articles of interest.

Inclusion Criteria and Article Selection Process

Articles were included in the review if they were peer-reviewed English language articles with a research intervention design (i.e., quantitative, qualitative, mixed methods), rather than theory-based articles, that described interventions where participants were >50% AI/AN. Since the SEM was introduced as a key model in 1988, we included articles published from 1988 onwards. We included articles with intervention studies that aimed to address food access within AI/AN communities, and that additionally provided participants with any type of food (e.g., cultural/traditional foods, fruits, vegetables, seeds) as a result of their participation in the intervention.

A two-stage process was implemented to determine article inclusion. First, the titles and abstracts of 100% of the articles identified through the search strategy were screened by two reviewers (DC, LMP) and any discrepancies were resolved by discussion with a third reviewer (NR). One reviewer then screened 100% of the full text articles identified in the first stage of the article selection process (DC), with a second reviewer screening 25% of the full-text articles to ensure consistency (LMP). A third reviewer was brought in to resolve any discrepancies by discussion (NR).

Data Extraction and Analysis

One reviewer completed 100% of the data extraction from the included full text articles (DC), with a second reviewer cross checking a random sample of 10% of the articles (LMP). Data charting was completed in Excel 365 and included the following elements: general article information (citation, year); level(s) of SEM targeted; evidence of SEM level(s) targeted; type of food access; rural or urban setting (if known); geographic location; specific AI/AN Tribe (if specified); total number of participants, including number of AI/AN; type of intervention design; source of funding; intervention aims and outcomes; and whether the article was open access. See the supplemental file to this article for full details.

The overarching methodology outlined by Golden and Earp (2012) guided our data analysis to identify intervention activities and their specific targets for change within the SEM. An *a priori* cod-

ing system was developed that was intended to capture intervention activities and outcomes, targets for change, program settings, and any theoretical bases mentioned in the included articles (Golden & Earp, 2012). Intervention targets were identified based on what changes were highlighted in articles at each SEM level (see Table 1). Two reviewers developed and pre-trialed the coding system to ensure consistency (DC, NR). We then carried out deductive content analysis through the method described by Kyngäs and Kaakinen (2019) through the lens of the SEM. One reviewer coded 100% of the data (DC) within NVivo 14, with a second reviewer performing regular coding audits to ensure agreement within the data analysis process (NR).

Results

A total of 395 articles were screened for this scoping review with fourteen articles meeting the inclusion criteria for further analysis (see Figure 1). Twelve of the studies were published after 2016, indicating that most of the food access literature in AI/AN communities has been carried out within the last seven years. Authorship overlap was noted in four of the fourteen included studies (Haslam et al., 2023; Ornelas et al., 2021; Ornelas et al., 2017; Taniguchi et al., 2022), with additional noted overlap in funding sources between studies with nine being federally funded. Many of the studies occur-

red in the Southwest region of the U.S. ($n = 5$), with studies also occurring in the Northern Plains region ($n = 3$), Alaska ($n = 2$), the Pacific Northwest ($n = 2$), and in Oklahoma ($n = 2$).

Five of the studies recruited from two or more Tribes, including the Traditional Foods Program study (DeBruyn et al., 2020) that was carried out with seventeen unique Tribal partners. All studies were carried out in rural areas, while two studies additionally included urban areas in addition to being rurally focused (Davis et al., 2003; DeBruyn et al., 2020). Six of the studies utilized a mixed methods design that included both quantitative and qualitative data collection processes; another six of the studies utilized quantitative methods; and the remaining two studies used a qualitative method design. The number of participants greatly varied among the studies, with study sample sizes ranging from 12 in the Yéego Gardening intervention (Ornelas et al., 2017) to 1,704 in the Pathways study (Davis et al., 2003). Surveys and focus groups were the most used data collection methods used across the 14 studies. See Table 2 for the full data characterization of the included studies.

Type of Food Access and Key Findings from the Interventions

The type of food access interventions varied across the included studies. Food access was promoted in the studies through various means, including sup-

Table 1. Social Ecological Model (SEM) Intervention Categories and Targets for Change

	Intrapersonal	Interpersonal	Institutional	Community	Public Policy
<i>What are the targets for change among AI/AN interventions across SEM levels?</i>	- Eating behaviors - Traditional foods consumption - Attitudes toward traditional foods - Self-efficacy for eating fruits and vegetables and growing food - Knowledge on gardening, food preparation, and nutrition - Perceptions of traditional foods - Goal setting	- Knowledge on food choices, cooking, and preservation - Role modeling healthy food behaviors - Gardening capabilities - Increasing cultural identity - Self-monitoring behaviors	- Fostering food access and healthy meals - Promoting positive organizational attitudes toward traditional foods - Organizational capability to promote food access and/or gardening	- Enhancing social norms around gardening and traditional foods - Increasing knowledge on food plants - Positive perception of community change - Increased collective efficacy for gardening/farming	- Addressing barriers to gardening and food access - Increased community engagement and knowledge on policy - Tribal support for policy change that supports food access

porting community and/or school gardens; providing seeds; providing traditional foods at school, family, and community events; and providing meals to families. Food was directly provided to children in schools, as well as to families through early childhood education programs in some studies (Davis et al., 2003; Mattingly & Andresen, 2016; Taniguchi et al., 2022). Vouchers were also prescribed to participants to access fresh and frozen produce as well as traditional foods in the Produce Prescription programs (Budd Nugent et al., 2022).

Food access interventions were found to have varied impacts, including increasing traditional food intake, increasing capacity for gardening and/or farming, as well as overall increases in access to food (Armstrong, 2000; Bersamin et al., 2019; Cueva et al., 2020; DeBruyn et al., 2020; Ornelas et al., 2017). Increased access to fresher and healthier foods through vouchers and educational sessions were also found to be important in some of the studies (Budd Nugent et al., 2022; Haslam et al., 2023; Mylant et al., 2021, 2021;

Figure 1. Adapted PRISMA Diagram

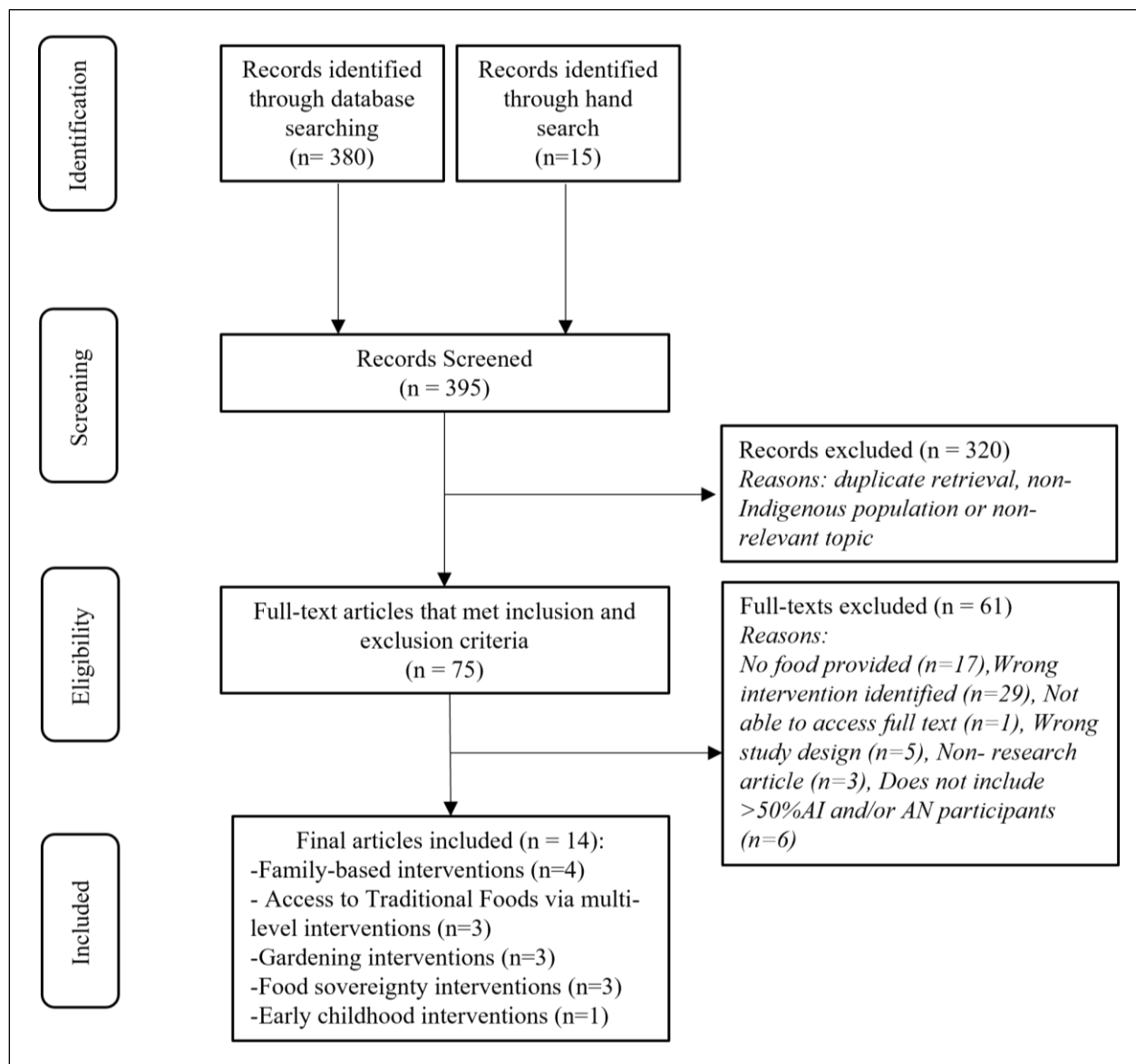


Table 2. Descriptive Characteristics of the Included American Indian/Alaska Native (AI/AN) Food Access Interventions Studies

Author	Year	Geographic Location	Intervention Design	<i>n</i>	Level of Social Ecological Model (SEM) Targeted	Type of Food Access	Key Findings
Armstrong	2000	Northwest American Indian Tribe	Quantitative	Undisclosed	Intrapersonal, community	Community garden produce	Workshops designed to be social, Informational and involve community. Community garden established to improve access for participants and elders to fresh produce and encourage exercise.
Bersamin et al.	2019	AK	Quantitative	76	Intrapersonal, institutional, community	Traditional foods at school, and family and community events	Participants in the intervention group consumed more servings of fish (traditional food). Results also indicated positive association between traditional way of life and beliefs regarding skills to harvest and store salmon.
Brown et al.	2020	Northern Plains American Indian Tribe	Mixed methods	25	Intrapersonal, interpersonal, institutional, community, public policy	Vouchers for produce, garden produce, seeds	Community gardening and traditional ways of being were motivating factors for participants to grow food. The POMS* Inventory showed positive change for intervention participants in the gardening group. Food access was promoted for participants at sessions.
Budd Nugent et al.	2022	AZ, NM, UT, AK	Quantitative	Undisclosed	Intrapersonal, interpersonal, community	Food prescription vouchers (produce/traditional foods)	Food access promoted through prescription vouchers. Vouchers supported the promotion of family- and community-level food access. Produce options increased to meet redemption needs by participants and also the general community.
Cueva et al.	2020	~US	Mixed methods	43 (interviews), 350 youth per year	Intrapersonal, interpersonal, institutional, community, public policy	Gardens, traditional foods	Feast for Future has supported cultural connectedness, intergenerational learning, the revitalization of farming and gardening, increased access to healthy foods, and positive changes among involved individuals and communities.
Davis et al.	2003	AZ, SD	Mixed methods	1,704 youth, 2,544 caregivers	Intrapersonal, interpersonal, community	Foods in classrooms, food at family and community events	Pathways curricula designed specifically for American Indians, deemed successful in introducing children and their families to healthful living, increasing their cultural identity, and promoting food access at family events.
DeBruyn et al.	2020	~US	Mixed methods	17 Tribal partners	Interpersonal, community, public policy	Garden, farming, traditional foods	The Traditional Foods Project (TFP) addressed social support and healthy diet factors associated with individual and community health. Partners developed local programs promoting food access in their communities. Results indicated that gardening, availability of healthy foods, and new health practices occurred and supported food access.

Haslam et al.	2023	OK	Quantitative	94	Intrapersonal, interpersonal, community	Meals at in-person sessions, food for parents	Primary outcome was an increase in vegetable and fruit intake among children. Researchers developed and implemented a hybrid curriculum. Modest participation in online component and more parent participation for in-person meetings where meals were provided. Food access was promoted at in-person sessions.
Mattingly & Andresen	2016	SD	Quantitative	12 staff, 15 Head Start sites	Intrapersonal, interpersonal, institutional, public policy	Food incentives, food in classrooms	NAP SACC** program focused on environmental policies and best practices promoting healthy weight development through healthy food access for children. Program successfully implemented across 15 Head Start sites.
Mylant et al.	2021	~US	Mixed methods	25	Intrapersonal, interpersonal, community	Family meals at sessions	Obesity rates among intervention groups remained the same while waitlist group increased by 20%. Focus groups revealed positive child behaviors to be strengths and adult disconnect to be a weakness. Food access promoted at sessions.
Ornelas et al.	2017	NM	Qualitative	12	Intrapersonal, interpersonal, community	School/community gardens, traditional foods, workshops	Community input was essential throughout the intervention. Community garden Intervention improved access to fruits and vegetables and traditional foods for participants.
Ornelas et al.	2021	NM	Qualitative	28 (focus groups), 2 youth classrooms	Intrapersonal, interpersonal, community	Meals, school garden, traditional foods	Traditional food activities and teachings emerged as key components of intervention. Community garden intervention improved food access for participants and local residents.
Sowerwine et al.	2019	CA, OR	Mixed methods	711 (surveys), 162 (interviews), 128 (focus groups)	Intrapersonal, interpersonal, community, public policy	Workshops, food camps	More than 1,300 educational events. Increased stakeholder knowledge and capacity to engage in transformative food system change. Native food workshops increased access to local foods. Pikyav Field Institute established to increase capacity to promote and sustain capacity for food access.
Taniguchi et al.	2022	OK	Quantitative	284	Intrapersonal, interpersonal, community	Family recipe kits	Changes noted in dietary intake, BMI, health status, systolic blood pressure, and food insecurity. Vegetable consumption significantly increased for intervention children. Access to local produce increased at ECEs.***

~ United States (U.S.) is used when the geographic location in the U.S. is undisclosed or there are a group of geographic locations; * POMS = Profile of Mood States;
 ** NAP SACC = Nutrition and Physical Activity Self-Assessment for Child Care; *** ECE = Early Childhood Education programs.

Ornelas et al., 2017). Food was brought into classrooms in studies targeting children (Davis et al., 2003; Mattingly & Andresen, 2016), with cultural connectedness, intergenerational learning, and overall capacity building to improve local food systems also noted in some of the studies (Cueva et al., 2020; Davis et al., 2003; DeBruyn et al., 2020; Sowerwine et al., 2019).

The Social Ecological Model (SEM) Levels Targeted by Interventions

When we examined the included articles through the SEM, we found that some explicitly stated which level(s) of impact they were targeting while others did not. We determined, however, that all of the articles described an intervention where multiple levels of SEM impact were identified. Notably, two of the interventions targeted all the SEM levels (Brown et al., 2020; Cueva et al., 2020). Thirteen of the fourteen included articles targeted the ‘intrapersonal’ level, while the ‘community’ level had twelve articles. The ‘intrapersonal’ and ‘community’ levels were the most targeted levels of the SEM among all the interventions. Twelve of the included articles targeted the ‘interpersonal’ level of the SEM. The ‘institutional’ and ‘public policy’ levels of the SEM were found to be the least targeted levels in our review. Table 3 depicts the SEM impact levels identified within the included articles which are further detailed below.

Intrapersonal level factors include individual level

knowledge, attitudes, behavior, skills, and self-efficacy (McLeroy et al., 1988). Food access interventions targeting the intrapersonal level more specifically addressed eating behaviors, attitudes, and perceptions toward traditional foods and the consumption of traditional foods. The self-efficacy around eating fruits and vegetables and growing food were targeted as well as the knowledge of gardening, food preparation, and nutrition.

Interpersonal level factors may include family and kinship structures, which are important in AI/AN communities. Interpersonal processes and groups may include both formal and informal social networks and support systems (McLeroy et al., 1988). Interpersonal level food access intervention targets included knowledge on food choices, cooking, and food preservation. Role modeling and self-monitoring behaviors were also found to be important changes targeted at the interpersonal level.

Institutional level factors include social organizational characteristics and both formal and informal rules and regulations (McLeroy et al., 1988). Institutional level food access intervention targets included fostering food access and positive organizational attitudes toward traditional foods. Enhancing organizational capacity to promote food access and/or gardening was also found to be targeted from within institutions such as schools and Tribal & early childhood education facilities (Bersamin et al., 2019; Brown et al., 2020; Cueva et al., 2020; Mattingly & Andresen, 2016).

Table 3. Social Ecological Model (SEM) Article Distribution among American Indian/Alaska Native (AI/AN) Food Access Interventions

SEM Level	Relevant Articles*
Intrapersonal	(Armstrong, 2000), (Bersamin et al., 2019), (Brown et al., 2020), (Cueva et al., 2020), (Davis et al., 2003), (Haslam et al., 2023), (Mattingly & Andresen, 2016), (Mylant et al., 2021), (Budd Nugent et al., 2022), (Ornelas et al., 2017), (Ornelas et al., 2021), (Sowerwine et al., 2019), (Taniguchi et al., 2022)
Interpersonal	(Brown et al., 2020), (Cueva et al., 2020), (Davis et al., 2003), (DeBruyn et al., 2020), (Haslam et al., 2023), (Mattingly & Andresen, 2016), (Mylant et al., 2021), (Budd Nugent et al., 2022), (Ornelas et al., 2017), (Ornelas et al., 2021), (Sowerwine et al., 2019), (Taniguchi et al., 2022)
Institutional	(Bersamin et al., 2019), (Brown et al., 2020), (Cueva et al., 2020), (Mattingly & Andresen, 2016)
Community	(Armstrong, 2000), (Bersamin et al., 2019), (Brown et al., 2020), (Cueva et al., 2020), (Davis et al., 2003), (DeBruyn et al., 2020), (Haslam et al., 2023), (Budd Nugent et al., 2022), (Ornelas et al., 2017), (Ornelas et al., 2021), (Sowerwine et al., 2019), (Taniguchi et al., 2022)
Public Policy	(Brown et al., 2020), (Cueva et al., 2020), (DeBruyn et al., 2020), (Mattingly & Andresen, 2016), (Sowerwine et al., 2019)

* An article may have had more than one SEM level represented, so the article may be located in multiple SEM level rows in the table.

Community level factors include organizational, institutional, and informal network relationships (McLeroy et al., 1988). The community level food access intervention targets for change included enhancing social norms around gardening and traditional foods, as well as increasing collective knowledge on food plants (Cueva et al., 2020; Sowerwine et al., 2019). At the community level, some interventions additionally noted positive perceptions of community change and increased collective efficacy for gardening and/or farming (Cueva et al., 2020; Sowerwine et al., 2019). As a result of the interventions that targeted the community level, community connectedness, and increased community capacity to improve food access were noted for ten of the total interventions. Overall, the development of community-based interventions through gardens and traditional foods was noted to be critical for gaining further insight into the influential factors and common barriers that may hinder the growing of food (Brown et al., 2020; Cueva et al., 2020; DeBruyn et al., 2020).

The *public policy level* targeted by the food access interventions included addressing policy barriers to food access and gardening at the Tribal and state levels. Public policy level approaches were specifically discussed in five of the included studies (Brown et al., 2020; Cueva et al., 2020; DeBruyn et al., 2020; Mattingly & Andresen, 2016; Sowerwine et al., 2019). Two interventions developed and implemented wellness policies in schools and early childhood education facilities as part of the intervention (Cueva et al., 2020; Mattingly & Andresen, 2016). Community level policies that aimed to improve overall food access and food systems were also developed in two of the larger studies (DeBruyn et al., 2020; Sowerwine et al., 2019). In addition to policy level interventions, increased community engagement and awareness on policy that supports community food access was also discussed in two of the interventions (DeBruyn et al., 2020; Sowerwine et al., 2019). Support from Tribal leadership and policymakers was also noted as important for intervention success and impact on local food access (Haslam et al., 2023; Taniguchi et al., 2022).

Cultural Factors and Food Access

In addition to the noted SEM level findings, it was noted more generally across the included articles that Indigenous culture was an important influence among the food access interventions. Notably, twelve of the interventions discussed culture as an important influence and component of their interventions. Cultural influences and factors in the respective interventions included: the inclusion of Indigenous languages; the inclusions of intergenerational teachings on growing and consuming food; the inclusion of traditional foods; the incorporation of traditional ecological knowledge (TEK); and platforming overall ways of connecting to food, family, and community as part of the intervention. Promoting access to traditional foods in homes, schools, and communities was often discussed across the articles as being important to increasing food access and improving health (Bersamin et al., 2019; Budd Nugent et al., 2022; Cueva et al., 2020; Ornelas et al., 2017; Ornelas et al., 2021; Sowerwine et al., 2019). Connecting to cultural knowledge and practices (e.g., planting culturally important foods, preparing and cooking cultural foods) were additionally highlighted as being important components for four of the interventions carried out (Bersamin et al., 2019; Brown et al., 2020; Cueva et al., 2020; Davis et al., 2003).

Another more general feature across the included articles was the dominance of *community-based interventions*. Ten of the interventions were denoted as being community-based interventions where direct community and stakeholder input was sought at the beginning of the development of the interventions. Community advisory boards and partnerships between researchers and the Tribal communities were formed before the interventions were developed and informed the foundation of the interventions. Stakeholders (e.g., Elders, farmers, educators, Tribal leadership) often informed community needs surrounding food access, health, and wellness. For example, Bersamin et al. (2019) ensured that local input and the Yup'ik worldview were integrated into intervention activities and evidence-based development strategies. The Food Resource Equity for Sustainable Health (FRESH) study by Taniguchi et al. (2022) additionally stated that commitment from the

Osage Nation was integral to the study's development and success.

Discussion

Our scoping review attempted to provide further insights into the existing literature surrounding food access interventions in AI/AN communities in the U.S. We specifically mapped the existing literature to the SEM to identify common SEM impact levels that AI/AN food access interventions are targeting. Below, we have further reflected on existing gaps in the literature on food access interventions in AI/AN communities.

All of the included interventions were conducted in rural areas with two of the interventions being conducted in both rural and urban locations (Davis et al., 2003; DeBruyn et al., 2020). The clear lack of interventions conducted exclusively in urban AI/AN communities surrounding food access is important as the majority of AI/AN populations live in urban areas (~70%) (NCUIH, 2022). There is limited research generally on food insecurity for urban AI/ANs; however, the limited evidence that does exist suggests that urban AI/AN individuals may experience higher food insecurity when compared to their rural counterparts (Dong et al., 2023). Various factors may contribute to food insecurity for urban AI/AN individuals, including high rates of poverty and limited access to culturally appropriate food access services and resources (Dong et al., 2023). Food insecurity may also contribute to other health outcomes. In a study carried out by Dong et al. (2023) they found that associations between food insecurity and cardiometabolic risks can impact urban AI/AN youth. Urban AI/ANs may also experience racial misclassification, which may further compromise the accuracy and usefulness of AI/AN health assessments (Yuan et al., 2014). Further research and support for food access programs involving urban AI/ANs are needed to better understand the potential similarities and differences across AI/AN populations to improve health outcomes.

Increasing access to Indigenous traditional foods as well as promoting gardening abilities were highlighted as important factors in many of the included studies. Traditional foods may promote food access for AI/AN communities and benefit

overall health (Gutierrez et al., 2023). The Feast for the Future (FFF) program by Cueva et al. (2020) promoted traditional food access in three Tribal communities through the intergenerational Traditional Foodways Education Program and community farming initiatives. Youth participants were taught by local Elders about seasonal traditional cooking, gardening, and farming, and key food practices such as harvesting (Cueva et al., 2020). More importantly, traditional foods were brought into schools and enhanced organizational support toward these foods (Cueva et al., 2020). Overall, stakeholders expressed that the FFF intervention fostered Indigenous approaches to supporting healthy living and cultural identity through traditional foods (Cueva et al., 2020). The Traditional Foods Project (TFP) also supported the notion that traditional foods are interwoven with land, identity, food sovereignty, and food security (DeBruyn et al., 2020). Traditional foodways are critical to improving healthy food access, individual and collective relationships with food, and overall health outcomes (Cueva et al., 2020; DeBruyn et al., 2020; Gutierrez et al., 2023; Sowerwine et al., 2019). Multilevel traditional food interventions hold much promise in impacting AI/AN food systems and communities through culturally grounded and community driven approaches.

All the included studies targeted multiple levels of the SEM, which points to research projects in Tribal communities potentially being attuned to the importance of being inclusive of multiple levels of the community experience regarding food access. This multilevel approach to addressing food access is notable as the targeting of many impact levels is known in other contexts to potentially influence individual and collective food access (Stluka et al., 2018). For example, rural multilevel food access interventions have been carried out in other communities in the U.S. Stluka et al. (2018) discusses a multistate longitudinal multilevel intervention that aimed to improve food security through food policy councils and food pantries. The team found the community and strengths-based approach to be effective. However, there were also challenges with the study including timelines, participant retention, and fidelity (Stluka et al., 2018). Multilevel interventions, especially those in rural areas, have the

potential to improve food access and foster positive changes in rural food systems. Prominent public health funding agencies (e.g., Centers for Disease Control and Prevention, United States Department of Agriculture [USDA], and Food and Nutrition Services) also recommend multilevel interventions that can foster a policy, systems, and environmental change (PSE) approach (Randall et al., 2023). In a study by Randall et al. (2023) in the rural Southern U.S, qualitative findings indicated that community-based interventions and cultural influences were found to be key components to a PSE approach. Further research that assesses multilevel impacts in rural communities, including with AI/AN communities, may improve the understanding of multilevel approaches in varied contexts.

It became apparent throughout the review that interventions tended to target the institutional and public policy impact levels the least, whereas they targeted the intrapersonal (individual) and community SEM levels the most. Where policy levels were incorporated, they were mainly at the Tribal level with sparse interaction at state or federal policy levels. This despite federal policy resulting in programs such as the Food Distribution Program on Indian Reservations (FDPIR) (which introduced processed foods to AI/AN communities) continuing to influence food choices for those that utilize their services (Budd Nugent et al., 2022). Institutional and public policy level targets have the potential to have profound impacts on food access in AI/AN communities. Institutions that may exist in AI/AN communities include worksites, schools, universities and colleges, hospitals, parks and museums, and faith-based organizations (Harris et al., 2012). The complexities of what food is allowed and available in these institutional settings in AI/AN communities may derive from many multilevel and interacting policies at local, state, Tribal, and federal levels. Additionally, navigating the various policies impacting food access in Tribal communities can be unclear due to the potential for policy overlap. Local policy interventions at the Tribal level are of course needed. However, there is also need for more food access interventions that target policies that regulate state and federal programs directly within Tribal settings (i.e., federal

hospitals, public schools). There is also a need for further capacity building and infrastructure that enables Tribal stakeholders to be able to advocate at Tribal, state, and federal levels.

In considering some of the key gaps and knowledge mobilized on food access interventions within Tribal communities from this review, there are several considerations for developing, operationalizing, and amplifying food access programs. We have framed these considerations within a traditional food storage basket as depicted in Figure 2. Baskets are significant to many AI/AN communities. The basket is culturally important and is connected to food as it is used to carry food and plants in ceremonies and was used when traveling long distances within some Tribal Nations. Food access considerations may include: (1) the historical and current policies impacting food access in Tribal communities; (2) the importance of the development and delivery of multilevel food access interventions; (3) the importance of leveraging existing

Figure 2. Traditional Food Storage Basket with Key Considerations for American Indian/Alaska Native (AI/AN) Food Access Interventions



strengths in AI/AN communities to enhance food access through community-based programs; and (4) the importance of traditional foods and culturally aligned programs and their role in food access. These four considerations are reviewed below.

Historical and current policies continue to impact AI/AN communities' access to food. A better understanding of the policy-based approaches to increasing AI/AN food access is greatly needed. More specifically, there is a critical need for more research that assesses the viability and impact of policy interventions that aim to increase food access in AI/AN communities. Additionally, research that examines the long-term effects of policy approaches to increasing food access in AI/AN communities could further inform intervention development. Despite the food access interventions reviewed having some targets at the Tribal policy level, there is a paucity of research that assesses the impact of Tribally driven policies and their effectiveness in promoting food system change and increasing overall food access. In spite of this paucity of research, there is continued potential to improve the local Tribal policy environment surrounding food and agriculture through mechanisms such as Tribal Food Codes (Indigenous Food and Agriculture Initiative [IFAI], 2024). There is a need for more research that can provide examples of effectively improving local Tribal policy environments such as the American Indian Healthy Eating Project (AIHEP). AIHEP was carried out with seven North Carolina AI Tribes in which they used an ecological framework to improve access to healthy, affordable foods (Fleischhacker et al., 2012). The AIHEP resulted in the Tools for Healthy Tribes toolkit and engagement with Tribal policymakers to increase access to healthy foods (Fleischhacker et al., 2012).

Multilevel food access interventions typically intervene on two or more levels of the SEM (Charns et al., 2012) and may have the greatest impact in improving health (Trickett, 2009). However, multilevel interventions are rare in AI communities despite their potential to positively impact health (Blue Bird Jernigan et al., 2020). With all the food access intervention studies included in this review being multilevel, further investigation could determine why the food access space is leading in multi-

level interventions in AI communities compared to other research areas, and what lessons may be learned from those approaches. Additionally, challenges to intervention science within AI communities often lacks the consideration of cultural and sociological contexts existing in these settings (Blue Bird Jernigan et al., 2020). With this, better understanding of the culturally important measures and the role of environmental and social influences on food access is needed in the context of multilevel interventions.

Food access interventions within AI/AN settings requires a *community-based* approach that prioritizes local knowledge and input. The Sowerwine et al. (2019) intervention included in this review provided a detailed narrative of the process and partnerships needed to develop a multilevel intervention to enhance food access within the Klamath, Karuk, and Yurok Tribes. Through a community-based participatory research (CBPR) approach, the intervention promoted food security through teachings around accessing and preparing traditional foods, leveraged local community strengths, and created sustainable food system changes (Sowerwine et al., 2019). The project was effective in integrating cultural values through the partnership between Tribal partners and university-extension staff, while also fostering Tribally led research, education, and workforce development (Sowerwine et al., 2019). Through partnerships and a CBPR approach, the project exemplifies how local Indigenous community strengths and knowledge can transform food systems and enhance infrastructure to sustain longer-term project outcomes (Sowerwine et al., 2019).

Successful interventions conducted within AI/AN communities have been found to be grounded in culturally based approaches in which local values, worldviews, and ethics are integrated (Walters et al., 2020). *Traditional foods and culturally aligned programs* have therefore been highlighted in many of the articles included in this review. Traditional foods themselves are culturally important foods that have provided nourishment and sustained for AI/AN Peoples for millennia. Many Indigenous Peoples, including American Indians, are reclaiming their food systems through Indigenous food sovereignty (Gutierrez et al., 2023).

Food sovereignty initiatives support Indigenous communities' ability to increase access to traditional and healthy foods while also reducing dependence on processed foods (Blue Bird Jernigan et al., 2021). For example, traditional foods are vital to Alaska Native diets where they are an important nutrient source and contribute to overall food security (Walch et al., 2018). Interventions that support AI/AN Peoples in rebuilding food sovereignty in their communities have the potential to create sustainable changes and impacts (Gutierrez et al., 2023). Indigenous food sovereignty also supports access to traditional foods and can help foster collaboration between historically "siloeed segments of communities (e.g., agriculture, land use, commerce, health departments)" to create more food equitable environments (Blue Bird Jernigan et al., 2021, p. 7). Interventions that enhance Indigenous food sovereignty may also promote approaches that restore relationships between Indigenous Peoples and their homelands and strengthen their ecological knowledges (Coté, 2016). With this, there is need for more research that better supports an understanding of how Indigenous food sovereignty can be used as an applied public health approach to improve traditional food access within AI/AN communities.

Limitations

Most of the articles included in this scoping review had a participant base that was AI with a clear lack of AN representation. Therefore, our findings may not be representative of the AN population due to their lack of representation in this review. Additionally, food access interventions that are carried out in AI/AN communities may not always be published in peer-reviewed academic journals. As this review included only peer reviewed studies, relevant community-based food access work happening on the ground in AI/AN communities may therefore not be fully represented. Regardless, as policy and funding structures are often informed by academic orientated publications, we felt it was important to get an idea on the breadth of the liter-

ature on this topic area within the literature that may be used for informing food access dialogues and programmatic work. Future work should be directed toward examining non-academic sources of Tribal food access programs to create a more comprehensive understanding of targets for change to inform future food access intervention development.

Conclusion

Our scoping review provided further evidence that food access is a tantamount public health issue and priority for AI/AN populations in varied settings. We reviewed the literature on interventions aiming to address food access in AI/AN communities. Included articles were mapped across the SEM, which highlighted clear gaps at the institutional and public policy impact levels, with a more specific policy gap at the state and federal policy levels of intervention. Nonetheless, our review highlighted that there is valuable research that has been conducted on AI/AN food access interventions with many interventions targeting multiple levels of the SEM. Further collaboration between AI/AN communities and researchers may lead to the development of more informed multilevel interventions that integrates Indigenous methodological approaches and culturally based approaches to improving food access. AI/AN food systems were once robust, diverse, and fully supported the health and well-being of AI/AN Peoples (Sarkar et al., 2020). By honoring the strengths, knowledges, and experiences of AI/AN communities it is possible to contribute to the rebuilding of AI/AN food systems while ensuring the right to food for current and future generations.



Acknowledgments

We would like to acknowledge Devon Olson, research and education librarian at the University of North Dakota School of Medicine and Health Sciences, for her expertise and guidance in developing our search strategy.

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Appendix

Table A1. Example PubMed Search Strategy

Search Terms
("Native American"[Title] OR "American Indian"[Title] OR "Alaska Native"[Title] OR "American Indian/Alaska Native"[Title] OR "Indians, North American"[Mesh]) AND (("access to food"[Title] OR "healthy food access*"[Title] OR "food bank"[Title] OR "food pantr*"[Title] OR "food assistance"[Title] OR "food security"[Title] OR "food shelf"[Title] OR "fruit and vegetable prescription*"[Title] OR "obesity prevention"[Title] OR "Healthy Food Availabilit*"[Title] OR "Availability of Healthy Food*"[Title] OR "Healthy Foods Availabilit*"[Title] OR "Access to Health Food"[Title] OR "Food Deserts"[MeSH] OR "Food Insecurity"[MeSH] OR "Food Security"[MeSH] OR "Food Assistance"[Mesh]) OR (("health promotion"[Title] OR intervention[Title] OR program*[Title] OR protocol*[Title] OR project*[Title] OR initiative*[Title] OR validation*[Title] OR evaluation*[Title] OR development*[Title] OR assessment*[Title] OR pilot[Title] OR strateg*[Title] OR "Health Services, Indigenous"[MeSH] OR "Health Promotion"[Mesh] OR "Program Development"[Mesh] OR "Program Evaluation"[Mesh] OR "Preventive Health Services"[Mesh]) AND ("food sovereignty" [Title] OR "traditional food*"[Title] OR foodway*[Title] OR "food security"[Title] OR "food system*"[Title] OR "cultural food"[Title] OR nutrition[Title] OR agriculture[Title] OR farm*[Title] OR garden*[Title] OR permaculture[Title] OR cook*[Title] OR vegetable*[Title] OR fruit*[Title] OR seed*[Title] OR forage*[Title] OR "food is medicine" OR "food as medicine" OR harvest*[Title] OR recipe*[Title] OR diet*[Title] OR "Diet, Healthy"[MeSH]))))

Hāloa: The long breath of Hawaiian sovereignty, water rights, and Indigenous law

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FIRST NATIONS
DEVELOPMENT INSTITUTE

Submitted February 21, 2024 / Revised June 2 and July 12, 2024 / Accepted July 25, 2024 /
Published online January 28, 2025

Citation: Apoliona-Brown, P. (2025). Hāloa: The long breath of Hawaiian sovereignty, water rights, and Indigenous law. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 29–58. <https://doi.org/10.5304/jafscd.2024.141.021>

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Abstract

This research explores how Native Hawaiian–led efforts to protect sacred lands and waters reveal forms of Indigenous survivance and resistance to the logics of settler colonialism. These forms range in visibility from direct protest to the perpetuation of Indigenous practices, values, and knowledge systems. Inspired by movements for social justice on the North American continent, the Hawaiian Renaissance of the 1970s saw a reawakening of pride in Hawaiian culture within the context of the rapid changes brought by statehood in 1959. In response to the forceful thrust of Americanization and physical displacement of rural communities, young Native Hawaiians rose to defend their right to live as Hawaiians in their own homeland. As a result of the activism of the Hawaiian Renaissance, the 1978 Constitutional Convention reaffirmed

Native Hawaiian rights previously codified by Kingdom law, which included a unique public trust doctrine grounded in Indigenous land and water management. My research is guided by the mo‘olelo (oral histories) of nā kūpuna who were once the “radical” activists of the Hawaiian Renaissance. Their stories shed light on a history unaccounted for in standard textbooks and reveal a genealogy of Native Hawaiian resistance that was reawakened under the banner of Aloha ‘Āina (reciprocal love of land).

Keywords

Aloha ‘Āina, cultural practice, environmental justice, food sovereignty, Hawaiian Renaissance, Indigenous resistance, Native Hawaiian, public trust, settler colonialism, water rights

Funding Disclosure

This article was made possible with research funding from the First Nations Development Institute through the inaugural Tribal Food Systems Research Fellowship. Funding of the author’s master’s research came from New York University’s Steinhardt Student Research and Creative Project Grant and the C. V. Starr Fund for Asian/Pacific/American Research.

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Introduction

For many Indigenous communities, access to water ensures the ability to feed and sustain yourself in your culture on your land. While Indigenous dispossession is often associated with the tremendous loss of land seized by the United States, to ignore water misses one of the largest areas of Native Hawaiian struggle. Water rights have always been a fundamental part of Hawaiian law. Hawaiian Kingdom laws protecting Native Hawaiian traditional and customary practices, including the use of water for kalo (taro) cultivation, were reaffirmed within the Hawai'i State Constitution in 1978 due to the Hawaiian Renaissance of the 1970s, a period of tremendous activism and cultural revitalization. And yet water remains largely controlled by corporate interests, and an ongoing struggle tied to the perpetuation of Indigenous lifeways and the health of the land. This work considers the impact of settler colonialism on Indigenous foodways through the lens of Native Hawaiian resistance movements that reaffirm Indigenous forms of sovereignty and survivance grounded in Aloha 'Āina. Using the personal accounts of elders who fought to protect Native Hawaiian rights, this research traces the historical significance of water to Indigenous food sovereignty from the abundance of the traditional ahupua'a system to Hawai'i's current state of food and water scarcity, culminating in the devastating fires that ripped through Lahaina, Maui, in August 2023.

Settler Colonialism and Indigenous Survivance

Patrick Wolfe (2006) describes settler colonial inva-

sion as a structure, rather than an event, contingent upon the elimination of the Native. Settler colonialism is a structural process that makes lands available for white settlement through various forms of Indigenous erasure.¹ And yet, Indigenous peoples persist. Audra Simpson (2014) reminds us that “this ongoing and structural project to acquire and maintain land, and to eliminate those on it, did not work completely” (p. 12). As Native scholars work to denaturalize the logics of settler colonialism that normalize Indigenous erasure, this story of Indigenous resurgence is a testament to our survivance² (Morgensen, 2011, p. 2).

Aloha 'Āina is a cultural and spiritual philosophy at the foundation of Kānaka 'Ōiwi³ identity and is rooted in an ancestral worldview with deep love and connection to place based on kinship and reciprocity. The term, meaning love of land, has “structured centuries of sustainability” and continues to “frame community responses” to the challenges of today (Beamer et al, 2021, para. 1). Beyond offering a framework to address issues of environmental degradation, Aloha 'Āina also holds political connotations associated with Hawaiian sovereignty.⁴

After Queen Lili'uokalani was forcibly removed from power in 1893,⁵ English became the primary mode of instruction through Act 57 of the 1896 Laws of the Republic of Hawai'i. Kānaka Maoli children were physically punished for speaking their own language in school. With 'ōlelo Hawai'i (Hawaiian language) effectively banned, the nūpepa (Hawaiian language newspaper) went underground and became an impor-

¹ This operates through the physical disappearance and displacement of Indigenous lives; the coordinated traumas of cultural repression and forced assimilation; and the racialization of Indigenous people that removes claims to nationhood often obfuscated by the celebration of liberal multicultural democracy.

² Ojibwe scholar Gerald Vizenor repurposed the term “survivance” to move beyond the paradigm of mere survival, orienting us instead toward “renewal and continuity into the future” (2008, p. 25). He describes survivance as “a reciprocal use of nature, not a monotheistic, territorial sovereignty” and Native stories of survivance as “an active presence” (1998, p. 15). According to Noelani Goodyear-Ka'opua (2013), “Aloha 'āina has been a practice of Kanaka Maoli survivance for generations” (p. 32).

³ I use Native Hawaiian, Kānaka Maoli, and Kanaka 'Ōiwi interchangeably to refer to Indigenous people of Hawai'i. The term Kanaka 'Ōiwi (of the ancestral bone) emphasizes Hawaiian indigeneity in terms of ancestry (McGregor, 2010).

⁴ Hui Aloha 'Āina was a political party that carried 38,000 signatures to Washington, D.C., protesting U.S. annexation in 1897. Almost every Kānaka Maoli today can point to an ancestor's signature in the Ku'e Petition.

⁵ In 1893, Lili'uokalani was overthrown by a group of missionary descendants, sugar planters, and financiers backed by the U.S. Navy stationed at Pearl Harbor in what U.S. President Cleveland later condemned as an illegal “act of war” (Apology Resolution, 1993).

tant source of the resistance and survivance.⁶ In the very first issue of the *nūpepa*, *Ke Aloha 'Aina*, published on May 5, 1895,⁷ Joseph Nāwahī describes Aloha 'Āina as a magnetic pull within the heart of the Hawaiian nation that unwaveringly points toward sovereignty (p. 7).⁸ The term was intentionally resurrected during the Hawaiian Renaissance by activists inspired by stories of resistance from the time of the illegal overthrow (Blount Report, 1894–95).⁹

Storytelling as Methodology

According to Charlotte Coté (2022), Indigenous storytelling is “a powerful act of resistance” and a “transformative practice” that shapes who we are (p. 7). Our stories are “Indigenous theory ‘in action’” (p. 8). As methodology, Indigenous storytelling challenges colonial narratives and academic paradigms by allowing Native voices, perspectives, and experiences to enter academic spaces that have historically been “unwelcoming and alienating for Indigenous people” (Larissa Behrendt as cited in Coté, p. 7). Eualearoi/Gamillaroī scholar Larissa Behrendt describes storytelling as “an act of sovereignty that reinforces Indigenous identity, values, and worldviews” (Behrendt as cited in Coté, p. 7).

For these reasons, my work centers the stories of Indigenous elders active during the Hawaiian Renaissance. Once dismissed as “radicals,” their conviction turned the tide of colonial erasure at a critical moment in history. My parents’ stories brought me to this research. My mother, Leimomi Apoliona, was a founding member of the Protect Kaho‘olawe ‘Ohana (PKO or ‘Ohana), a small group of Native Hawaiian activists who organized to stop the bombing of a sacred island that the United States Navy had used for target practice

since World War II. My father, E. Cooper Brown, was an environmental lawyer with the public interest groups Life of the Land and Legal Aid Society of Hawai‘i. He represented Native Hawaiian communities on various fronts, including early water rights litigation that set legal precedent for ongoing efforts to restore streamflow to traditional food systems using Hawai‘i’s unique public trust doctrine.

My research is guided by the *mo‘olelo* (oral histories) of *nā kūpuna* (elders) who were part of the Hawaiian Renaissance. This methodology draws inspiration from environmental justice storytelling (Houston, 2013), which seeks to comprehend and communicate the place-based meaning of environmental injustice from the perspective of those most impacted by social and environmental imperialism, as well as community-based participatory research. In addition to secondary sources and archival data, I conducted interviews with over 20 activists, community leaders, educators, lawyers, politicians, and *kalo* (taro) farmers between December 2022 and August 2023. Their stories, personal records, and artifacts supplement the written record.

The Story of Hāloa

My mother’s generation was born and raised during the intense cultural repression of the Territorial Period (1900–1959), when *Kānaka Maoli* were taught to either forget or be ashamed of who they were. For this reason, the support of *nā kūpuna* who held stories and chants passed down orally through generations was essential to the process of remembering (see W. Ritte quote, Appendix D). As the young activists of the Hawaiian Renaissance sought to recover the remnants of Hawaiian culture and history that were fast disappearing, stories,

⁶ These efforts kept the Hawaiian language alive, allowing future generations a vast archive of Hawaiian genealogies, histories, and commentary that would have otherwise been lost.

⁷ The article was published on May 25, 1895, just six months after he was arrested and charged with treason by the Republic of Hawai‘i for his part in a failed attempt to restore Queen Lili‘uokalani to power.

⁸ The original text reads, “Ke Aloha ‘Āina; He Aha Ia? ‘O ke Aloha ‘āina, ‘o ia ka ‘Ume Māgēneti i loko o ka pu‘uwai o ka Lāhui, e kāohi ana i ka noho Kū‘okoa Lanahila ‘ana o kona one hānau pono‘ī.” This means, “Aloha Aina; What is it? Aloha Aina is a magnetic pull in the heart of the Nation, steadfast in the sovereignty of his own birthplace” (translation by Ku‘ulei Kanahale; Nāwahī, 1895, p. 7); see also Ka‘iwakiloumoku (n.d.), *Ke Aloha 'Aina; He Aha Ia?*

⁹ Emmett Aluli and George Helm were researching the work of Hui Aloha ‘Āina and saw a connection between their efforts to protect Kaho‘olawe and the Hawaiian sovereignty movement at the turn of the century (Alegado, 2023; eulogy on file with author).

music, hula, and traditional foodways emerged as alternative conduits of knowledge that carried Hawaiian culture, like seeds waiting for the right conditions to grow.

George Jarret Helm, Jr., was a talented musician, born and raised on his family's homestead farm in Kalama'ula, Moloka'i. As the president of the Protect Kaho'olawe 'Ohana, George brought the kūpuna into the movement through his music and sincere interest in learning about the old ways. According to my mother, who was his girlfriend at the time, George "always had his little beat-up guitar and he would just start singing the old songs. That's how he won the kūpuna over. I'm sure that's why Auntie Edith loved him!"

Edith Kenao Kanaka'ole, endearingly known as Auntie Edith,¹⁰ is a revered kumu hula vital to the reawakening of Hawaiian culture and spiritual practices.¹¹ According to her daughter, Dr. Pualani Kanaka'ole Kanahale, at a time when people were still "hesitant about doing things Hawaiian" and Native Hawaiian lifeways were guarded and kept private, Auntie Edith shared her time, effort, and wealth of knowledge freely with the movement. She felt that "all this knowledge that we have, all this smarts in things Hawaiian, it's not ours. We learned it from something else or somewhere else, and mostly from chants. And so, it's not ours. It belongs to Hawai'i."

In 2023, a U.S. quarter was released honoring Auntie Edith's contributions to American history.¹² The coin features her image and the inscription "E hō mai ka 'ike" (Grant us wisdom), the opening words of a chant she composed for the protection of Kaho'olawe that continues to ground every event and movement in Hawai'i today. Almost ironically, my mother recalls how it was Auntie Edith who suggested they not call themselves the Protect Kaho'olawe Fund but the Protect

Kaho'olawe 'Ohana, which means family.

After enjoying Hawaiian music in Hilo, Hawai'i, Apoliona and Helm visited Auntie Edith at her homestead in Keaukaha. It was around 4am and George called out from their car, "Auhea 'oe?" ("Where are you?"), to which Auntie Edith responded, "Hui! Mai 'ai" ("Come in and eat!"). Apoliona recalls,

She had a bowl of the most sour poi I've ever seen.¹³ You put your finger in it and all the bubbles would pop. And then she had raw manini fish just cut in half, with Hawaiian salt on. And that was breakfast.

As they ate, Auntie Edith started talking about this very Hawaiian custom of sitting around the poi bowl together. You couldn't be mad at your company eating this way, dipping your fingers in the same bowl. She then started talking about 'ohā, the small offshoots that grow from the makua (parent), the main corm of the kalo plant, as illustrated in Figure 1. Traditionally, the makua is cut from the huli, which are the stalks used for replanting, and cooked using stones in an underground oven. It is then pounded to make poi, the staple food of the Hawaiian people.

Auntie Edith then explained how 'ohā is the root of the word 'ohana (family), and Hāloa, the kalo plant, is our elder sibling that we must care for and respect. With that, she said they should call themselves the Protect Kaho'olawe 'Ohana, not "Fund."

Protect Kaho'olawe 'Ohana is a name that prioritizes the abundance of land and family over financial wealth. The name intentionally reestablishes a familial connection to 'Āina, the Hawaiian word for land that literally translates to "that which feeds." Unlike the settler colonial concept of land

¹⁰ It is customary to refer to Hawaiian elders as Auntie or Uncle both endearingly and as a sign of respect.

¹¹ Her family has continued her legacy of teaching all who come through the Edith Kanaka'ole Foundation, Hālau o Kekuhi, and Lonoa Honua with the understanding of the importance of Hawaiian lifeways in and beyond Hawai'i. In the words of Dr. Candace Fujikane, Auntie Edith "wrote chants for everyone, knowing that all people, Kanaka and non-Kanaka, would have to participate in chanting for the healing of the earth."

¹² She was one of five women honored by the American Women Quarters Program in 2023 for their contributions to American history.

¹³ Fresh poi is often sweet tasting, while fermented poi is sour. The old-timers loved fermented poi, which is very nutritious and a good source of probiotics and Vitamins A and B.

Figure 1. A Protect Kaho‘olawe ‘Ohana Thank You Card Illustrated by Leimomi Apoliona

The kalo plant came to symbolize Aloha ‘Āina. “Kalo kanu o ka ‘Āina” means to plant taro of the land.

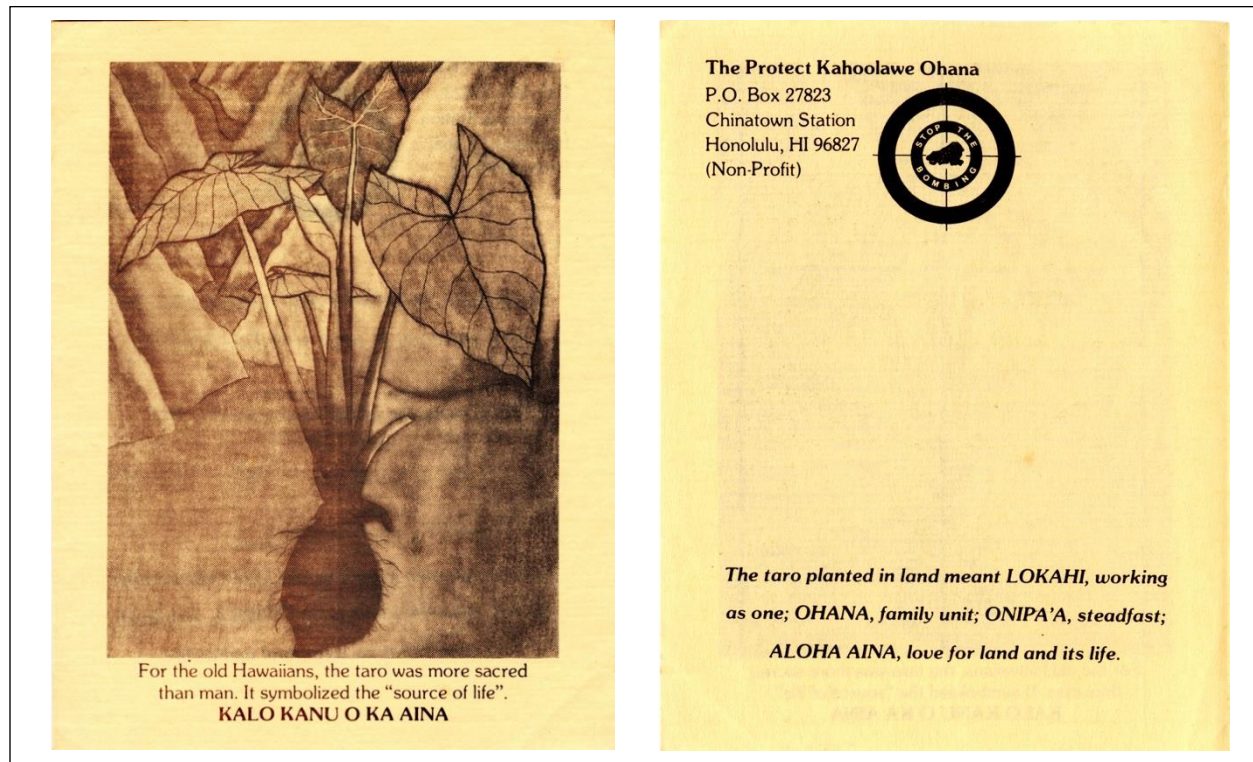


Image source: Leimomi Apoliona, personal records. The kalo plant was illustrated by Apoliona.

as territorial possession, ‘Āina is respected as an elder we descend from. The story of Hāloa is part of our creation story and a constant reminder of the genealogical relationship Kānaka Maoli have with ‘Āina, and the reciprocity that underscores our responsibility to mālama (care for) and aloha (love) ‘Āina, who feeds, clothes, and nourishes in return (Kame‘eleihiwa, 1992).

Hā-loa also breaks down to mean “long breath.”¹⁴ As Kanahēle explains, “The idea of Hāloa is a psychological thing to me, initially, because it has to do with giving, not only breath, but giving life to the Hawaiians.” In physical form, Hāloa is the taro plant we eat. In psychological form, Hāloa is the breath that “helps us to live the life that we have.” It is the understanding that we have food and a future in Hawai‘i.

The Abundance of Traditional Food Systems

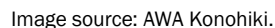
Once a completely self-sufficient island nation,

Hawai‘i is now dangerously dependent on outside resources, importing roughly 90% of the food consumed on the islands (Loke & Leung, 2013; Office of Planning, Department of Business, Economic Development and Tourism [OP-DBEDT], 2012). As the most geographically isolated place on earth, with the nearest landmass of California 2,500 miles away, the lack of local food production is a serious concern, especially considering the risk of losing access to supplies to natural disaster, pandemic, and war (Hawai‘i State Legislature, 2012).

For generational kalo farmers and Native Hawaiian rights activists who have fought for decades to restore water to traditional foodways, the solution to Hawai‘i’s food insecurity lies in the blueprint left by our ancestors. According to Tiare Lawrence regarding the return of streamflow to ancestral lo‘i in Kahoma Valley, Lahaina, ‘Āina previously left dry by plantations for over a century, “When we talk about food security, we should talk

¹⁴ Hā means “to breathe” and loa means “long.”

Unlike Hawai'i's current state of food insecurity, every ahupua'a of every moku (district) of every island was self-sufficient.



Using stones and flowing water, Native Hawaiians developed sophisticated modes of agriculture and aquaculture that could produce enough food to satisfy a population of 1.2 million people, roughly equivalent to the present-day population (Kura-shima et al, 2019). Ahupua'a, regions of communal responsibility extending from the mountains to the ocean reefs, were loosely defined by watersheds

Unique to Hawai'i, vast networks of wetland kalo cultivation covered windward valleys and flat lands.¹⁵ Stone 'auwai (irrigation ditches) borrowed water from rivers and streams to flow through terraced lo'i kalo (taro fields). This water was

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always returned to its natural course before entering the muliwai (mouth of the river) or loko i'a (fishpond) at its base, illustrated in Appendix A. The continuous connection of cold water flowing from the mountains to the ocean maintained the hydrologic cycle, recharged groundwater aquifers, and provided a passageway for endemic species to travel upstream.¹⁶ While most no longer receive water, the stone infrastructure of these systems, seen in Figure 3, remains a permanent feature of many landscapes often hidden beneath a thick overgrowth of invasive vegetation.

Figure 3. Lo'i Kalo at Noho'ana Farm

Water manually held back during a storm is returned to these terraced lo'i. Hōkūao Pellegrino explained that without access to water, these lo'i within his family's kuleana land had been inactive and hidden beneath thick vegetation. Through litigation, the return of wai via Waikapū Stream was won in 2014—an ongoing struggle and hard-fought victory for Hui o Nā Wai 'Ehā.



Photo credit: Photo taken in Waikapū, Maui, in December 2022 by Puanani Apoliona-Brown.

The Hawaiian Constitution: Protecting Native Hawaiian Land and Water Rights

Laws that developed around traditional practice were codified by the 1839 Bill of Rights and the first constitution of the Hawaiian Kingdom in 1840. At that time, Lahaina was the capital of the Hawaiian Kingdom. The area, referred to in chants as Ka Malu 'Ulu o Lele (the shaded breadfruit grove of Lele), was an abundant wetland fed by the region's groundwater aquifer and perennial streams that carried freshwater from the mountains through a vast network of lo'i kalo, to the flood-

plains below. At the center of a 17-acre (6.9-hectare) pond called Mokuhinia was Moku'ula, a small island and the royal residence of King Kamehameha III, Kauikeaouli (Manalo-Camp, 2023).

According to tradition, freshwater belonged to Kāneikawaiola (Kāne of the life-giving waters). Therefore, water, like sunlight, as “a source of life to land and man, was the possession of no man, even the ali'i nui (high chief) or mō'i (king)” (Handy et al., 1972, p. 63).¹⁷ Instead, the ali'i channeled their dominion as trustee, a concept enshrined in Hawai'i's first constitution¹⁸ and remains at the heart of Hawai'i's current public trust doctrine, which articulates the State's kuleana (responsibility) as trustee (Haw. Const. art. XI, § 1).¹⁹ It is the legal duty

¹⁶ The continuous flow of freshwater into the ocean supports critical habitats for endemic species like 'opae (Hawaiian shrimp) and 'o'opu (Hawaiian goby), and creates areas of brackish water that attract herbivorous fish.

¹⁷ The right to use water “depended entirely upon the use of it” (Handy et al., 1972, p. 61). For this reason, a “spirit of mutual dependence and helpfulness prevailed” (p. 61) and streamflow was used always with respect for downstream users and the health of the stream itself. If you “abandoned or neglected” (p. 64) the water, land, or fishing grounds you lost your right to it.

¹⁸ The land and its resources from Hawai'i to Ni'ihau were “not [the King's] private property. It belonged to the chiefs and people in common, of whom [the King] was the head, and had the management of landed property” (Haw. Const. of 1840 as cited in Sproat, 2009).

¹⁹ “For the benefit of present and future generations, the State and its political subdivisions shall conserve and protect Hawai'i's

to Aloha ‘Āina that prioritizes care of land and community above individual ownership and wealth (Sproat & Palau-McDonald, 2022).

While the Māhele of 1848 incorporated principles of private property ownership, it also ensured that all lands granted were “subject to the rights of Native tenants” who retained a “vested” interest in the land (MacKenzie & Sproat, 2017, pp. 503–505).²⁰ The Kuleana Act of 1850 offered *hoā‘āina* (Native tenants) the opportunity to obtain fee simple title to the lands they cultivated and resided upon.²¹ Kuleana lands were some of the most productive lands and were often used for wetland *kalo* prior to the diversion of water. Even as parcels of land were being distributed to individuals, traditional and customary rights were protected, and the waters associated with those lands were not privatized. Section 7 of the Kuleana Act reaffirmed Native Hawaiian rights to continue traditional fishing and gathering practices throughout the *ahupua‘a* for noncommercial use, and declared “springs of water, running water, and roads shall be free to all, on lands granted in fee simple” (MacKenzie & Sproat, 2017, p. 509; Haw. Rev. Stat. § 7-1).²²

The Rise of King Sugar

Following the Māhele, large tracts of land fell into the hands of *haole* sugar planters and businessmen (MacLennan, 2014). This transfer coincided with an increased demand for Hawai‘i sugar due to disruptions in American sugar caused by the Civil War.²³ The expansion of plantation agriculture on Hawai‘i’s dry leeward plains required vast quantities of water diverted in ditches from the *kalo*-growing windward valleys. All water licenses issued under the Kingdom permitting diversion included the

express condition that “the existing rights of present tenants of said lands or occupiers along said streams” would not be “lessened or affected injuriously” (Maly & Maly, 2001, p. 444). It was not until after the illegal overthrow and annexation of Hawai‘i that the number of ditches increased exponentially, tripling in the decades that followed as shown in Figure 4.

An understanding of the central role of water within Native Hawaiian foodways provides context for the extent of harm caused by its removal and the ongoing pattern of dispossession and displacement that continues today. Many wetland *kalo* growers, unable to sustain themselves on their land in their culture, were uprooted from their ancestral lands and forced into the cash economy to find work on plantations or in the growing cities. As the number of ditches increased, so did the number of Hawaiians living in crowded tenements of Honolulu where they were exposed to foreign diseases they lacked immunity to. From 1910 to 1920, the number of Hawaiians living in the city of Honolulu increased from 13,520 to 17,530 (McGregor, 1990). That same decade, the population of pure Hawaiians continued to decline from 26,040 to 23,720—less than 3% of the estimated population of 1 million prior to European arrival in 1778 (Stannard, 1989; U.S. Bureau of the Census, 1931).

Displacement, Food Insecurity, and the Thrust of Americanization

The structural process of settler colonial elimination involves the removal of Native people from the land. During the territorial years, the United States exerted “direct colonial rule” over the islands, setting in motion the systematic erasure of Hawaiian language, history, and cultural identity

natural beauty and all natural resources, including land, water, air, minerals and energy sources, and shall promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency of the State. All public natural resources are held in trust by the State for the benefit of the people” (Haw. Const. art. XI, § 1). This was added by the 1978 Constitutional Convention and election on November 7, 1978.

²⁰ Those lands included the 984,000 acres of Crown Lands and the 1.5 million acres of Government Lands that resulted from the Māhele to be “set apart forever to the chiefs and people of [the] Kingdom” (Privy Council Minutes, 1847, p. 282).

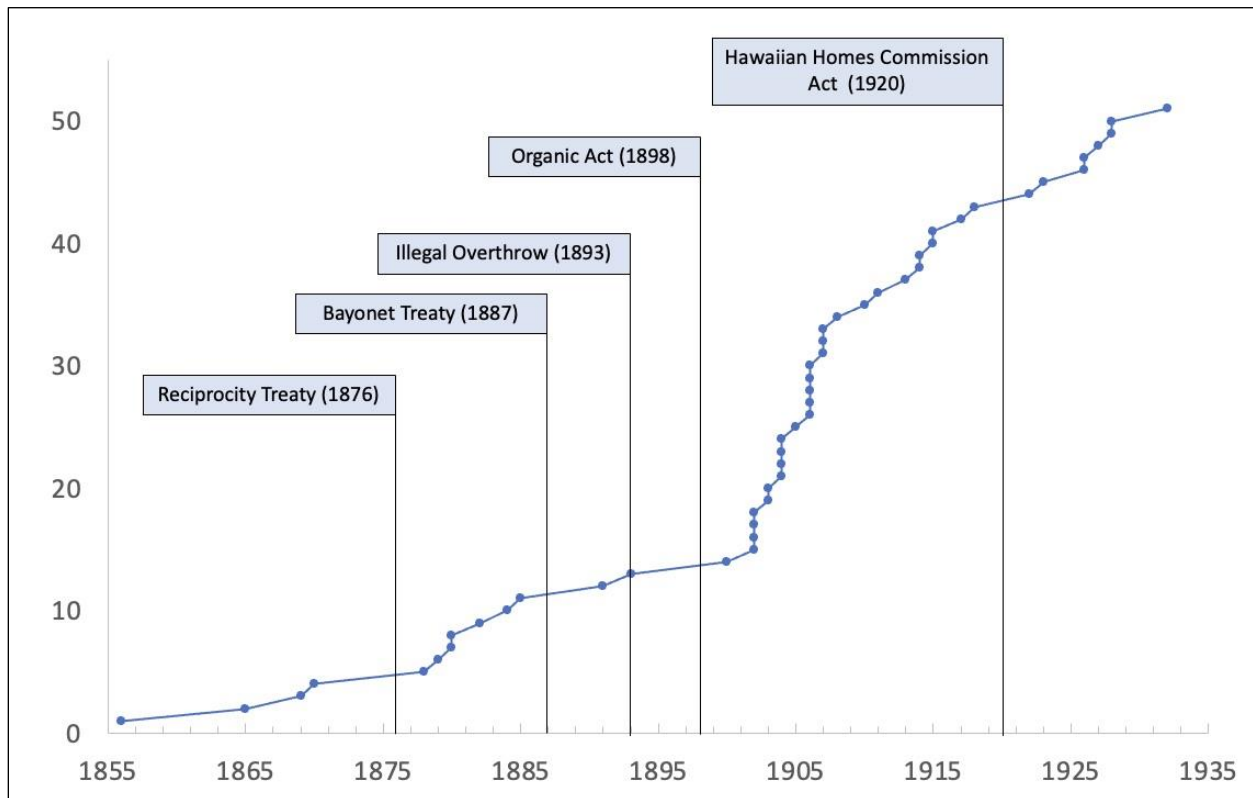
²¹ Previously, those lands were held in trust by the *konohiki*, lesser chiefs who functioned as land and water managers.

²² Kamehameha III added the amendment with concern for the value of land without the ability to “a little bit of land, even with an allodial title, if they were cut off from all other privileges, would be of very little value” (Privy Council Minutes, July 13, 1850, p. 713).

²³ As northern states were denied access to the sugar-producing South, there was an increase in demand for sugar from alternative sources like Hawai‘i. Sugar increased from \$0.0695/lb. in the 1850s to \$0.1719/lb. by 1864 (Kent, 1993, p. 38).

Figure 4. Plantation Ditches

The number of plantation ditches tripled after the illegal overthrow and annexation of Hawai'i when American sugar planters took control of the government.



Graphic created by author using ditches listed by Carol Wilcox (1997, Table 4, pp. 64-67).

that carried into statehood in 1959 (Taira, 2021). And yet, Native Hawaiian belief systems and ceremonies, chants, hulas, and healing practices carried on—often protected by families with a continuous line of knowledge and within more remote Hawaiian enclaves.

Dr. Davianna McGregor (2007) uses the term cultural *kīpuka* to describe those places that were “bypassed by major historic forces of economic, political, and social change in Hawai‘i” (p. 8). *Kīpuka* refers to the areas of land spared during a lava flow. In the same way *kīpuka* of old growth forest contain seeds for regeneration, the continuity of Hawaiian land-based knowledge and spiritual practices held within cultural *kīpuka* would prove invaluable to the regeneration of Hawaiian culture in the 1970s and the protection of Kaho‘olawe.

The Protect Kaho‘olawe ‘Ōhana was one

movement within the groundswell of activism that took place in response to the forces of settler colonialism that accelerated in the wake of statehood in 1959. Conflicts over land and water went hand in hand with the work of cultural revitalization that rescued Hawaiian language, culture, and history from the brink of extinction. The first uprisings and acts of civil disobedience erupted in response to the wave of evictions that cleared rural communities to make way for new development and an influx of wealthy Americans.

While evictions had frequently occurred since the Organic Act of 1900 enabled the U.S. military to seize land through eminent domain, displacement accelerated rapidly with the economic transition to tourism. Statehood heralded a period of economic growth fueled by unchecked development. As plantation agriculture phased out, tourism phased in with land still largely controlled by the

“Big Five” plantation oligarchy (Kent, 1993).²⁴ Landlords partnered with American developers to urbanize Hawai‘i, taking advantage of Hawai‘i’s tourism and development boom (Trask, 1987). In the decade that followed, the number of hotel rooms tripled, and the number of visitors increased fivefold, reaching 1.75 million visitors in 1970 (Southichack, 2007; McGregor 2010).

While tourism had been identified and promoted by the Territorial Government soon after the overthrow, the industry was now propelled by jet travel and the newfound disposable incomes enjoyed by Americans after World War II.²⁵ Concurrently, the post-war technological advances in food production and distribution, including the use of chemical fertilizers, pesticides, and preservatives, along with global trade, facilitated an increase in food imports to satisfy the new demand.

When sugar and pineapple production began to decline in 1966 due to rising labor costs and international competition, there was no government plan in place to convert those prime agricultural lands into local food production to meet Hawai‘i’s growing population (Southichack, 2007). Instead, land and water monopolized by plantation agriculture were repurposed, welcoming expensive residential subdivisions, luxury resorts, and exclusive golf communities. According to McGregor, recent director of the Ethnic Studies’ Center for Oral History at the University of Hawai‘i, “agricultural workers were being channeled to go work in hotels, and resources that had been going to agriculture, especially water resources, were now being redirected to resort development.”

The future of Hawai‘i’s local food security was further compromised as the Indigenous infrastructure that had supported Native Hawaiian food systems was destroyed and redeveloped. For example,

Maunalua—the area now known as Hawai‘i Kai—was once home to the largest fishpond on all the islands, Keahupua o Maunalua or Kuapā fishpond. In the 1950s, rural communities were displaced, and the land was developed into expensive subdivisions. Now the site of the Hawai‘i Kai Marina, Kuapā fishpond originally encompassed 523 acres (212 ha), and each acre produced 300–500 pounds (136–227 kg) of herbivorous fish annually (Kame‘eleihiwa, 2016, p. 55).²⁶ Loko i‘a produced protein “100 times more efficiently than the natural food chain” (Kelly, 1989, p. 84).

As development reached farther into the most remote areas, rural Hawaiian communities were “suddenly shaken by eviction notices and ‘No Trespassing’ signs” (Sanburn, 1991, p. 11). Simultaneously, young people, radicalized by the Vietnam War and movements for social justice on the continent, began to take action. McGregor, a founding member of the University of Hawai‘i Ethnic Studies program that was heavily involved in these early protests, shared how her generation understood various movements at that time:

When I got involved in Ethnic Studies, it was coming out of the Civil Rights Movement and the anti-war movement. And then, of course, our student movement. ... The war was still going on and the racism was so evident upon Indigenous and Native peoples, and Asians especially. ... Ethnic Studies was part of the whole consciousness of Native Hawaiian and “local” [people], in opposition to this Americanization, an assimilation that’s really forced upon us, especially after statehood and with the whole shift toward an American tourist market.

²⁴ The Big Five refers to the companies (Alexander & Baldwin, Ltd., American Factors, Ltd., C. Brewer & Co., Ltd., Castle & Cooke, Ltd., and Theo. H. Davies & Co., Ltd.) that had their start in sugar and came to dominate Hawai‘i’s political and economic affairs. The plantation oligarchy refers to the intertwined families of missionary descendants who founded those companies and amassed their fortunes through the sugar industry (Cooper & Dawes, 1985).

²⁵ Many of the same missionary descendants who orchestrated the overthrow, like Lorrin A. Thurston, were strong advocates for tourism. Thurston headed the Hawaii Promotion Committee, established in 1903 (Mak, 2015).

²⁶ Native Hawaiian historian Dr. Lilikalā Kame‘eleihiwa explained in my interview with her that there were still 114 fishponds on O‘ahu in 1881, more than all the other islands combined. These fishponds totaled 3,600 acres (1,500 ha), which means over a million pounds (454,000 kg) of fish were annually produced on O‘ahu alone. This is why the island was known as an ‘Āina momona, a land fat with food.

In 1971, Kalama Valley became the site of anti-eviction protests that sparked uprisings across the islands. The Bishop Estate, which controlled 10% of the islands, conducted the evictions. Founded by Princess Pauahi Bishop in 1884, the Estate's sole beneficiary was Kamehameha Schools, an institution originally intended for the education of Native Hawaiian children. Ironically, the Estate's board of trustees was dominated by Hawai'i's rich and powerful who were not of Native Hawaiian ancestry (Trask, 1987). In the 1950s, Bishop Estate partnered with Henry Kaiser to develop all of its land holdings on the east end of O'ahu through the Kaiser-owned Hawai'i Kai Development Company (Trask, 1987).

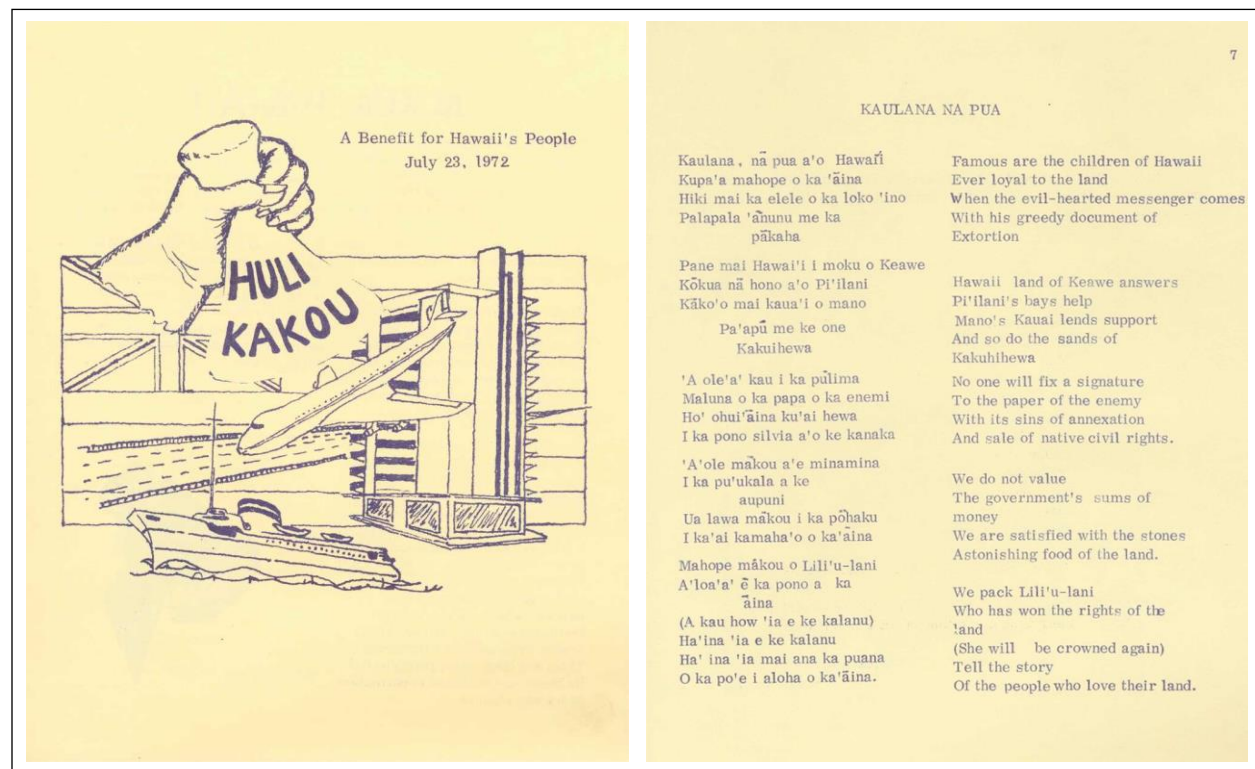
Many tenant farmers who refused to move had already been displaced from Hawai'i Kai and other valleys prior to Kalama Valley, the last undevel-

oped valley between the city of Honolulu and the windward side of O'ahu (Trask, 1987, p. 129).²⁷ A revolutionary and multi-ethnic confederacy of groups called Kōkua (Help) Hawai'i led the anti-eviction protests on O'ahu. Their slogan "Huli!" means to overturn or reverse. Huli is also the shoot of the kalo plant that is used for propagation. Seen in Figure 5, the image of an upheld poi pounder on the front of a 1972 pamphlet by Kōkua Hawai'i invokes political solidarity and the Hawaiian alternative in agricultural terms (Trask, 1987).

According to McGregor, "farming and self-sufficiency was one of the main issues" for Ethnic Studies. They saw the new development destroying important agricultural lands and fishponds as a major threat to the rural lifestyle Hawai'i had always known. It became clear that "a way of life was at stake, and protection of our island resources

Figure 5. 1972 Pamphlet by Kōkua Hawai'i

The words to Kaulana Na Pua (Famous are the Flowers) is found on page 7, calling on the seeds of resistance planted at the time of the overthrow. This song of protest written is also titled Mele 'Ai Pōhaku (Stone Eating Song) and He Lei no ka Poe Aloha 'Āina (A Lei for Those who Love the Land). (Kelly, 1972)



²⁷ The territorial period had created several land-rich but capitol-poor landlords who teamed up with developers from America to take advantage of the development boom and urbanization of Hawai'i.

was at stake, and our ability to feed ourselves was at stake.” In Figure 6, the demands of Kōkua Hawai‘i reflect this concern for self-sufficiency.

While they were unable to save Kalama Valley, the network of organizers who met on the frontlines, facing bulldozers and police, would later spring into action at a moment’s notice to stop future evictions. Their ongoing efforts inside and outside of the system would protect important food systems, including the ahupua‘a of He‘eia, now a center of land-based education and home to the largest working loko i‘a on O‘ahu, and the valleys of Waiāhole-Waikāne on the windward side of O‘ahu, seen in Appendix B. The generational kalo growers and kuleana land holders of those valleys would also go on to win major legal battles for water rights using laws established by the Hawaiian Kingdom that were reaffirmed by the 1978 Constitutional Convention.

Huli in the Court: Restoring Indigenous Laws

Alongside the rapid phase of development and displacement, statehood also brought certain rights. During the territorial years, Hawaiians had no power, authority, or representation. As U.S. citi-

zens, Hawai‘i’s residents could elect their governor, which in turn resulted in more representative judicial appointments. In 1966, William S. Richardson became the first Kanaka Maoli to hold the State of Hawai‘i’s highest judicial post. During his 16-year tenure as chief justice of the Hawai‘i Supreme Court, he presided over several landmark decisions that recognized Hawai‘i’s unique cultural and legal history.

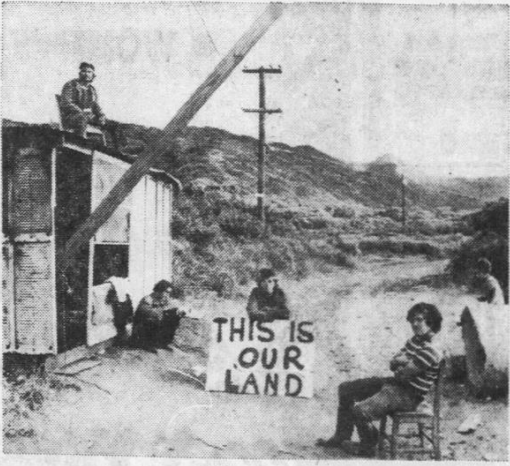
In 1973, the Supreme Court’s *McBryde Sugar Co. v. Robinson* decision looked to the principles of traditional Hawaiian water usage to interpret the law, reversing territorial decisions that had treated water as private property (MacKenzie, 2010). When a conflict over water rights between two sugar companies was brought to the Hawai‘i Supreme Court, the court ruled that neither of the companies owned the water. Instead, it was “reserved” by the State for the common good of the people of Hawai‘i. The court ruled that private ownership of water was never conveyed with the fee simple title established by the Māhele and affirmed Section 7 of the Kuleana Act, currently Hawai‘i Revised Statutes § 7-1, which protects traditional subsistence practices and ensures that springs and running water are free to all.

Figure 6. Demands of Kōkua Hawai‘i

This full-page advertisement published in the *Hawai‘i Star Advertiser* in 1971 listed the demands of Kōkua Hawai‘i, which indicate a strong commitment to defending Hawai‘i’s land, water, and agricultural self-sufficiency.

KOKUA HAWAII PEOPLE'S LAND PROGRAM

1. WE MUST SAVE OUR FARM LANDS TO GROW FOOD ON. WE MUST STOP THE DEVELOPERS WHO WANT TO POUR CONCRETE OVER EVERYTHING.
2. WE MUST STOP PEOPLE FROM MOVING HERE UNTIL WE CAN FIRST TAKE CARE OF OUR OWN LOCAL PEOPLE'S NEEDS.
3. WE MUST TAKE CARE OF OUR AIR, LAND AND WATER. IF WE KILL NATURE, NATURE WILL KILL US.
4. WE MUST GET BACK OUR LAND FROM THE FEW BIG LANDHOLDERS THAT HAVE ALMOST ALL OF IT. IT WAS STOLEN FROM US IN THE FIRST PLACE.
5. WE MUST USE OUR LAND TO HOUSE AND FEED OUR PEOPLE AND LEARN TO RELY ON OURSELVES TO DO IT — NOT ON THE MAINLAND.
6. AS A START, WE DEMAND THAT KALAMA VALLEY BE SAVED FOR THE LOCAL PEOPLE AND THAT THE TOURIST AND HIGH-INCOME DEVELOPMENT PLANNED BY BISHOP ESTATE AND HAWAII-KAI BE STOPPED.



Source: *Hawai‘i Star Advertiser*, 1971.

While the laws protecting traditional and customary rights established by the Hawaiian Kingdom were overlooked during the Territorial years, they had survived due to the language of the Organic Act²⁸ and Admissions Act that allowed Kingdom Law to “continue in force.”²⁹ In 2007, Chief Justice Richardson reflected on his approach as upholding Hawai‘i’s “unique legal system, a system of laws that was originally built on an ancient and traditional culture.” A testament to the magnetic force of Aloha ‘Āina, his court “set about returning control of interpreting the law to those with deep roots in and profound love for Hawai‘i” (Richardson, 2007, as cited in Mackenzie, 2010, p. 6).³⁰

Hui Alaloa and Access Rights

As people became knowledgeable about Hawaiian law, more protests emerged in the 1970s. On Moloka‘i, Hui Alaloa (Group of the Long Trails) was formed by members who would later lead the Protect Kaho‘olawe ‘Ōhana. Hui Alaloa sought to regain rights of access to alaloa, traditional trails encircling every island that protected subsistence hunting, fishing, and gathering rights under the first law of Kamehameha I, Kānāwai Māmalahoe: The Law of the Splintered Paddle (Hawai‘i Legal Auxiliary, n.d.).

Learning about land rights and spending time with nā kūpuna, early members of Hui Alaloa began to realize how much had changed and discovered meaningful support for their cause. Walter Ritte, Jr. is a long-time activist and kupuna who continues to lead and inspire Indigenous rights

efforts on several fronts.³¹ Reflecting on how and why he became a founding member of Hui Alaloa prior to PKO, Ritte explained that he was constantly being arrested for hunting to feed his family—a course of action justified under Kānāwai Māmalahoe.

That law was to protect people on the trails so that they could feed their families. It’s like, “okay, that’s what we’re trying to do!” So the trails, the alaloa, was always open and you are protected and you could use those trails. And now we couldn’t.

On July 4, 1975, Hui Alaloa organized its first protest, a Hawaiian rights demonstration in defense of Kānāwai Māmalahoe. The march attracted a lot of press as “Molokai demonstrators—including the aged, men, women and children—were challenging the powerful Molokai Ranch Co.’s policy of forbidding public right-of-way to the sea on old Hawaiian trails that crisscross its property” (Lueras, 1975, p. 3).

Ritte, seen in Figures 7 and 8, explained how the alaloa ran along the coastline to protect subsistence fishing and gathering, but Moloka‘i Ranch had erected fences restricting access to beaches on Moloka‘i’s west end where it was planning a multi-million dollar resort complex. About a hundred demonstrators marched along the traditional trail, taking down the fences that restricted access. Although protestors were warned they would be arrested as police officers brought over on barges from Maui stood by, “we knew anything from the

²⁸ The Hawaiian Organic Act of 1900, which made Hawai‘i a territory, declared “the laws of Hawaii not inconsistent with the Constitution or laws of the United States or the provisions of this Act shall *continue in force*, subject to repeal or amendment by the legislature of Hawaii or the Congress of the United States.”

²⁹ The Admission Act of 1959 made Hawai‘i a state. “All Territorial laws in force in the Territory of Hawaii at the time of its admission into the Union shall *continue in force* in the State of Hawaii, except as modified or changed by this Act or by the constitution of the State, and shall be subject to repeal or amendment by the Legislature of the State of Hawai‘i.”

³⁰ He goes on to say, “The result can be found in the decisions of our Supreme Court beginning after Statehood ... consistent with Hawaiian practice, our court held that the beaches were free to all, that access to the mountains and shoreline must be provided to the people, and that water resources could not be privately owned” (William S. Richardson, Spirit of Excellence Award Acceptance Speech at the ABA Spirit of Excellence Awards Luncheon, 2007, as cited in MacKenzie, 2010).

³¹ Ritte continues to challenge Moloka‘i Ranch with his involvement in community-led efforts to reclaim Hawaiian lands and waters. In 2019, he was one of the 38 kūpuna arrested for protecting sacred land on the frontline of Mauna Kea. As an environmental activist, Ritte has fought against the agrochemical industry’s stronghold in Hawai‘i and helped rally the visceral community uproar that halted the patenting and genetic engineering of three kalo varieties by the University of Hawai‘i College of Tropical Agriculture and Human Resources (UH-CTAHR) in 2002.

Figure 7. Walter Ritte, Jr., Founding Member of Hui Alaloe and Protect Kaho'olawe 'Ohana

Photo taken at Keawanui Fishpond, Moloka'i, in December 2022



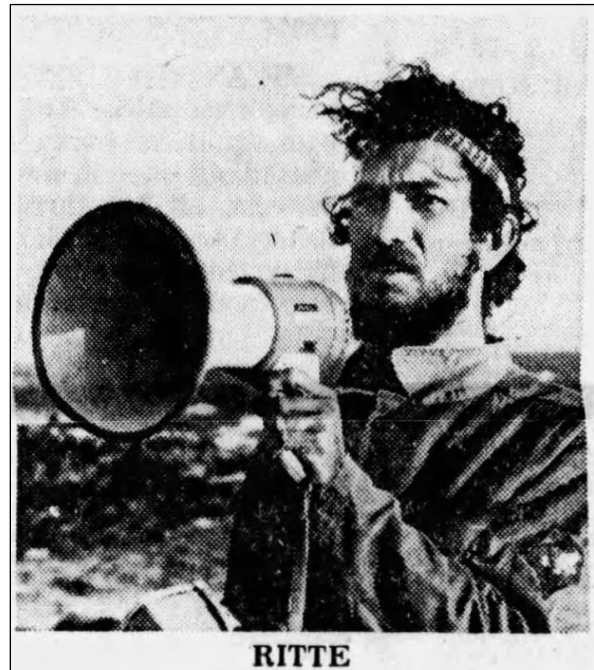
Photo credit: Puanani Apoliona-Brown.

high watermark down was public.”

Noa Emmett Auwae Aluli was a young doctor from O'ahu and another founding member of Hui Alaloe and PKO. He had moved to Moloka'i to research the impacts on Native Hawaiian health caused by the transition to tourism occurring on every island. At the protest, he told a reporter that in addition to having access to the beach, “the people of Molokai really need fishing areas, because seafood supplements their generally low incomes” (Lueras, 1975, p. 3). Upon reaching Kawākiu Beach, the march ended in an impressive display of the abundance of Moloka'i, described in *The Honolulu Advertiser* as “one of the most-complete Hawaiian luaus this reporter has seen during some 12 years in the Islands” (Lueras, 1975, p. 3).

Figure 8. Walter Ritte, Jr., During the Hawaiian Rights Demonstration

Ritte was featured in the *Honolulu Advertiser* holding a megaphone on July 4, 1975.



Forging Native Rights Alliances In and Beyond Hawai'i

The young Native rights activists of the Hawaiian Renaissance frequently flew to neighboring islands to support each other's protests, fundraisers, and events, strengthening relationships between groups and their political analysis along the way. As questions surrounding Hawaiian land and sovereignty emerged, alliances were also made outside of Hawai'i as Kānaka Maoli organizers looked to the struggle for self-determination led by First Nations on the continent.

Stephen Kāneai Morse, seen in Figure 9, was a founding member of the Hawaiian Coalition of Native Claims (HCNC),³² a legal advocacy group modeled after the Native American Rights Fund.³³ Morse spoke with me about his early involvement in Hui Alaloe's marches and PKO,

³² HCNC is now the Native Hawaiian Legal Corporation, a legal advocacy group dedicated to the advancement and protection of Native Hawaiian rights, culture, and identity that has won the restoration of streamflow to kalo growers in East Maui, dewatered for over a century.

³³ According to Morse, NARF, led by John Echohawk, came to Hawai'i in 1974 to support Kānaka Maoli in starting something similar.

Figure 9. Stephen Kāneai Morse

Morse was interviewed at this farm in Waimānalo, O‘ahu, Hawaii, in December 2022.



Photo credit: Puanani Apoliona-Brown.

and his interest in the strategies of First Nations beyond Hawai‘i.

Morse shared how it was HCNC’s “legal research on Kaho‘olawe that led to it being the subject of our occupation.” After letters and formal requests to join state officials on a monitoring tour of the island were repeatedly denied, a contingent of Native Hawaiians went to the 1975 National Congress of American Indians conference held in Portland, Oregon.

We were really interested in finding out how the tribes interacted with government, both state and federal levels. We had no clue what we were doing, right? And we’re talking about sovereignty, and we’re talking about self-governance. But we had no idea what that all

meant. So, little by little we learned from the tribes.

At the conference, they met members of the American Indian Movement who had recently occupied Alcatraz (1969–71) and Wounded Knee (1973). Their use of direct action to gain recognition of treaty rights helped shift federal policy toward self-determination, ending the period of termination that was in effect from 1953 to 1970.³⁴ Morse recalls, “So they’re all saying, ‘why don’t you guys go occupy the island?’”

Kaho‘olawe: The First Landing

Kaho‘olawe is a small Hawaiian island about 6 miles (10 km) off the southwestern coast of Maui (see Appendix C). The island’s original name, Kohemālamalama o Kanaloa, speaks to its importance. It is the only Hawaiian island named after one of the four major akua (deities), Kanaloa, the god of the ocean, and was used to teach the art of Polynesian navigation. Morse described how the whales returned every year to give birth in the channel between Kaho‘olawe and Maui because of the abundance of food found in those waters.

Considered nothing more than a barren rock by the United States, the island was sequestered by the Navy on December 8, 1941, when martial law was declared following the attack on Pearl Harbor (Kaho‘olawe Island Reserve Commission, n.d.). The sacred island of Kanaloa soon became known as “The Target Island” and was used as a bombing range for fifty years. In 1971, attacks on the island intensified when the U.S. began to sponsor the Rim of the Pacific (RIMPAC) exercises every two years, inviting its Pacific allies to collectively bombard Kaho‘olawe among other war games.

The first landing on Kaho‘olawe was originally organized to gain traction behind a Hawaiian Native Claims Settlement Act that had stalled in Congress, which sought land or monetary reparations for the U.S.’s involvement in the illegal overthrow of the sovereign Indigenous government of

³⁴ House concurrent resolution 108 (HCR-108) resulted in the termination of over 100 tribes. The U.S. walked away from its treaty responsibilities, resulting in the loss of over 1 million acres of Native land that was removed from its protected status.

the Hawaiian Kingdom.³⁵ Activists were called from organizations across Hawai‘i, including Hui Alaloa and lawai‘a (fishermen) from Maui who had interest in the fishing grounds surrounding Kaho‘olawe. According to Aluli (1989), “We knew they needed Hawaiians who were fishermen and hunters, and Hawaiians who were into securing their so-called rights of access.”

While dozens had taken boats at dawn from Ma‘alaea Harbor on Maui, only nine reached the island, including Morse and leaders of Hui Alaloa. Aluli and Ritte broke away from the group and explored the island for two days before they were arrested by federal marshals. In an interview in 1989, Aluli recalled how the island revealed its cultural significance to them, “We weren’t really into looking for archeological sites, but all of a sudden all these ko‘as (shrines) and all these points just kind of came alive” (Aluli, 1989).

In witnessing the number of historic sites being used as targets, Ritte felt the bombing of the island was an attack on their history: “It’s almost like they were blowing up our library. ... If you’re there long enough you realize that the island itself was dying. Not only blowing up our history, but they’re killing the island.”

As the two were airlifted from the island, they could see Kaho‘olawe’s red soil bleeding out into the ocean without vegetation to hold the land, and they felt it calling them to “a deeper commitment to protect this land” (Aluli, 1989).³⁶ Afterward, they met with Helm to develop their messaging and reason for “trespassing” on the island. According to Aluli who, with Helm, had been researching his great-grand-aunt Emma Nāwahī’s involvement in Hui Aloha ‘Āina at the turn of the century (Alegado, 2023),

George was real clear. He says, “we gotta say it’s Aloha ‘Āina.” It’s the love of the land, it’s the life of the land. It’s that spirit, aloha, for the land. It’s going back to the land. It’s saving the land that’s important. ... This was the reason why Aloha ‘Āina came alive. And this was the motivating force that, that really saw us directly and clearly as to what we had to do. (Aluli, 1989)

This was the start of the Protect Kaho‘olawe ‘Ohana. As the generation began to learn the truth of what happened to the Hawaiian nation, they recovered a history stolen from them along with their religion, language, and culture. Upon reaching Kaho‘olawe, the young activists recognized something of themselves in the battered island, and they saw it as something worth saving. With the leadership of George Helm and the guidance of kupuna like Auntie Edith, the ‘Ohana, seen in Figure 10, built upon the energy for revolutionary change of the 1970s to cultivate a movement for the protection of sacred land, grounded in Aloha ‘Āina (see L. Apoliona quote, Appendix D). In 1994, title to Kaho‘olawe was officially transferred from the Navy to the State of Hawai‘i to be “held in trust” for the future “sovereign native Hawaiian entity” as recognized by the United States and the State of Hawai‘i (Haw. Rev. Stat. 6K).³⁷

PKO’s work restored a sense of spiritual connection to ‘Āina and brought public awareness to the injustices Native Hawaiians continued to suffer. Leimomi Apoliona’s personal records and notes speak to the sense of hope that motivated them to action:

We in the ‘Ohana felt that by unifying the desecrations of Hawaiian culture and the lāhui (nation), into an ideal symbolized by

³⁵ Charles Kauluwehi Maxwell, a fisherman from Maui and president of the Aboriginal Lands of Hawaiian Ancestry (A.L.O.H.A.), organized the landing. With the support and guidance of the Cook Inlet Region Corporation, which had won major settlements in Alaska, A.L.O.H.A. investigated the issue of the Crown and Government Lands “ceded” to the U.S. by the Republic of Hawai‘i in 1898 and fought for reparations.

³⁶ From the 1989 interview with Nā Maka o Ka ‘Āina, Aluli explained: “What this island showed us at that time was that it was a very beautiful island, an island that was being destroyed. An island that was actually calling us deeper to a commitment ... to motivate us to stop whatever destruction was happening.”

³⁷ “Kaho‘olawe shall be held in trust as part of the public land trust; provided that the State shall transfer management and control of the island and its waters to the sovereign native Hawaiian entity upon its recognition by the United States and the State of Hawai‘i” (Haw. Rev. Stat. § 6K).

Figure 10. Protect Kaho‘olawe ‘Ohana (PKO) Press Conference at the Bishop Museum, January 31, 1977

Featured in the foreground are Leimomi Apoliona (left) and Dr. Emmett Aluli (right).



Source: *Honolulu Star-Bulletin* photo by Terry Luke provided by Leimomi Apoliona.

Kaho‘olawe, we could help regenerate a new consciousness. The ideal was Aloha ‘Āina and the ‘Ohana as an organizing principle. By attempting to save Kaho‘olawe, we could bring to the public consciousness the urgent need to save the still viable Hawaiian culture and race. In fact, we have the audacity to believe that we just may have something to teach the world. (Leimomi Apoliona, personal records, n.d.)

The 1978 Constitutional Convention: Restoring Native Law

By the late 1970s, Native Hawaiians were channeling protest into political action. The 1978 Constitutional Convention (Con-Con) exemplified the decade of change catalyzed by the resistance to Americanization and the reclamation of Native Hawaiian rights. While a proposal to “preserve and enhance the heritage and culture of the Hawaiian people and encourage continued support of Hawaiian traditions” (State of Hawai‘i, 1972, pp. 517–518) was laughed off the floor at the Constitutional Convention held a decade prior (according to an interview with John Waihe‘e), the 1978 Con-Con marked a decisive shift in public consciousness as a result of the Hawaiian Renaissance.

In 1978, a delegate named Adelaide Keanuenueokalaniniuamamao “Frenchy” DeSoto from Wai‘anae, O‘ahu, channeled her experience with PKO into an agenda for bold change (Sanburn, 1991). According to former Hawai‘i governor John Waihe‘e,³⁸ not only did Auntie Frenchy create and chair a Hawaiian Affairs Committee, she made the strategic decision to staff her office with young activists representing a range of Hawaiian rights issues.

An important proposal ratified by the convention was the State’s reaffirmation of Native Hawaiian traditional and customary rights exercised for subsistence, cultural, and religious purposes (Const. Art. 12, § 7). The amendment brought added weight to laws of the Hawaiian Kingdom that already continued in force and remain critical to legal battles over water rights today. Significantly, the amendment applies to Native Hawaiians defined as lineal descendants of the original inhabitants of the islands, a definition

³⁸ A member of the first graduating class of the William S. Richardson School of Law at the University of Hawai‘i and the first Native Hawaiian governor of the State of Hawai‘i, Waihe‘e began his political career as a delegate to the 1978 Con-Con.

based on genealogy rather than blood quantum.³⁹ Because these rights protect kalo cultivation, which requires access to abundant streamflow, committee debates revealed ongoing tensions between Native Hawaiian rights and plantation interests, even as sugar and pineapple were phasing out (State of Hawai'i, 1980, p. 436).

All 34 proposed amendments to the State constitution passed in 1978. Constitutional amendments established the Office of Hawaiian Affairs to address the ongoing challenges of historical injustices to the Hawaiian people, restored 'ōlelo Hawai'i as an official language of the State, codified Māmalahoe Kānāwai as a symbol of the State's commitment to public safety, reaffirmed the protection of Native Hawaiian traditional and customary rights, and established a unique public trust doctrine grounded in Indigenous practice, requiring the protection and management of water for present and future generations (Haw. Const. art. XI, § 1; Haw. Const. art. XI, § 7). The Con-Con also mandated the establishment of an agency tasked with managing Hawai'i's water resources, which resulted in the creation of the Hawai'i Commission on Water Resource Management (CWRM) and the State Water Code in 1987. Every provision in the Hawaiian affairs package had its origin in the protests of the Hawaiian Renaissance.

The Ongoing Structures of Settler Colonial Occupation

Although the Protect Kaho'olawe 'Ohana was successful in stopping the bombing of Kaho'olawe, the U.S. military continues to bomb, occupy, and destroy sacred Hawaiian land.⁴⁰ The military occupies over 220,000 acres (89,000 ha) across the Hawaiian Islands—more than 5% of the total land

area—and controls approximately 85,000 acres (34,400 ha) on O'ahu alone, nearly 25% of the island (Grandinetti, 2014; U.S. Indo-Pacific Command, 2021). Just weeks before my research began, 1,100 gallons (4,164 L) of firefighting foam containing PFAs (aka “forever chemicals”) were released from the U.S. Navy's Red Hill Bulk Fuel Storage Facility on November 29, 2022. The leak compounded the 14,000 gallons (53,000 L) of petroleum jet fuel that had already leaked into O'ahu's sole source aquifer and contaminated the island's drinking water in November 2021.⁴¹

The Con-Con resulted in strong legal protections for the use of water for kalo cultivation in the Hawai'i State Constitution and Water Code, continually upheld in numerous court decisions. Furthermore, the State Water Code outlines the responsibilities of CWRM to prioritize public trust purposes over private commercial interests when balancing competing needs. And yet, commercial interests continue to wield tremendous power and influence over Hawai'i politics and economic priorities, resulting in ongoing conflicts.

According to a 2021 Maui water rates study, luxury hotels and resorts were charged the same water rates as single-family residents and less per thousand gallons for usage above 35,000 gallons (132,000 L) a month (Riker, 2022). To put this in perspective, Maui County Council Vice Chair Keani Rawlins-Fernandez explained how the Grand Wailea—which used nearly 500,000 gallons (1,900,000 L) of water a day⁴² in FY 2020 (Riker, 2022)—incurs no penalty for excessive water consumption, while single-family households are penalized despite using only an average of 10,000 gallons (38,000 L) of water a month. Simultaneously, commercial enterprises have avoided the

³⁹ This is referring to the 50% blood quantum used in the Hawaiian Homes Commission Act of 1920. While blood quantum remains the criteria for the HHCA today, the protection of Native Hawaiian traditional and customary rights such as kalo cultivation applies to all lineal descendants of the original inhabitants of Hawai'i. The amendment protects “all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by ahupua'a tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778” (Haw. Const. art. XII, § 7).

⁴⁰ Lands such as Pōhakuloa at the base of Maunakea on Hawai'i and Makua Valley on O'ahu continue to be used for live training exercises.

⁴¹ According to a federal survey, the contaminated water system—which serves over 93,000 individuals—caused thousands to suffer acute health impacts related to petroleum contamination (Troeschel et al., 2022).

⁴² According to Maui County documents, the Grand Wailea used a total of 172,340,000 gallons (652,000,000 L) of water in fiscal year 2020 (Riker, 2022).

harsh restrictions placed on local residents during droughts, an issue that brought national attention to Maui's water shortages and the impacts of over-tourism in 2021 (Lipscomb, 2021). As the number of annual visitors to Hawai'i reached 9.2 million in 2022, conflicts over water earned Maui a place on Fodor's "No List" discouraging travel to the island (Fodor's Travel, 2022).

For decades, Maui has been at the forefront of legal battles to protect Hawai'i's precious freshwater resources and restore streamflow for *kalo* cultivation. In 2022, under the leadership of Deputy Director M. Kaleo Manuel, CWRM voted to designate Maui Komohana (West Maui) as a Surface and Ground Water Management Area, an unprecedented decision triggering greater oversight by the state in managing water resources. Respected by the community for his understanding of Hawai'i's unique water laws relating to the environment and Indigenous rights, Manuel cited diminished rainfall due to climate change as one cause for the designation.

On August 8, 2023, Maui's water crisis reached a new level of urgency as a horrific wildfire swept the historic town of Lahaina, killing over 100 people. With Hurricane Dora passing to the south and a high-pressure system to the north, the fire ripped through parched fields of invasive grasses left in the footprint of the sugar plantations that had surrounded Lahaina. The embers spread easily, fanned by 80 mph winds, leaving over 2,000 buildings destroyed and around 8,000 individuals displaced.

At the height of the fires, hoses ran dry as firefighters and individuals tried desperately to save their homes, leading to questions about Maui's water supply. For Native Hawaiian families who have fought for streamflow restoration since the closure of Pioneer Mill Company's sugar operations in 1999, this tragedy is easily traced to over a century of settler colonialism that transformed

Lahaina from wetland to tinderbox through the diversion of streams and overexploitation groundwater aquifers.

In the days and weeks after the fires, the actions of government officials sent shockwaves through a community already reeling with overwhelming trauma and loss. On August 9, Governor Josh Green suspended the State Water Code⁴³ by emergency proclamation, threatening to undo years of hard work protecting minimum streamflow standards for *kalo* growers. On August 16, Manuel was reassigned following groundless accusations that he had delayed the release of stream water needed to fight fires—claims made by an executive at West Maui Land, a real estate development company (Corkery et al., 2023, para. 8).⁴⁴

On September 19, 2023, hundreds of written and oral testimonies were brought to the monthly CWRM meeting, calling for the reinstatement of Manuel and the State Water Code. Over the course of 12 hours, CWRM heard testimony highlighting the ongoing struggle for water, the very real fear of displacement by outside interests in rebuilding Lahaina, and a distrust of the priorities of the state. In her testimony, kupuna Mialisa Otis spoke to the changes that she witnessed since her childhood in Lahaina, picking fruit along Front Street on her way to school:

Our wai just came from everywhere. Going on the Pali (cliff), that's all you see. When there's rain, you see little streams coming down in every little crevice of land going through the Pali. We don't see that anymore because of the diversion and because of the diversion, we hurt. ... The only way we can rebuild is water. ... Wherever there is water, there is life, and we're not going anywhere. We're not going anywhere. (Hawaii Commission on Water Resource Management, 2023, 5:40)

⁴³ The Water Code (Hawai'i Revised Statutes chapter 174C) incorporates public trust principles in balancing public and private water interests and outlines the responsibilities and composition of the State Water Commission, "as well as its directives for appropriately managing ground and surface water" (Sproat, 2009, p. 9).

⁴⁴ In a press conference on August 14, 2023, Governor Josh Green declared, "there has been a great deal of water conflict on Maui for many years. ... People have been fighting against the release of water to fight fires. I'll leave that to you to explore." The next day, an article was published insinuating that a delay in the release of water to fight fires was caused by an over deference to *kalo* growers, even as the vast majority of Maui's water flows toward resorts and private interests.

Conclusions and Further Research

My fieldwork was bookended by tragedies involving water that highlight how the same forces of settler colonial erasure that sparked protest during the Hawaiian Renaissance continue to this day. For Kānaka Maoli, the fight for water is part of the ongoing struggle for self-determination. Despite the State of Hawai'i's constitutional mandate to manage water as a public trust resource, to protect Native Hawaiian traditional and customary rights, and to ensure adequate streamflow for cultural and ecological purposes such as kalo cultivation, streams continue to run dry because they are diverted for commercial use (Sproat, 2011). While the harm caused by the military and tourism echoes a familiar refrain, what is even more constant lies in the heart of the Hawaiian people and their unwavering commitment to Aloha 'Āina.

Sam Ka'ai, a respected kupuna and master carver, lost his life's work in the Lahaina fires. His collection of carvings and cultural artifacts from his voyages with the Hōkūle'a⁴⁵ was housed within the beloved Nā 'Aikāne o Maui Cultural Center, which burned to ashes along with a vast archive of ancient artifacts and historical pieces from the Hawaiian Kingdom. In the aftermath of the terrible destruction, Ka'ai dreamt of seeds. He saw the community planting traditional seeds and medicine in the ashes, and the return of kalo to the 'Āina (Ahia & Goodman, 2023).

As Lahaina looks ahead to how it will rebuild in the aftermath of the fire, its Native people are directed by a sense of purpose that extends beyond the present, to past and future generations. There is an urgent call for the return of water to Malu 'Ulu o Lele and for the future of Lahaina to be decided by community leaders, not land development companies. Steps forward should involve inventory and forecasting of the appurtenant water rights⁴⁶ within Maui Komohana, and better resourcing of CWRM to uphold its constitutional mandate. The restoration of the wetlands of Mokuhinia and the island of

Moku'ula would be a powerful example of what is possible through Indigenous leadership and the restoration of traditional food systems.

In Hawai'i, the history of water is tied to colonial violence and power. It is also tied to Indigenous survivance, resurgence, and Native Hawaiian law. While Indigenous water rights are uniquely codified within the Hawai'i State Constitution due to Hawai'i's history as a sovereign and internationally recognized Indigenous nation, similar forms of Native land and water governance sustained traditional foodways and thriving communities for millennia prior to colonial invasion elsewhere. As water scarcity is fast becoming a global challenge (Jones et al., 2024), First Nations fighting to protect precious freshwater sources, remove dams, and restore streams are revealing a path forward grounded in the rights of nature, or rather a sense of kuleana to our non-human relatives. Future research that brings together Food Studies, Native Studies, and law would benefit by examining the intersection of Indigenous foodways, treaty rights, and environmental protection. 

Acknowledgements and Dedication

Thank you to the First Nations Development Institute for its generous support. To my parents and everyone I interviewed for this project, mahalo for sharing your time, stories, and mana'o (thoughts) with me. It is a privilege to have had this chance both learn and share this history. A special thank you to Dr. Davianna McGregor for generously guiding and speaking with me while also mourning the loss of her life partner, our beloved Dr. Noa Emmett Aluli. Uncle Emmett was a dear friend of my mother's and a major inspiration for this project. To the generation who brought about the Hawaiian Renaissance, mahalo nui loa.

I dedicate this article to Dr. Noa Emmett Auwae Aluli, who joined the ranks of na 'aumākua (the ancestors) on November 30, 2022. A founding

⁴⁵ Sam Ka'ai carved the female and male ki'i—Kiha Wahine Ka Mo'o o Malu Ulu o Lele and Kāne o Hōkūle'a Ka Lani—that were lashed to the manu of the Hōkūle'a. The ki'i offered protection and guidance for the historic voyage in 1976, which marked the rebirth of the Indigenous art of Polynesian navigation during the Hawaiian Renaissance.

⁴⁶ Appurtenant water rights of "kuleana and taro lands" are the rights of parcels of land that were cultivated, usually in kalo, at the time of the Māhele (Haw. Rev. Stat. §174C-101[d]). They have the highest level of protection under the law (Sproat, 2009, p. 10).

member of the Protect Kaho‘olawe ‘Ohana and Hui Alaloa, Uncle Emmett dedicated his life to the lāhui and the protection of Kaho‘olawe.

“The health of the land is the health of our people is the health of our nation.”
—Noa Emmett Aluli

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Appendix A. Lo'i Kalo and Ahupua'a

Figure A1. Traditional Lo'i Kalo System and Water Use

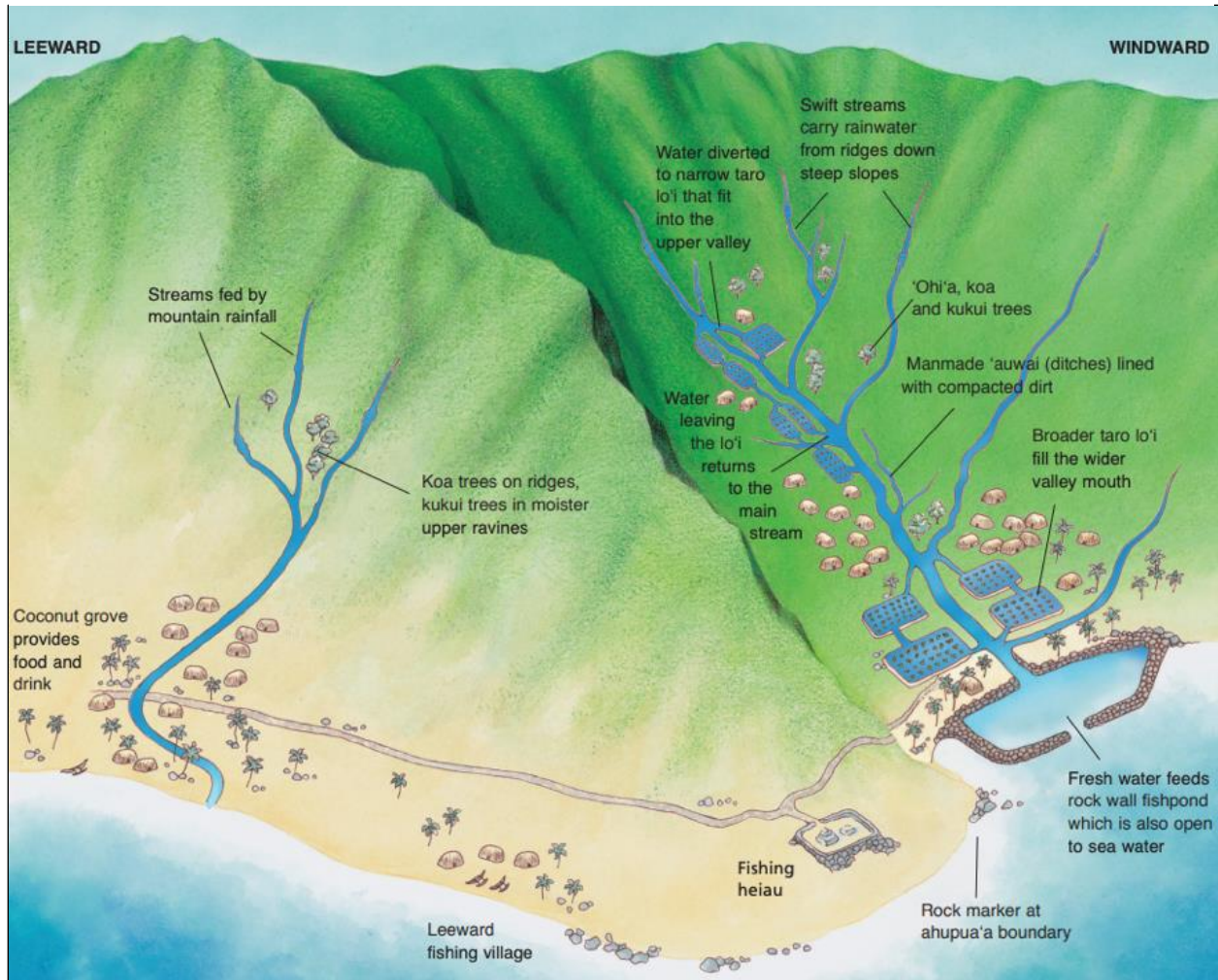


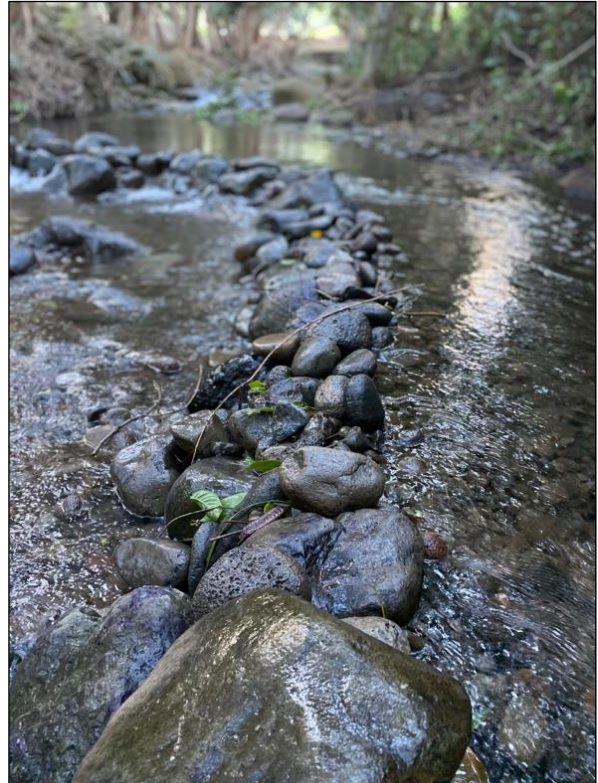
Image source: Hawai'i Board of Water Supply.

Figure A2. Pictured with Leimomi Apoliona, Water Rights Activist Hōkūao Pellegrino Clears Debris from the ‘Auwai Upstream of Noho‘ana Farm After a Storm

The ‘auwai system is maintained by the community of kalo farmers who uses it. Waikapū Maui, December 2022.



Figure A3. Stacked Stones Change Water Levels, Directing Streamflow into ‘Auwai And Lo‘i Kalo Fed by Waikapū Stream, Maui



Appendix B. He'eia & Waiāhole-Waikāne today

Figure B1. Lo'i Kalo at Kāko'o 'Ōiwi in He'eia

Once slated for development, the ahupua'a of He'eia is now a center for land-based education due to community organizing and the efforts of groups like Ethnic Studies that had fought the Kalama Valley evictions.



Figure B2. The Water that Irrigates the Lo'i Kalo of Kāko'o 'Ōiwi Flows into the Fishpond at Paepae o He'eia, the Largest Working Loko I'a on O'ahu

Plans to have the area dredged and made into a marina were stopped by community resistance.



Figure B3. The First Legal Battles for Water Rights were Waged by the Kalo Farming Community of Waiāhole-Waikāne

Water rights veteran Charlie Reppun with his lo'i at Waianu Farm. Waiāhole-Waikāne, January 2023.



Appendix C. Kaho‘olawe

Figure C1. Kaho‘olawe is a Small Hawaiian Island about 6 Miles off the Southwestern Coast of Maui
The island’s original name is Kohemalamalama o Kanaloa.

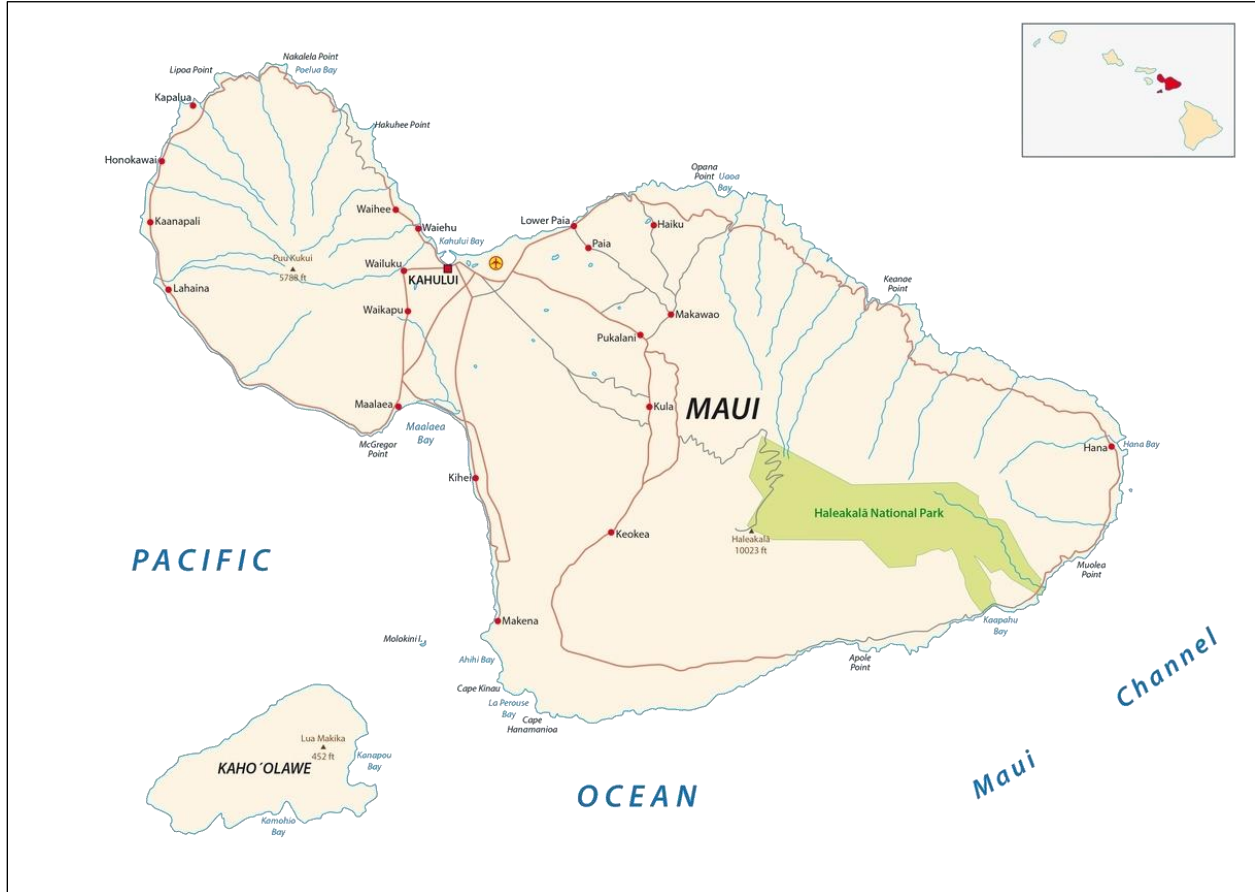


Image source: *Hawai‘i Life*, 2017.

Appendix D. Quotes

“We didn’t know nothing. I mean, we didn’t know the language. We never know our history. We never know nothing. So, if the kūpuna wasn’t talking to us, we don’t know where we would’ve ended up.”

—Walter Ritte, Jr., personal communication, 2022

“The prosperity which the military so greatly enhances, may not be worth the price. Fire power for Freedom and Aloha ‘Āina are both slogans: However, the former is negative in scope, whereas the latter is life-affirming and life is what Kaho‘olawe is all about.”

—Leimomi Apoliona, May 21, 1977, *Honolulu Star Bulletin*, p. 9

A framework to guide future farming research with Indigenous communities

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Research Fellowship



FIRST NATIONS
DEVELOPMENT INSTITUTE

Submitted February 24, 2024 / Revised September 8 and October 28, 2024 /
Accepted October 29, 2024 / Published online January 28, 2025

Citation: Hayden, D., & Hayden, A. (2025). A framework to guide future farming research with Indigenous communities. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 59–73. <https://doi.org/10.5304/jafscd.2025.141.022>

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Abstract

We present a framework to guide applied research with Indigenous Peoples. Indigenous cropping systems are relevant to scientifically addressing many of the shortcomings and problems regarding current cropping systems. Indigenous food sovereignty movements are currently preserving and expanding their cropping system food ways. The knowledge underlying these efforts is not static but dynamic, incorporating contemporary tools in ever changing environments. We highlight four principles of Indigenous farming that are reflected in both practice and cultural traditions: polycultures, seed-keeping, sustainability, and community. These principles have been pivotal to the primary author's doctoral research as they collaborate with Indigenous communities in Wisconsin to trial organic

farming practices that utilize their traditional values and knowledge. We encourage more applied research in farming and natural sciences that uphold Indigenous ways of knowing as equal to Western science through collaborating with Indigenous Peoples. Researchers should be aware of the implications of research in Indigenous communities, involving the cultural boundaries associated with crops and seeds, which are often not regulated and thus warrant protection. As Western science seeks to find sustainable alternatives to current farming norms, as seen in other areas of land management, we encourage creating shared learning environments between researchers and Indigenous Peoples to foster relevant and equitable outcomes for farming practices.

Funding Disclosure

The current doctoral research of the primary author has been funded by the Ford Foundation (2020–2021) and is currently funded by a U.S. Department of Agriculture National Institute of Food and Agriculture Predoctoral Fellowship (#2023-67011-40522). The primary author also received funding from the First Nations Development Institute through the inaugural Tribal Food Systems Research Fellowship for the development of this manuscript.

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Keywords

Indigenous foods, framework, extension, traditional ecological knowledge, organic, scientific collaborations

Introduction

There have been efforts within Western science to acknowledge and integrate Indigenous perspectives and knowledge systems. Relevance of these efforts has steadily been growing in the natural sciences, as we continue to redefine our relationships with land and the underlying natural processes/resources (Berkes et al., 1994; Menzies, 2006). For example, Western science has begun working to understand the role of Indigenous fire management, helping governmental agencies maintain landscapes, control more destructive and unpredictable fires, and further forestry research (Nikolakis & Roberts, 2020; Wynecoop et al., 2019). Coastal Indigenous Peoples have been integral to research in monitoring and managing fisheries and marine populations (Capistrano & Charles, 2012; Menzies, 2006; A. J. Reid et al., 2021). Indigenous practices and knowledge are currently discussed with regard to stewardship of fauna populations through hunting and conservation efforts (Souther et al., 2023). It is important to note the circumstances underlying reconciliations of knowledge, that Indigenous management practices were suppressed by colonization and subsequent government policies for centuries as a tactic to further remove Indigenous Peoples from their lands, cultural practices, and traditional foods.

Indigenous farming has not seen enough attention to influence mainstream practices. Research about Indigenous farming is presented through historical and theoretical lenses and rarely, if ever, applies current Indigenous food practices in practical research (Doolittle, 1992; Kapayou et al., 2023; Lewandowski, 1987; Mt. Pleasant, 2011, 2015; Mt. Pleasant & Burt, 2010). Compared to modern mechanized farming, Western science makes unfounded and less researched assumptions that traditional or Indigenous farming practices are inefficient and impractical (Acharya et al., 2020; Rahman et al., 2011). Moreover, a complex mesh of political and economic factors upholds the current farming system to impede change, in individ-

ual policy or more systemic, while also weakening the line between research and application (Bowman & Zilberman, 2013; Prokopy et al., 2019), further inhibiting support for adoption of Indigenous methods and institutional recognition of these practices (Johnson et al., 2021). Only recently has there been direct contribution from Indigenous farming practices in an applied manner (Kapayou et al., 2023).

In this applied theory essay, we will describe the principles of Indigenous farming and their significance for Indigenous cultures in North America. We will present a framework to guide Western farming research, which encompasses many fields of natural sciences, on how to better integrate this knowledge and science through research collaborations. We then discuss this framework in the context of the primary author's doctoral research, driven by an Indigenous perspective.

Principles of Indigenous Farming and Their Cultural Significance

Currently, Indigenous farming is an expanding effort coinciding with other movements of Indigenous food sovereignty, defined as Indigenous Peoples controlling and maintaining traditional food systems to feed their communities with culturally relevant foods (Coté, 2016). According to the 2017 U.S. Department of Agriculture census of agriculture, approximately 80,000 farms are owned by Indigenous Peoples and there are 60,000 producers; both numbers increased 7–10% from the 2012 census (USDA National Agricultural Statistics Service [USDA NASS], 2017). These numbers represent agriculture as a whole: 75% of the farms specialize in livestock production and only the remaining 25% are crop focused (USDA NASS, 2017). While Indigenous farming exists and has continued to proliferate through Indigenous people maintaining their connection to their land and cultural traditions, as of now the definition of Indigenous farming is only distinct from the modern definition of farming (cultivation of land and growing of crops) as meaning performed by Indigenous Peoples. We feel, however, that the Indigenous worldview that centers a deep and sacred connection to the land deserves to be emphasized, although it may seem broad. Growing crops is

fundamental to knowledge of the environment and our connection to it (Pesantubbee & Zogry, 2021), “Traditional Ecological Knowledge” (TEK), defined as a “cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission” (Berkes, 2018, p. 8). In this essay, we take a broader view of TEK as encompassing multiple domains of Indigenous experience and simply refer to it as Indigenous knowledge (Berkes et al., 2000).

In North America, Indigenous Peoples from different cultures farmed in a diverse range of environments that required various strategies and practices (Hurt, 1987). What allows these traditions to continue across generations are the ties Indigenous Peoples have to the land along with the connection to cultural knowledge they uphold. Connection to the land is interwoven into traditional farming, which emphasizes manual labor such as planting, weeding, and harvesting by hand. We identify four principles of Indigenous farming that are consistent with both historical and contemporary practices along with actual Indigenous worldviews of land stewardship. These principles of polyculture, seed-keeping, sustainability, and community are integral to cultural traditions and offer alternative ways of thinking about many questions and concerns Western scientists have about current colonial-rooted farming practices. Such research should be guided by Indigenous farming practices, informed by Indigenous worldviews, and improved by traditions before post-colonial conventional agriculture. The four principles are important for the subsequent framework we will discuss.

Polycultures

Many crops domesticated in Central and North America are integral to culture and foodways today. Important staples such as corn, beans, and squash are grown by many Indigenous cultures in environments across North America. The common practice known as The Three Sisters, growing corn, beans, and squash together because they nourish and support each other, is a prominent example of companion planting, or polyculture, which has guided farming practices in many cultures. Benefits of polycultures include diverse diet, and current

research validates their long-term sustainability (Mt. Pleasant, 2016). Not every culture practices companion planting, or polyculture, exactly the same way as there are variations of the Three Sisters (Mt. Pleasant & Burt, 2010). Historical accounts also describe companion planting practiced as spatial crop diversity, planting mixed fields and not relying upon a strict monoculture crop (Fritz, 2019; Hurt, 1987). There is strong archeological evidence that Indigenous ancestors domesticated and grew vast, diverse crops (Fritz, 2019). Polycultures represent a fundamental difference between Indigenous farming and current colonial-rooted monocultures. Western science has discovered the correlation between the diversity of plant communities and their productivity, a concept researchers want to transition into mainstream farming (Mariotte et al., 2018; Tilman, 2020). Indigenous Peoples proliferated plant communities, rather than post-colonial conventional farming that integrates plant communities in a reductionist practice. A plethora of research shows how polycultures can be more successful than monocultures in terms of productivity and yield (Vandermeer, 1989). Although not all current Indigenous cropping efforts include polyculture consistently, or they may rely on monoculture practices, their values and utility are often engrained alongside traditional methods. Indigenous cropping systems offer a manipulatable system that can help researchers disentangle the ecological factors that influence the success of polycultures. We argue that understanding these systems is relevant to current research on better optimizing diverse cropping systems to meet the needs of a growing population while relying on ecology to reduce reliance on external inputs.

Seed-keeping

Seed-keeping preserves genetic diversity through growing and passing on seeds and the underlying knowledge from generation to generation (Hill, 2017). These efforts have also been called “rematriation,” which emphasizes the role of women in Indigenous societies in preserving traditions and knowledge (Herrighty & Hill, 2024). Through sharing and gifting seeds, genetic diversity is intentionally preserved by facilitating mixing seeds within a variety to maintain diversity and prevent cross-

pollination. Preservation of Indigenous varieties may have also allowed unique phenotypes to continue, contrasting with the genetic diversity of current conventional crops lost through decades of breeding that prioritized yield or size. Crop research now investigates the heirloom and wild ancestors of crops for traits lost such as nutrition, resistance to disease, interactions with microbial partners, and ability to withstand harsher climates (Chen et al., 2015; Kumar et al., 2020; Newton et al., 2011; Pérez-Jaramillo et al., 2016; Zsögön et al., 2018).

There are Indigenous concerns about potential corporate malfeasance and academic misconduct involving long-stewarded traditional heirloom seed varieties. Research and genetic modification of heirloom seed varieties without the informed consent or prior knowledge afforded to traditional seed-keepers is known as biopiracy (Reid, 2009). There is little to no regulation and protection for ownership or stewardship of these seeds at any level of government, both tribal and federal. There have been local and international efforts, but nothing consistent across Indigenous North America (McCune, 2018).

Indigenous Peoples exercising the right to food sovereignty tend to resist the ideas of Western ownership that allows people or entities to own living organisms, considering living organisms to be kin. A seed could easily end up in the hands of researchers or even companies just through informal means of passing ownership such as gifting. This situation gives no incentive for researchers to follow regulations or create measures to protect Indigenous seeds. Without regulation, there could be subsequent research on these crops that is not sanctioned by the Indigenous owners. Attempting to mine the data and knowledge stewarded by Indigenous Peoples would be unethical without providing them informed consent or agreement. This is why we emphasize collaborative efforts that build relationships and trust. A seed is only part of a whole system, made up of its genetic material, the Indigenous Peoples who have cultivated them for centuries, and the land that provides for their existence. Seed research requires input from the Indigenous Peoples who have stewarded them for centuries along with the very land they cultivate (Her-

righty & Hill, 2024; Nazarea, 2005). Research should be cautious and documented to ensure equitable outcomes for the Indigenous Peoples involved. Incorporating Indigenous values and practices more aligned with traditional ways could help democratize farming practices and instill relationship-based collaborations between Indigenous Peoples and researchers that could help to reverse centuries of harm.

Sustainability

A common thread that connects Indigenous people of the past to the future is land stewardship. We develop an understanding of our cultural knowledge through land stewardship; it becomes one's duty to preserve our environment to ensure future generations can further cultural knowledge. The goal of Indigenous farming is to create a balance that sustains land to ensure that future generations can grow crops and continue cultural knowledge. Indigenous Peoples have been in witness to the pollution and land degradation consequent to genocide and removal of stewardship. Certain cultural practices have become largely inaccessible and a large body of cultural knowledge has been lost. Indigenous Peoples in North America are subsequently at the forefront of many environmental movements as they understand that much of their cultural identity continues to be at stake. Like other people of color, they find themselves among the most affected by negative environmental outcomes (Fernández-Llamazares et al., 2020).

We emphasize these points to support the idea that Indigenous people who farm will tend to align themselves with sustainable practices and options. Explorers and early colonists noted that Indigenous Peoples were not afflicted with land problems such as soil fatigue and erosion—major issues for today's farmers (Doolittle, 1992; Hurt, 1987; Mt. Pleasant, 2011). Practices such as controlled burnings and soil structures like mounds and ridges altered the landscape, and crop rotation allowed for optimal nutrient cycling and less intensive cultivation of land. Tillage done by hand did not have the same negative effects as large-scale machinery tillage. In the experience of the primary author's research on the norms of contemporary Indigenous growers, chemical inputs such as herbicides and

especially pesticides are avoided. The primary author also notes that land farmed by Indigenous Peoples with a history of non-Indigenous cultivation often requires major investments to rebuild soil fertility to better support sustainable and productive farming. A significant research effort would be to establish long-term management plans for utilizing fertilizers, a current necessity that could be mitigated through sustainable practices such as cover crops. Many of these practices align with what Western colonized farming defines as organic, sustainable, or conservational. These sustainable alternatives naturally coincide with the Indigenous farming ethos and would be fertile ground for future collaborations. Many Indigenous growers mirror Western ideas of sustainability and are experimenting with some contemporary tools while being wary of others that are seen as harmful. We believe Indigenous voices should be uplifted in sustainable farming as the goals and outcomes align.

Community

Practices such as seed-keeping, planting, weeding, and harvesting are tied to cultural knowledge. Colonial-rooted farming sees manual labor as inefficient, but overlooks the knowledge sharing that happens during these traditional practices. Much of the labor in Indigenous farming systems is still done by hand by multitudes of people, the foundation of traditional farming. Current literature on Indigenous food sovereignty emphasizes the health benefits from not just healthy foods, but from physical farm (Jernigan et al., 2023). Farming smaller acreages would make incorporating manual labor in practices such as planting, harvesting, and weeding possible while facilitating the associated cultural knowledge. According to the 2017 USDA census, the percentage of Indigenous-owned farms of 1–10 acres is 25%, almost double the national average (13%). (USDA NASS, 2017). This trend has been confirmed from personal experiences and in the literature on current Indigenous farming (Johnson et al., 2021). Growing acreages of 1–10 acres would become more feasible with multiple people and/or a community effort utilizing manual labor along with farming machinery.

Although we hesitate to generalize about all

Indigenous cultures in North America, we cannot ignore the role women have in many cultures that revolve around seed-keeping and crop domestication (Blue Bird Jernigan et al., 2021; Fritz, 2019; Herrighty & Hill, 2024). In the USDA 2017 census, 44% of Indigenous producers are women, notably higher than the 36% of American producers that are women (USDA NASS, 2017). This trend is relevant because it indicates the important role of Indigenous women within communities and foods systems. It is important to note that working in agriculture is already demanding physically and mentally. Women are often also faced with already disproportionate and unpaid domestic labor; ignoring how women's labor is integral to the system would only further perpetuate the effect that the unpaid and unrecorded labor of women leads to bad health outcomes (Seedat & Rondon, 2021). Indigenous women are leading most food and seed sovereignty efforts today, a stark contrast to post-colonial white male-dominated farming (Pilgeram et al., 2020). We must acknowledge that there are Black Indigenous people, and Black American farmers who have an unbroken lineage of land stewardship sharing a sacred connection to the land evolved through farming, seed-keeping and historical crop domestication (Ruffin, 2010). In fact, there are similarities between this framework and principles in the agroecology of African American cropping systems (Densu, 2010). There are also similarities in the struggles for land access, funding, and representation against systemic racism that still affect BIPOC farmers today (Buechler, 2022; Carpenter, 2012). Traditionally, farming is a community effort, which many food sovereignty movements emphasize as there are benefits ranging from culture revitalization to positive health outcomes. Research should understand the community aspects of these collaborations, when relevant, and address the needs and questions of communities and growers.

A Framework for Future Crop Research

We present a framework consisting of the four principles of Indigenous farming: polycultures, seed-keeping, minimal impact on land, and community. The purpose of the framework is to guide applied farming research asking quantitative ques-

tions, which can pertain to many fields such as plant sciences, microbiology, soil sciences, and environmental sciences (Table 1). The four principles may not apply to every Indigenous cropping system, but one or more principles will be relevant and/or reflected in cultural traditions that need to be sustained. The principles allow researchers to be aware of traditional practices and the associated cultural boundaries and expectations of Indigenous farming. We define cultural boundaries in this paper in the context of relationship-building and participation in Indigenous food system, in this case, to understand Indigenous cultures and the activities that reinforce the relationship to agriculture. The principles we previously defined as the framework act as cultural boundaries for scientists to respect and integrate within their research.

When conducting research that will be working with Indigenous Peoples either to preserve or expand Indigenous cropping systems, these principles can guide researchers. For example, research on methods utilizing pesticides and herbicides may not likely align with the goals of Indigenous farmers. And if researchers want to grow traditional seed varieties on campus or at a research station, there are ethical considerations needed alongside discussion with Indigenous Peoples to obtain

informed consent. If researchers have these principles in mind when building relationships, there can be more direct discussions and planning for collaboration and research. Researchers will not have to spend time in a back-and-forth with Indigenous Peoples attempting to understand why their research is not relevant to the needs of Indigenous Peoples. Research must become a social endeavor because growing food in Indigenous communities is a social endeavor. In contrast to previous methods such as community-based or action participatory research, this framework is a different practical application, creating scientific partnerships as opposed to studying Indigenous people as passive subjects. This framework reinforces research *with* Indigenous Peoples rather than research about and partly informed by Indigenous Peoples.

Introducing a framework for research on Indigenous cropping systems is important because there is currently little guidance or regulation by institutions. Any current regulation works in tandem with regulations on research with humans. For example, Kapayou et al. (2023) investigated the Three Sisters effect on soils at different sites with Indigenous partners across the Midwest. The research team created an advisory board to guide their work on the Iowa State University campus

Table 1. Framework for Indigenous Farming

	Principles of Indigenous Farming			
	Polyculture	Seed-keeping	Sustainability	Community
Definition	Indigenous Peoples often grew various crops spatially together. These practices have continued and allow opportunities to trial other forms of contemporary polycultures.	The intentional preservation of traditional seed genetics over generations. These crops are sacred and require permission and oversight from their stewards.	Sacred connection to land through stewardship. Indigenous Peoples are often at the forefront of environmental movements and practices.	Indigenous Peoples working together to preserve traditional food systems. Often there is an emphasis on manual labor-heavy practices connected to cultural traditions.
Recommended application for research	How do diverse cropping systems (traditional or contemporary) function and what ecological principles drive success?	Can these ethically sourced crop varieties guide breeding practices and foster important crop traits?	How can we better monitor and optimize sustainable outcomes with alternative farming practices?	How to help preserve and maintain Indigenous food systems that are linked to many cultural, economic, and environmental outcomes?
To facilitate all principles in research, there need to be:				
• Formal agreements or regulation (MOUs, IRBs, etc.) • Acknowledgment of historical power dynamics and institution's current relationship with Indigenous Peoples • Data sovereignty to ensure that Indigenous Peoples have ownership and say in how data is published and further distributed				

and subsequent on-farm experiments run by their Indigenous partners (Kapayou et al., 2023). Concurrent with these efforts there were ethnographic studies conducted through interviews, that had to be cleared from their Institutional Review Board (IRB), in order to better understand perspectives on Indigenous foodways held by their research partners (Kapayou et al., 2023). IRBs represent an institutional regulation meant to protect human research subjects and the researcher. Another regulation is the Institutional Animal Care and Use Committee (IACUC), which does the same for animal research. The regulation for plant research, however, is mainly implemented when working with plant diseases or genetically engineered plants to ensure containment (Miller et al., 2009; Wolt & Wolf, 2018). This is representative of the Western colonial-rooted view of plants as organisms for which ethical protections are generally unnecessary, which directly clashes with many Indigenous worldviews that uphold plants as kin. There has been discussion at the international level about the methodology for utilizing sources of biodiversity such as plants for research, but such discussion have not occurred in the U.S. with Indigenous people (David, 2018). Researchers trained in natural sciences tend to be strictly quantitative and often lack training in the ethics or historical implications of their work.

To emphasize the stewardship of Indigenous lands, we encourage efforts to participate in the community, which can take the form of on-farm research. This facilitates protecting seed genetics and cooperating with supportive cultural traditions, and helps researchers gauge first-hand the capacity and needs of the Indigenous growers. Observations that stem from actual environment and management practices can benefit research. Consistency in observations hold more scientific weight than if performed in a more controlled environment away from the Indigenous community. In the case of agricultural research, these observations lead directly to practical agronomic outcomes while laying the groundwork for future research that can better untangle mechanisms in a more controlled environment. Such insightful data can help facilitate sharing of knowledge between Western science and Indigenous community efforts.

As with all research with Indigenous Peoples, there are ethical considerations and cultural boundaries that must be acknowledged and addressed. Western research, since its inception on Indigenous lands, has commanded a presence conducting research in order to analyze as well as to document beliefs and traditions (Smith, 2012). Research worked in conjunction with colonization, providing the inadequately developed narratives about Indigenous people with a credibility that only served to justify genocide and assimilation (Drawson et al., 2017; Smith, 2012; Wilson, 2008). As a response, the field of Indigenous Studies developed so as to shift the narrative back to Indigenous Peoples, through research conducted amongst themselves and by developing methodology for future research (Wilson, 2008). Due to the lack of Indigenous scholars in many fields of research, many ethical considerations and cultural boundaries were not even acknowledged and had to be developed. For example, in the fields of medical and genomic research, Indigenous researchers have sought to ethically diversify data pools with Indigenous Peoples (Boscarino et al., 2022; Claw et al., 2018; Tsosie & Claw, 2020; Tsosie et al., 2020). Much research on Indigenous Peoples had not been held to high cross-cultural ethical standards or led by Indigenous Peoples, leading to tension between researchers and Indigenous communities in general (Garrison, 2013; Smith, 2012). For this framework, we advise collaborating with the Indigenous perspective by situating Indigenous Peoples not as the subject, but rather as research partners in investigating natural processes and how to optimize farming practices. Collaboration should validate that Indigenous people have continued to practice traditional knowledge of farming methods that should be considered as worthwhile as conventional farming. They should also make note that at one time, pre-colonization, the Indigenous way of farming was the conventional farming of the land.

The four principles are relevant to the many issues and questions in modern colonial-rooted farming that Western science is attempting to address. The prominence of monocultures in conventional farming has had direct and indirect negative effects on environmental quality, leading to the perception that modern farming is not sustainable

(Hossain et al., 2020; Reay et al., 2012). Monocultures facilitate the use of herbicides, pesticides, heavy fertilization, and tillage that damage biodiversity. Prioritizing uniformity and yield through monocultures has reduced genetic diversity, causing loss of traits vital for nutrition and other ecological functions (Falke et al., 2013; Meyer & Purugganan, 2013). Researchers have long advocated for breaking the monoculture norm and increasing crop diversity through space (intercropping, interseeding cover crops) and time (cover cropping, rotations) (Mariotte et al., 2018; Tilman, 2020). The four principles of Indigenous farming provide insight into these issues with relevant data, oral histories, and perspectives all from the very same lands we farm today. Indigenous growers may be more open to trialing sustainable practices that need more data to be determined to apply on bigger scales. As climate change continues to put insurmountable pressure on cropping systems, we must utilize all tools to both reduce reliance on greenhouse gas-based solutions and create ecological resiliency.

This framework also seeks to address the power dynamics between research institutions and Indigenous Peoples. Race and equity has been an intensifying significant topic in academia; in the last five years discourse has been galvanized into action as a result of the COVID-19 pandemic, the George Floyd protests, and the current pushback on DEI initiatives (Dorn et al., 2020; Meikle & Morris, 2022). Racial inequity has also driven discussions about how research institutions have currently and historically interacted with Indigenous Peoples. For example, the roles of land-grant institutions, often at the cutting edge of agricultural research, have been interrogated as directly benefiting from the genocide and dispossession of Indigenous Peoples (Ahtone et al., 2024; McCoy et al., 2021). This forms a stark imbalance in the power dynamics that operate within the already tenuous relationships Indigenous Peoples have with scientific research. Research needs to also address the needs of Indigenous Peoples in the post-colonial state by understanding the underlying systemic obstacles against them, beginning with acknowledgement of these power dynamics. We find this especially relevant for progressive farming research,

with Indigenous Peoples still struggling for both access to land and capacity and support to steward their lands. This framework emphasizes the sharing of knowledge, especially of data between Indigenous communities and research institutions.

The discussion of data sovereignty in Indigenous research often emphasizes protecting data relating to health, language, and other cultural knowledge (Marley, 2019; Rainie et al., 2017). This puts current research on Indigenous agriculture more on a trust basis, as there is little institutional incentive or infrastructure to make agreements regarding this type of research. Even simple and formal agreements such as memorandums of understanding (MOUs) are not presented as initial ideas from the administration of research institutions. We argue that institutions need to make a concerted effort to ethically source seeds in collaboration with Indigenous Peoples. The act of knowledge sharing, especially through gifting or sharing seeds, is fundamental to the Indigenous way of life. However, the unfortunate truth is that research institutions have broken the trust of Indigenous Peoples, to the point that they advocate more for protections and regulation of their knowledge and data (Garrison, 2013). As discussed before, crops and other natural resource data are not considered protected by regulation on both ends—research institutions and, often, Indigenous communities—so that research institutions need formal agreements that will honor the goals and wishes of Indigenous Peoples regarding their data. Some Indigenous nations do have their own IRBs that oversee all research, including on crops, but IRBs require resources and expertise not all nations can manage. We argue that it is best to place leading responsibility for IRBs on research institutions (Hull & Wilson, 2017).

Framework in Practice of Primary Author's Doctoral Research and Methodologies

The primary author of this paper is currently a doctoral student at the University of Wisconsin-Madison in the department of plant pathology. In 2019 they began research collaborating with Ohe·láku (Among the Cornstalks), a farming co-op on the Oneida Reservation (Stevens & Brewer, 2019; Webster, 2023). Ohe·láku as a group is inter-

ested in incorporating organic practices alongside their traditional methods to improve soil health and reduce weed pressure as they expand their corn systems. Associated with soil health is their interest in how belowground microbes are influenced by their changes in management practices. To address their interest and needs, the primary author and his co-advisors, Dr. Erin Silva and Dr. Rick Lankau, developed a project in which different mixtures of cover crops were interseeded between the rows of the traditional White Corn; changes in the below-ground microbial community composition were observed. Although the primary author's research background is in quantitative analysis of plants and microbes, without initial experience conducting research with Indigenous communities, his own Indigenous background guides the direction of the research and relevant cultural awareness.

This interest in implementing interseeding into a long term and reduced-tillage management system created an intriguing intersection between contemporary practices and Indigenous knowledge. The Oneida people have a strong connection to the Three Sisters practice, but the manual labor and time needed to maintain a larger field of Three Sisters is not currently feasible due to time constraints and obligations of community members. Interseeding cover crops between rows of corn has been suggested in order to yield outcomes analogous to the Three Sisters traditions, such as weed suppression, lowered disease threats, and addition of organic matter to the soil similar to the intercropping practice of the Three Sisters. These outcomes emphasize the long-term sustainability goals of Ohe·láku in their efforts to heal soils on their lands while continuing their farming traditions. The focus on interseeding is combined with traditional practices such as hand harvesting, minimal tillage (with the goal of no-till), and disregard for pesticide and herbicide options. Ohe·láku has worked to adequately fertilize soils, from both conventional and organic sources, to ensure corn and cover crop productivity while adding nutrients to a soil drained from previous non-Indigenous stewardship via conventional farming practices. The downstream goal is to further reduce fertilizers and rely more on the cover crop benefits as a way to mitigate current

regional issues with overfertilization and water pollution (Puckett, 1995).

The success and feedback from our initial years of relationship building has helped in expanding this work to other Indigenous food efforts in Wisconsin. Although these other efforts could not be implemented as experiments for the primary author's dissertation, they laid the groundwork for future efforts. The years of relationship building and connecting with different Indigenous partners allowed better gauging of the needs of Indigenous producers in Wisconsin and how the University of Wisconsin could support their efforts directly. Association with obtaining a doctoral degree gave an incentive for this research to continue for around five years despite ongoing events such as the COVID-19 pandemic. In the experience of the primary author, many Indigenous collaborations involving crop research before this project, and subsequent efforts, were often short-term and not well-documented within the academy. This revealed the ignorance about how scientifically relevant current Indigenous food systems are and how the university could work to help preserve and maintain them.

The primary author advocated for building trust between Indigenous Peoples and the University of Wisconsin, the need for which highlights the importance of this research. To address data sovereignty, the primary author is working with university administration to create a Memorandum of Understanding (MOU) that would allow Indigenous partners to own their data, share co-authorship on eventual publications, and ensure that samples and data collected are not used outside the scope of the project. Institutional regulation for this type of Indigenous crop research, focused solely on quantitative methods, is inadequate if it does not include some aspect of humans as part of the research questions. It is the first time the administration has considered anything like this, as there has not been any research project like this, and the hope is to set a precedent for future research. Since a MOU is a non-legal binding agreement, we the authors hope for required future agreements that protect Indigenous Peoples and ensure researchers and the university are aware of cultural boundaries. As this effort is already outside the scope of a plant

pathology doctoral student, we hope just that these efforts have at least established the idea among administration and other researchers.

The primary author's research is located at the University of Wisconsin-Madison, one of the land-grant institutions that benefited from the genocide and removal of Indigenous Peoples through land sales when they were created through the Morrill Act (Ahtone et al., 2024; McCoy et al., 2021). Even more heinous is the physical placement of the institution on an area known as Teejop to the Ho-Chunk people, where effigy mounds are found both intact and disturbed throughout the campus (Birmingham & Rosebrough, 2017; YoungBear-Tibbetts, 2009). This is a constant reminder for Indigenous Peoples on campus and gives more urgency to institutional efforts to reconcile these atrocities with Indigenous Peoples.

The goal of this research is to support Indigenous communities and their food sovereignty efforts, a restorative justice approach. We have provided financial support, resources, shared knowledge, and labor support through the research that has built stronger relationships between the university and Indigenous communities. As of the writing of this paper, there has been an increase in funding from a Sustainable Agricultural Systems Coordinated Agricultural Project. from the USDA at the University of Wisconsin-Madison that focuses directly on supporting Indigenous food systems. Part of the grant's goal is to increase the number of Indigenous graduate students working on Indigenous food systems at the University of Wisconsin-Madison, giving hope that current research will continue and more communities with various needs and research interests can be supported.

Concluding Thoughts and Future Questions

In this applied theory essay, we present a framework to guide applied farming research to collaborate with Indigenous people. The principles of Indigenous farming are polycultures, seed-keeping, minimal impacts on land, and community, all of which have a role in guiding research questions to be practical and culturally appropriate while addressing current challenges faced by Western science to make farming more sustainable. We want to culti-

vate applied scientific collaborations that directly address the needs and questions of Indigenous Peoples rather than theoretical approaches. We uphold the notion that the localized and experiential knowledge from Indigenous Peoples is equal to Western science. Phrases such as “we need to support and acknowledge Indigenous knowledge” tend to not encompass the idea of also supporting the Indigenous people themselves (Kimmerer & Artelle, 2024). This is because the knowledge held by Indigenous Peoples is often treated as a single independent entity. From the perspective of the secondary author, Western institutions absolve themselves from failing to include Indigenous people in more complete background research, not fostering shared collaboration, as well as continuing to perform as the pre-eminent authority for validation.

As Indigenous people, we are often asked how Western institutions can be better informed about Indigenous Peoples. The purpose of this framework is to provide an introduction to Indigenous farming practices and their cultural significance. We acknowledge that many researchers in the natural sciences are not trained to collaborate with marginalized communities or to understand the history of Indigenous North America peoples. By describing the principles and associated cultural boundaries, we hope to foster feasible and fruitful collaborations that tackle relevant scientific questions that can be answered by the principles of Indigenous cropping systems. Just as Indigenous scholars are trained in Western scientific methodology, we encourage Western researchers to learn more about ways of Indigenous science. In agriculture and natural science there currently are few Indigenous scholars, which is part of why these discussions and projects have not come to fruition. It is often left to the Indigenous scholars in these fields to advocate for such projects.

Scientific research has unlimited potential when combined with Indigenous knowledge. We recommend a model of informed scientific collaboration rather than a process that is one-sided and extractive. If scientists are indeed supportive of integrating all relevant knowledge into a functional paradigm, they should appreciate that Indigenous knowledge is a science with a more local and com-

community-involved way of asking questions and solving problems. Mainstream science attempts to take an “unbiased” and objective position, whereas experience and unique perspectives directly inform Indigenous knowledge.

Science is challenged to understand how to transform current food systems while reversing many of the harmful trends created by scientific innovations, while navigating climate change to find more efficient and sustainable practices. What

we are presenting here is another way of viewing the system to better unravel many the issues of our cropping systems. This can also be viewed as an new method of adding to our shared knowledge base to further scientific research. Collaboration and mutual education, joining the resources of scientific institutions and the sovereignty of Indigenous Peoples, can be a source of restorative justice for the land.



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Understanding Indigenous knowledge of conservation and stewardship before implementing co-production with Western methodologies in resource management: A focus on fisheries and aquatic ecosystems

Tribal Food Systems
Research Fellowship



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Submitted February 6, 2024 / Revised July 29, November 13, and November 26, 2024 /
Accepted November 26, 2024 / Published online January 28, 2025

Citation: Maracle, S. R., Maracle, J. T., & Lougheed, S. C. (2025). Understanding Indigenous knowledge of conservation and stewardship before implementing co-production with Western methodologies in resource management: A focus on fisheries and aquatic ecosystems. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 75–86. <https://doi.org/10.5304/jafscd.2025.141.024>

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Abstract

In the face of an increasing global human population and multiple anthropogenic environmental

stressors including climate change, the limitations of relying solely on Western science and approaches to mitigating impacts, conserving biodiversity, and managing resources sustainably is

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Disclosures

The authors declare they have no conflicts of interest to disclose.

Funding Disclosure

The authors are grateful for financial support provided by NSERC Alliance, NSERC PGS – D, and the First Nations Development Institute through the inaugural Tribal Food Systems Research Fellowship.

Acknowledgments

We would like to thank the support from First Nations Development Institutes program officers and Fellowship co-recipients for their support and guidance in the development of this research. We would like to thank Keith Williams for his assistance in conceptualizing and refining concepts throughout this research.

apparent. Many Indigenous Peoples have lived sustainably as part of their respective environments for millennia, passing conservation and management practices down generations despite colonization and genocide. Long-standing Indigenous knowledge and philosophies offer alternate worldviews that can complement Western conservation and resource management and may strengthen efforts to restore environmental integrity and conserve species and ecosystems. Researchers often tout the co-production of knowledge with Indigenous collaborators using frameworks like the *Kaswentha* (Two Row Wampum—Haudenosaunee) and the *Etuaptmunk* (Two Eyed Seeing—Mi'kmaq) without first seeking to understand the foundations of Indigenous knowledge itself, and its deep roots in environmental sustainability. We develop a thesis of the embedded relational nature of Indigenous knowledges and the unique strengths and perspectives that must be understood before effective and ethical co-production can be possible. We contend that Indigenous knowledge must be treated as a distinct framework to inform conservation and stewardship of biodiversity and nature, rather than selectively integrating it into Western science. Building relationships with local Indigenous nations will help actualize sustainable practices that are rooted in millennia of empirical data. This will help to promote a shift toward a holistic and relational worldview for more impactful conservation action.

Keywords

Indigenous knowledge, resource management, fisheries, knowledge co-production, conservation, sustainability, worldview

Introduction

We are experiencing the widespread, rapid, and unprecedented degradation of ecosystems worldwide, with loss of species, compromised ecosystem functions, and diminished 'ecosystem services' to human communities. Essentially, within a single generation, the integrity and functioning of many ecosystems have collapsed, caused by myriad interacting anthropogenic stressors that include invasive species; pathogens that cause both wildlife and human disease; habitat loss, fragmentation, and degrada-

tion; increasing rates of resource extraction (mining, forestry); and rampant pollution (Dudgeon et al., 2006; Reid et al., 2019). The impacts on biodiversity are staggering. The United Nations Intergovernmental Science–Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) estimates that 1 million terrestrial, freshwater, and marine species are at risk of extinction globally, a rate of loss that is unprecedented in human history. The World Wildlife Fund's 2024 Living Planet Index (WWF, 2024) integrating temporal data for approximately 35,000 populations of 5,495 vertebrate species worldwide shows an overall decrease in biodiversity greater than 73% between 1970 and 2020. Freshwater species are disproportionately impacted by these human stressors, with declines exceeding 80% and the rate of loss expected to increase over the next few decades (WWF, 2024). While Western science often effectively diagnoses the proximate causes of biodiversity loss, conservation practitioners and policymakers struggle to "translate information into action" and thus to develop effective conservation and stewardship approaches that will slow or mitigate the human impacts (Buxton et al., 2021). Western scientific approaches alone are likely insufficient to monitor, mitigate, or reverse ecosystem declines, and some recommend embracing Indigenous insights and practices (e.g., Jardine, 2019; Jessen et al., 2022; Mervis, 2023).

Many Western science-based conservation initiatives suffer from changing notions of reference ecological conditions (that is, shifting baselines; see Soga & Gaston, 2018)—the ecological state(s) to which we may wish to return a particular region (Jardine, 2019). This means that the ultimate goals of many conservation actions for mitigating or reversing impacts on ecosystems are often ill-defined, and that the most effective practices to achieve enduring conservation are seldom implemented (Pauly, 1995). Modern Western conservation movements arguably started only in the 19th and early 20th centuries (Sodhi & Erlich, 2010); thus, formal documentation of human environmental impacts associated with preceding centuries is often sparse and inconsistent, and many stewardship regimes are focused on shorter-term actions (Barton, 2002; Morrison, 2019). Despite rapid and

profound technological advances and the obvious, continued negative effects of industrialization, global trade, and human population growth, environmental impacts and conservation challenges remain largely unaddressed—with significant political and socioeconomic impediments precluding the adoption of effective strategies in many jurisdictions (WWF, 2024). The insights available from Indigenous cultures, knowledges, and philosophies can complement Western scientific efforts and may provide effective means to achieve conservation and undertake meaningful, impactful stewardship (Heller et al., 2023; Ransom & Ettenger, 2001).

In contrast to Western ecological science and conservation biology, which mostly arose in the 20th century, Indigenous knowledge is the place-based accumulation of ways of knowing, being, and doing across multiple generations (Jessen et al., 2022). Indigenous knowledge then is comparable in important ways to the accretion of scientific data, but is embedded within and reflects the worldview of each Indigenous nation. Although each nation is unique and we should eschew pan-Indigeneity,¹ comparisons of cultures do reveal important common themes in terms of respect, relationality, and reciprocity with the natural world. For example, Indigenous holistic and relational approaches to addressing environmental issues bring perspectives and practices that have proven historically effective for sustainable management and co-existence with all relations (Campbell & Butler, 2010; Groesbeck et al., 2014; N. J. Wilson & Inkster, 2018). Reflecting this, our goal in this paper is to illustrate how Western scientific approaches to conservation (with a focus on freshwater ecosystems) would benefit from understanding how the worldviews and practices of many Indigenous Peoples can move us closer to long-term sustainable practices rooted in a collective understanding and relationality (S. Wilson, 2008). We highlight current and historical frameworks for co-producing knowledge but emphasize that we must first seek to under-

stand the underlying principles and philosophies of knowledge systems prior to braiding them. Our focus here will be fisheries and the conservation of aquatic ecosystems and species, both because this is something we have studied using environmental DNA (Maracle et al., 2024) and because there are compelling case studies of sustainable Indigenous practices. We start with a general discussion of frameworks for co-producing knowledge, the importance of respect and reciprocity, and the centrality of place and relationality in Indigenous conservation and food security. We then delve more deeply into how knowledge is generated and shared through culture. Finally, we explore how culture is maintained across generations through practice, or in other words, “ceremony” (S. Wilson, 2008).

Etuaptmumk and Kaswentha

The Etuaptmumk² (Two-Eyed Seeing) framework developed by Mi'kmaw³ elders Albert and Murdena Marshall is a model for co-production of knowledge and has become a center point for developing and informing many research, conservation, and management projects (henceforth simply ‘research’) with Indigenous Peoples in Canada (Bartlett et al., 2012; Wright et al., 2019). Albert Marshall describes Etuaptmumk as seeing “... from one eye with the strengths of Indigenous ways of knowing, and to see from the other eye with the strengths of Western ways of knowing, and to use both of these eyes together” (Peltier, 2018, p. 2). Implicit in Etuaptmumk is the assertion that each knowledge system is distinct and whole, and that by “weaving them together” research will unfold in a collaborative and equitable manner (Bartlett et al., 2012; Wright et al., 2019). Albert Marshall further asserts that Etuaptmumk creates an opportunity for a researcher to understand different perspectives and therefore offers a more thoughtful and inclusive way of doing things (Bartlett et al., 2012).

Etuaptmumk allows different nations to use

¹ Pan-Indigenous refers to an approach to viewing and grouping Indigenous peoples that homogenizes groups of people who have distinct cultural, linguistic, geographical, and historical differences.

² Etuaptmumk - Mi'kmaw term for Two-Eyed Seeing. One eye views the world through Indigenous ways of knowing and the other eye through Western, or Eurocentric, ways of knowing. (Phonetic notation: Ed-do-up-dim-moomk).

³ Mi'kmaw - First Nations people of the Northeastern Woodlands of Atlantic Canada. (Phonetic notation: MIG-mah).

their own teachings, thus making co-production of knowledge and solutions to environmental challenges meaningful and relevant to each nation. As another illustration, the Kenyen'kehà:ka⁴ nation of the Haudenosaunee Confederacy⁵ (to which two of the three co-authors belong), directs collaborators toward two pivotal wampum agreements: the Kaswentha⁶ (Two Row Wampum) and Sewatokwà:tshera⁷ (Dish with One Spoon Wampum). Both agreements emphasize the collective responsibility of caring for the earth and sharing resources with other nations, both Indigenous and non-Indigenous (Jacobs & Lytwyn, 2020; Ransom & Ettenger, 2001). For Haudenosaunee scientists, upholding these wampums is integral to research, with the expectation of reciprocity. Collaboration with Indigenous Peoples is foundational to fostering inclusivity and appropriate representation for any conservation effort focused on a particular region, ecosystem, or species (Kusabs & Quinn, 2009; McCartney et al., 2023).

Attempts to adopt the Etuaptmumk framework that neglect Indigenous researchers has historically led to extractive and tokenizing outcomes that do not adequately acknowledge and build relationships nor value Indigenous practices and philosophies required to sustain the knowledge source itself and the people (Ludwig & El-Hani, 2020; S. Wilson, 2008). At the very least, this risks cultural appropriation, but it also can lead to racial biases that ultimately negatively affect research, its outcomes, and meaningful collaborative conservation. If Western scientists are settlers who lack a deep-rooted sense of place for the region being studied (e.g., a lake or river or watershed) and hold biased views of Indigenous Peoples and their knowledge systems, research may collapse into the historical, colonial relationships. Such biases, rooted in gener-

ations of hegemonic Western attitudes, can be ingrained and implicit. The consequence of this can be that proposed solutions to conservation challenges fail to address the role of Indigenous knowledge and cultural sensitivities, and the ethical responsibilities of working with communities and their sacred knowledge (Smith, 2021). In sum, using the Etuaptmumk approach means that Indigenous researchers and knowledge-keepers, with lived experience, must be involved from project conception, through information collection and interpretation, to design, deployment, and evaluation of conservation strategies.

Indigenous knowledge systems have existed since time immemorial and reflect generations of iterative experimentation and observation of human interaction with the local environment, passed down through successive generations so that each may be sustained and thrive (Stoffle et al., 2003). For example, Mohawk knowledge keeper Kanahkwahawi, in reference to relationship among plants, explained that western “science has proven ... what we’ve already known” with respect to symbiotic relationships (Kanahkwahawi, Kenyen'kehà, Tyendinaga Mohawk Territory, interview with JM, July 14, 2024). Many Indigenous people see themselves as the original empirical scientists, whose experiences and practices reflect generations of “experimentation,” a concept that merits attention. Indigenous knowledge firmly places humanity within the natural world, whereas Western science is typically based on a hierarchy where humans are not only apart from the natural world, but above it (Hendry, 2014). This notion is even embedded in some fields in ecology, whereas humans really must be viewed as one species among many (Dalrymple, 2022; but see European Environment Agency et al., 2023). Scholar Michael

⁴ Kenyen'kehà:ka or Kenien'kehà:ka: Mohawk word for the Mohawk nation of Atlantic North America, meaning “people of the chert.” (Phonetic notation: gah-NYEN-geh-hah-gah.)

⁵ Haudenosaunee: Mohawk word for the Six Nations or Iroquois Confederacy in Atlantic North America consisting of First Nations peoples of the Mohawk, Oneida, Onondaga, Cayuga, Seneca, and Tuscarora nations. (Phonetic notation: How-den-o-show-nee.)

⁶ Kaswentha: Mohawk word for the Two Row Wampum treaty, an agreement that arose from the initial meeting of Haudenosaunee and Dutch colonialists with three foundational principles: friendship and mutual respect; peace; and that the agreement would be forever. (Phonetic notation: Gus-wen-ta.)

⁷ Sewatokwà:tshera': Mohawk word for the Dish with One Spoon Wampum treaty, an agreement between the Haudenosaunee and Anishinaanbeg that occupied shared territory in the Great Lakes Region and subsequently shared resources. Symbolizing using a shared resource “dish” with mutual co-operation and consideration “one spoon.” (Phonetic notation: say-wah-doh-GWAH-say-rah.)

Christie advocates for the inclusion of Indigenous science to gain insight into how humans “fit into, rather than outside of the ecology” (Hendry, 2014, p. 44). Indigenous knowledge systems are built on a deeply felt and culturally embedded understanding of the inherent responsibility each person has to sustain the environment as its caretaker, emphasizing relationship and stewardship over any notion of rights to resources (Smith, 2021). While a pan-Indigenous lens can diminish cultural and historical distinctions among Peoples, including the foundational and pervasive concept of relationality with the living world should, as we argue below, underpin the conservation of water, aquatic species, and ecosystems, and indeed all of nature (N. J. Wilson & Inkster, 2018). Ultimately, then, Western scientists and the accompanying Western scientific approach must shift to allow space for the embedded relational nature of Indigenous knowledge to be woven into current conservation efforts (Tynan, 2021).

Etuaptmunk and the Kaswentha are examples of frameworks that underpin co-produced holistic and sustainable conservation efforts through implementation with local Indigenous Peoples and communities. For such efforts to be successful, a first step is to seek to understand, to value, and then to embrace (on some level at least) Indigenous knowledge and philosophies before addressing pressing environmental issues using both Indigenous and Western knowledge. In the following sections, we discuss some central aspects of Indigenous knowledge and the systematic and epistemological changes that need to be implemented before equitable co-produced management can arise. We illustrate this with some teachings from specific nations but emphasize the importance of understanding the values and practices of each nation.

Place and Relationality

Indigenous Peoples in North America have rich and diverse histories of coexistence with their respective ecosystems that extend back millennia, as do many Indigenous peoples worldwide (Bredlid, 2008; Kimmerer, 2015). The cultures of each region developed different and unique place-based practices that are vital to the survival of the people and persistence of local ecosystems; these

are based on iterative observations of nature across generations. The culture and knowledge development of an Indigenous nation in one region is obviously then specific to the ecosystems within which its Peoples have historically lived and currently inhabit and maintain. Place and the relationality therein is central to the development of any Indigenous knowledge system as people co-exist with their environment and its relations over long spans of time.

Place, in Indigenous philosophies, resonates in some ways with the discipline of human geography comprising three facets; physical, social, and emotional (Agnew, 1987, as cited in Creswell, 2014). The difference, however, lies in understanding that humans are intrinsically part of the place shared with all living beings (biological, physical, and chemical beings are all considered animate), each of whom works to fulfill their respective responsibilities of maintaining balance within their shared environment (Little Bear, 2000). Place and the relationality of people within it influence what facets of specific knowledge systems might be applied elsewhere and if they cannot.

Some beliefs and values of ecosystems are indeed shared across many Indigenous Peoples, leading to similar cultural practices and a shared historical ecological knowledge. For example, a value deeply embedded within many nations is the sacred nature of water and the notion of water as a life source (Latchmore et al., 2018; McMillan & Prosper, 2016). While there will always remain distinctions, such key common aspects of Indigenous knowledge of aquatic ecosystems and approaches to fisheries management can serve as foundations for co-producing conservation knowledge and undertaking stewardship that might be generalizable to other nations, other regions, and to Western practitioners.

Knowledge Transfer Through Culture

A common Western misperception of Indigenous Peoples is invariably that they lived on the land historically in primitive fashion without altering or affecting change in their local environment and that they lacked sophisticated environmental insights or technologies (Pierotti, 2010). This misunderstanding has been exacerbated by colonial

biases and the assertion that Indigenous Peoples were uneducated, incapable of complex social constructs, or had simple foundations of knowledge. However, modern paleo-research and recognition of the sophistication of contemporary Indigenous knowledge and voice has brought into focus the reality of long-standing Indigenous knowledge, and, most relevant here, knowledge of fisheries and sustainable management of aquatic resources in the Americas (Alexander et al., 2019; Kakoty, 2018; Lepofsky & Caldwell, 2013). For example, both the coastal and inland Salish existed in sufficient densities to have potentially significantly impacted their local ecosystems and resources around them, yet some harvested species (e.g., Chinook salmon, *Oncorhynchus tshawytscha*) that showed no marked decreases in stock size over thousands of years but that were negatively impacted after the arrival of Europeans (Campbell & Butler, 2010).

Campbell and Butler (2010) assert that two main factors contribute to such fisheries sustainability by Indigenous Peoples: (1) broad dietary flexibility shifting with season and availability, and (2) formalized social and cultural beliefs, with the former being significantly influenced by the latter. Indeed, Indigenous Peoples' interactions with any species were not considered in isolation (by them) but rather in relation to all beings within the environment, biological and otherwise, and in consideration of the vulnerability of any particular species to exploitation. These ideas were coupled with the general philosophy that one should switch species rather than "fish down the food web" (Campbell & Butler, 2010; Groesbeck et al., 2014; Pauly et al., 1998). The Māori people of Aotearoa (New Zealand) practiced a similar conservation approach referred to as *kaitiakitanga*, which translates to care and guardianship (McAllister et al., 2023). A self-imposed quota for any limited resource including fish, called the *Rahui* (Maxwell & Penetito, 2007), responded to the natural ebbs and flows of wild populations observed in Aotearoa, thus providing an opportunity for repopulation (see Hendry, 2014).

Such holistic and sustainable practices are deeply embedded and maintained within cultures, often reflected in stories of practices being passed down directly from the Creator or because nature

itself is considered a living entity (McMillan & Prosper, 2016). These knowledge systems accrue learnings from earlier generations through interactions with other beings within the environment, iteratively "correcting mistakes," and sharing corrections for the betterment of their communities and future generations. Instead of assuming that Indigenous Peoples have always innately known how to sustainably live with the environment, this implies that mistakes were made, that previous generations learned from nature and learned of the consequences of exploitation—and that ultimately these teachings were passed down through generations to ensure that such actions were not repeated (FiveCrows et al., 2025; McMillan & Prosper, 2016; Pierotti, 2010). The development of cultural stories and practices are part of the evolution of generational knowledge transfer. Stoffle et al. (2003) articulate how Indigenous practices become embedded in culture over hundreds of generations through the transfer of practices and values under many Indigenous worldviews—explaining how the first generation of Indigenous people in a new environment learns from nature through actions and consequences, but that, after approximately 150 generations, nature is recognized as the teacher, with each being having specific rights and responsibilities given by the Creator to sustain the whole (Stoffle et al., 2003). For example, the Haudenosaunee *Sewatokwà:tshera'* agreement likely arose from observing the negligent use of resources that negatively affected people of that time. This general concept of rights and responsibility teaches respect for all beings within an ecosystem, just as one human should respect another. Under this worldview, the relationships with and among beings are recognized and accepted. This leads to understanding that one's interactions with other beings may influence their ability (in turn) to fulfill their duties as intended, including sustaining humans as a part of the environment (Kakoty, 2018; Sheridan & Longboat, 2006). Whether Indigenous philosophy and practice are passed down from the Creator or are accrued through iterative observation and experimentation is of no concern really (in terms of their impacts on management, not their importance to people); rather, the lesson is that ecosystem management must come from a

place of humility and consideration of the “resource” as both teacher and kin from whom people can learn and for whom each person has responsibility to conserve so that future generations too may learn from it.

The Importance of Ceremony

Many Indigenous communities worldwide maintained productive, intact ecosystems through the notion of responsibility rather than right. Responsibility for nature and resources is deeply embedded in most Indigenous cultures and often conveyed through ceremonies and formalized through relationships with the natural world (Tewateronhianriks, Kenyen’kehà, Tyendinaga Mohawk Territory, interview with JM, July 6, 2024). For example, when fish start to run in the spring, many First Nations (e.g., Salish in present day British Columbia, Canada, and Oregon and Washington, USA) hold ceremonies which span the first few days of a migration to give thanks for the return of the fish but allowing the first fish to pass so that they may reach their spawning grounds (First Fish ceremony; Amoss, 1987; Lepofsky & Caldwell, 2013). Once fishing commences, this responsibility is continued by upholding designated fishing areas, days of rest during the season, and using selective harvest, allowing large fecund fish and small juvenile fish to survive. These practices are underlain by the notion that fish are a shared resource that other people and non-human kin depend on, so collection is often limited to what is needed and not more than half of what is available (Campbell & Butler, 2010; Kimmerer, 2015). Early anthropologists theorized that Indigenous sustainability was due to relatively small population sizes and suppression of large competing predators like bears (Alexander et al., 2019; Butler & Campbell, 2004). However, more recent assessments of Indigenous oral traditions and new palaeoecological data indicate how dietary flexibility and cultural values and beliefs played significant roles in maintaining resources (Campbell & Butler, 2010). For example, Pierotti (2010) notes the emphasis on non-equilibrium in Indigenous stories and ceremonies as a reminder of past events and recognition that such things can happen again; thus, thanks should be given now but steps should be taken to minimize impacts for the future. First

Fish ceremonies are important examples of this (Amoss, 1987; Pierotti, 2010).

In North America, many Indigenous cultural values and beliefs situate important aquatic taxa like salmon, lampreys, and mussels in the realm of the sacred, in some cultures referred to as “First Foods” (FiveCrows et al., 2025; McMillan & Prosper, 2016; Quaempts et al., 2018). These First Foods are species identified by the Creator as taking care of the people in traditional stories. This understanding is maintained through cultural practices such as being served first at ceremonies and gatherings and being served only after water, which sustains all life including the First Foods. These practices remind people of the sacrifice the species continue to make and the reciprocity of responsibility that should be accepted to ensure the persistence of these species as First Foods (Hendry, 2014; Quaempts et al., 2018). Such reciprocity for individual species collectively helps to ensure that healthy ecosystems are maintained. Switching from one local native species to another as abundances change or by modifying habitats to increase yield of more vulnerable species serve as tangible actions for conservation (Campbell & Butler, 2010; Groesbeck et al., 2014).

Whether they were once allies or adversaries, many nations have enshrined agreements to share aquatic resources (Jacobs & Lytwyn, 2020). Common core values of stewardship and respect superseded all else and in these situations led to sustainable harvest practices, ranging from large treaties with shared responsibility such as the Sewatokwà:tshera’ (Dish with One Spoon) to smaller community and individual practices including selective harvest locations, days of rest, shared weirs, and weirs and nets designed to allow passage of some fish (Atlas et al., 2021; Campbell & Butler, 2010; Jacobs & Lytwyn, 2020). These practices stem from philosophical beliefs and worldviews often with the foundational understanding that these species volunteered during Creation for the task of giving their lives to care for *all* humans. Without such respect, these caretakers (i.e., plants and animals) can be taken away (Amoss, 1987; McMillan & Prosper, 2016; Sheridan & Longboat, 2006; Wilson & Inkster, 2018). Understanding the role of culture in Indigenous practices and manage-

ment decisions facilitates embedding Indigenous management approaches and philosophies within ecosystem management and sustainability efforts, while simultaneously supporting and contributing to revivifying Indigenous languages, philosophies, and knowledge for future generations.

Meaningful Collaboration for Enduring Solutions

Indigenous knowledge does not fit into the formalized mold of Western science, with its emphasis on objectivity and, often, reductionism (versus relationality and holism). Where Western science incorporates no notion of spirituality while perceiving the physical world, Indigenous knowledge is unable to and indeed cannot separate them. This means that Indigenous knowledge systems are frequently treated as unsophisticated and inferior in addressing issues on conservation and management despite Western science often proving what Indigenous People already knew (Kanahkwahawi, Kenyen'kehà, Tyendinaga Mohawk Territory, interview with JM, July 14, 2024; Latulippe & Klenk, 2020). Western science must acknowledge and “trust that Indigenous people have the experience within our environment as original caretakers of the land since time immemorial” (Hendry, 2014, p. 45). In general, Western science continues to work under an anthropocentric worldview, treating humans as separate from the environment and as consumers of it and monetizers of its benefits, while seeing the environment as comprising a collection of resources without complexity (Smith, 2021; Stoffle et al., 2003). We must continue to strive toward a general Indigenous worldview, seeing humans as part of nature and recognizing that entities within nature have rights and responsibilities. Indeed, some ecologists already hold a version of this view, but until this view is shared (e.g., by policymakers, conservation practitioners, governmental resource managers), Indigenous knowledge and ceremony will remain unrelatable to Western methodologies (Latchmore et al., 2018; Ransom & Ettenger, 2001; Smith, 2021).

Collaboration between any Western scientist and an Indigenous community must first involve scientists seeking to understand the Indigenous worldview but also involve providing communities

with the tools to navigate the modern scientific world, particularly in the context of the language and complex jargon that often attends scientific disciplines. Importantly, we must encourage and educate Indigenous scientists—who have both lived experiences (Indigenous knowledge beyond birthright) and understanding of Western scientific disciplines and their terminologies, and who respect the value of both knowledge systems while maintaining clear boundaries. Otherwise, the unique vantages of each cannot be effectively transferred or related to conservation, as is the aim of Etuaptmunk. Importantly, different frameworks like the Kaswentha and Etuaptmunk vary in the teachings they offer, and all must be aware of and value these differences.

Fisheries management and conservation in general have not been as effective and enduring of environmental change as they could be. We contend that incorporating Indigenous approaches and practices can help to rectify this, but that a lack of consideration of Indigenous knowledge, complicated by the enduring impacts of colonization, has often impeded progress. Actively (e.g., residential schools in Canada) or even inadvertently (e.g., underfunding remote Indigenous communities standard education as well as Indigenous language fluency programs) preventing the transfer of knowledge across generations increases the risk that millennia old practices and ways of knowing are at risk of disappearing with the loss of Indigenous, languages, cultures, and people.

Building capacity in Indigenous communities, fostering resurgence of knowledge, and ensuring that stewardship practices are passed down to future generations will enable more compelling conservation research, and more sustainable and effective co-management approaches. This does not mean incorporating Indigenous knowledge into science; indeed, many Indigenous knowledge-holders and Western scientists alike would consider this inappropriate. Rather, space needs to be made in modern research for Indigenous science and cultural practices, in line with Etuaptmunk (Bartlett et al., 2012; Latulippe & Klenk, 2020).

Our review here emphasizes the importance of understanding how Indigenous Peoples' worldviews affect their concept of relationality with the

natural world. The foundation of many Indigenous knowledge systems stems from cosmological relationality and respect for nature as comprising living entities (e.g., the concept of First Food provided by the Creator; McMillan & Prosper, 2016). Many Indigenous philosophies highlight reciprocity and responses to environmental unpredictability that must be embraced so that future generations may benefit from and experience healthy ecosystems just as those alive now have benefitted from the actions of their ancestors (FiveCrows et al., 2025; Pierotti, 2010). In contrast to “manipulating” and “controlling” the environment solely to maximize human benefit, incorporating Indigenous knowledge into aquatic resource management and stewardship requires that we change perspectives—for example, exhibit openness to listening carefully to our environment, asking how our relationships with all beings within it must change to improve environmental health.

Embracing relational approaches and considering the spiritual and emotional ramifications of an environmental issue can be considered within scientific research, but potentially at the risk of diminishing both Western science and Indigenous knowledge. “Cherry-picking” portions of Indigenous knowledge that align with Western science or adding color to a Western paradigm reduces the integrity of both. Shifting the paradigm from incorporating Indigenous knowledge into conservation and management where convenient, to viewing Indigenous knowledge and practice as a framework for an alternate way of solving environmental challenges, we assert, will be more impactful. Only when we all learn to listen to nature and see humans as inherently part of ecosystems, as both the problem and potentially contributing to solutions, can co-produced knowledge be incorporated into effective and sustainable conservation and stewardship practices (Heller et al., 2023). 

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<https://doi.org/10.1177/1609406919869695>

Restoring an Onkwehonwehnéha ecosystem

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FIRST NATIONS
DEVELOPMENT INSTITUTE

Submitted March 10, 2024 / Revised November 12 and December 24, 2024 /
Accepted December 24, 2024 / Published online January 28, 2025

Citation: Jimerson, J. R. (2025). Restoring an Onkwehonwehnéha ecosystem.
Journal of Agriculture, Food Systems, and Community Development, 14(1), 87–99.
<https://doi.org/10.5304/jafscd.2025.141.030>

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Abstract

This is a reflective essay on Akwesasne Freedom School's effort to recreate a community of Onkwehonwehnéha (language and culture of the Original People) knowledge-sharing for healthier and more sustainable ways of living in alignment with the natural world, for the betterment of our people, the environment, and our Haudenosaunee (They Make a House, or the Six Nations) languages.

The Akwesasne Freedom School's work promotes speaking our languages in our natural environment, reinforcing the ceremonial teachings inherent in songs, words, thanksgiving, and stories. The Akwesasne Freedom School intends to build relationships by creating an everyday learning environment that promotes relationship-building between families, plants, and medicines.

Rebuilding healthy Indigenous communities requires reconnecting the people and the earth by utilizing our Indigenous or Original foods, languages, and cultural practices. This reflective essay seeks to validate further the critical relationship between Indigenous people and Indigenous food systems, its impact on learning, and the overall health and wellness of language, environment, and people. It could provide a model or framework for other Indigenous communities to emulate.

Keywords

Indigenous food sovereignty, Indigenous ecological practices, Indigenous permaculture, Iroquois, Haudenosaunee, Indigenous language and culture revitalization, Indigenous language and culture reclamation, Indigenous planting and harvesting, Indigenous pedagogy, language immersion

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Funding Disclosure

This article was made possible with research funding from the First Nations Development Institute through the inaugural Tribal Food Systems Research Fellowship.

Introduction

This paper is a reflective essay on my path to realizing my vision to recreate a community of knowledge with a focus on sharing healthier and more sustainable ways of living in alignment with the natural world for the health of our people, the environment, and our Indigenous languages. My vision originated from my homeschooled Indigenous language and culture-based upbringing. From this perspective, food sovereignty is choosing to work with the forces of the natural world to produce food sustainability. We are responsible for maintaining our reciprocal relationship with our foods, as they are perceived as our younger sisters. We nurture our sisters by doing our best to ensure they have a healthy environment to grow in. This nurturance is done with love and appreciation. We sing and speak our most gentle words to them in our language, as our language was the first language we were given to acknowledge our mutual relationship. Our language is the language our Indigenous plants have heard since our beginning.

This vision has taken me on many journeys, one of which included a journey to Mohawk Territory. The primary focus of this reflection will be my involvement with Akwesasne Freedom School (AFS) and three initiatives I worked on while there. AFS is a Mohawk language immersion school in Akwesasne, New York. The three projects that I will discuss are Ionkwatakiá'takéhnhen (Strengthening Ourselves), Sha'oié:ra Taonsetewatákientéhrha'ne' (We are getting to know each other again naturally), and Otsi'náhkwaon.

Journey to Mohawk Territory

I was born to the Onáiyote?á·ka (The People of the Standing Stone, or Oneida), who are a part of the Lotinuhsú·ni (They Build a House). Onáiyote?á·ka refer to ourselves as Ukwehú·we, which loosely translates to “the original people”; we refer to our language and culture as Ukwehuwehnéha, which can be loosely translated as “The language and culture of the original people.” I understand that language and culture cannot be fully considered in isolation. However, in some contexts, within this paper, I will use the term Ukwehuwehnéha to refer to language and culture separately.

The Lotinuhsú·ni are also known as the

Haudenosaunee, Six Nations Confederacy, and Iroquois Confederacy, which include the nations of Mohawk, Oneida, Onondaga, Cayuga, Seneca, and Tuscarora (Parker & Fenton, 1968). Lotinuhsú·ni originally resided throughout what is known today as New York State, Ontario, and Quebec. After the Revolutionary War, many Iroquois communities were displaced from their ancestral lands, which covered much of what is now New York State, to small parcels of land that amounted to less than five percent of their original territory. By the close of the 18th century, numerous social, cultural, political, and economic systems in these communities were heavily disrupted, and many communities found it difficult to adjust to these transformed circumstances (Mt. Pleasant & Burt, 2010). My family line was one of the many radically disrupted and forced to adapt, as we were among the many Oneida families displaced to what is known today as Oneida, Wisconsin. The intentional erasure of Indigenous peoples, plants, and relationships, such as the removal from homelands and waterways, is rooted in settler colonialism (Corntassel & Hardbarger, 2019). My family's dream of revitalizing Ukwehuwehnéha began with my grandmother, was passed down to my mother, and continued with me.

Like many Oneida families, our language has not been spoken as a first language in three generations. Despite being unable to speak our language fluently, my parents consciously raised me as a Ukwehú·we, teaching me about growing and harvesting our traditional foods and participating in ceremonies. I am the first generation in my family line to return to our homelands to live in what is known today as the state of New York. My daughters and I have carried on the dreams of my family line to learn Ukwehuwehnéha. Unfortunately, in my home community, there are no Oneida language immersion schools that have been successful in creating new fluent speakers. However, having been so far removed from our confederacy, I concluded that moving my family back to our Lotinuhsú·ni homelands was critical to advance our Ukwehuwehnéha learning.

Onkwehonwehnéha is the Mohawk cognate, with the same linguistic derivation as the Oneida word Ukwehuwehnéha. Moving forward in this

paper, I will use Onkwehonwehnéha to communicate concepts discussed relative to this project as it focuses on Onkwehonwehnéha. The only difference between Onkwehonwehnéha and Ukwehuwehnéha is the orthography spelling, which depicts the language that is being spoken about: Onkwehonwehnéha refers to “the language and culture of the original (Mohawk) people,” and Ukwehuwehnéha refers to “the language and culture of the original (Oneida) people.”

My family chose to learn Onkwehonwehnéha for three reasons:

1. Of all the Lotinuhshú·ni languages, Ukwehuwehnéha is the closest language related to Onkwehonwehnéha.
2. Kanien'kehá:ka (Mohawk) communities currently have the most significant population of first language speakers in the confederacy.
3. Kanien'kehá:ka communities are also known for their success in creating second-language speakers through their well-established immersion programs for all ages.

Institutionalizing Ukwehuwehnéha and Onkwehonwehnéha

I have had many goals and dreams for my language throughout my language-learning journey. They have extended from attempting to raise my children as speakers to establishing a language nest, to dreams of developing an adult immersion program and developing community initiatives for advanced second language learners. Despite the positive impacts of these efforts, something was missing. This became the most evident while attending a two-year adult language immersion program. This program required sitting in the same class for over 30 hours a week. This was the first time since my third-grade public school experience that I spent that much time inside a facility. Furthermore, due to the United States and Canadian border crossing our territories, I could not legally reside in the community where I attended the immersion program. For over a year, I made a nearly 70-mile (113-km) commute from a neighboring territory daily to complete the program. Although I was thankful to be afforded the experience, I had never

been more disconnected from my culture and the earth.

One day, for class, we attended a tree-planting event in the community. I recall feeling so good that day. I specifically remember being able to acquire the lessons and words that day quickly, and the stories and vocabulary stick with me to this day. This experience positively affected the remainder of my language immersion journey. Since then, I have realized that a relationship with the natural world has been missing in immersion spaces, which provides the sustenance necessary for our survival as Ukwehú·we and, therefore, Ukwehuwehnéha. With this realization, I envision Ukwehú·we working together to recreate authentic relationships with *all* of creation to continue Ukwehuwehnéha.

After completing the language immersion program, I wanted to do something to offset my carbon footprint from traveling to and from the program every day. I also wanted to give back to the people and the land that supported me in fulfilling my family's dream of learning our language. This ignited the idea to give back by planting Indigenous trees for the wellness of the land and all they contribute to our environment, people, and everyday culture. Trees are essential to our sustainability and sovereignty, as our people use wood to make our houses, fire, traditional tools, and sacred items, cook our foods, create ash to hull our Indigenous corn, use bark and roots as medicine, and consume nuts for food. Since learning Onkwehonwehnéha, I have worked in various immersion programs, which have helped me maintain Onkwehonwehnéha and ground myself in learning and teaching land-based activities such as growing Indigenous foods, planting and harvesting medicinal plants, tanning hides, and making dug-out canoes.

Introduction and Literature Review

Everything has changed. Nevertheless, if nature is sacred, it would be our mind to change it back to make it the way it was when it was supportive of life on the earth. To make the food the way it was, to make the water the way it was, to make the air the way it was, to make our bodies and everything on the planet the way it was, the way nature made it to be. (Mohawk & Barreiro, 2010, p. 276)

The Indigenous way of life was once centered around our responsibility to live in a relationship with the natural world. Since the Indigenous way of life has been disrupted, so has the natural world. The revitalization of Indigenous knowledge through language and culture is deeply interconnected in environmental restoration, with each aspect enriching the other. Long before “education” and “knowledge” were shaped by the Western perspective, Indigenous people everywhere had their cultural practice for knowledge transmission, often through songs, ceremonies, oral storytelling, and in spiritual and physical relation with the natural environment (Garcia & Shirley, 2012, p. 77). Songs, ceremonies, and stories are oral learning and teaching methods for Indigenous people. They come from observations of the natural world and their spiritual, mental, and physical needs. Stories that pass through the generations orally tell of lessons learned by their ancestors and serve as essential reminders of the significance of their long-established collective knowledge about their cultural value.

Like many Indigenous people, Onkwehonwehnéha values center on the natural environment that sustains them, such as the Three Sisters (corn, beans, and squash), who are considered the leaders of the foods. As Mt. Pleasant & Burt (2010) state, “Multiple scholars report that the Three Sisters are deeply rooted in Iroquois ceremonial life and are featured prominently in oral traditions” (Fenton et al., 1978; Lewandowski, 1987; Morgan, 1962; Parker, 1968, as cited in Mt. Pleasant & Burt, 2010, p. 74). Knowledge transference often happens in cultivating and harvesting, and knowledge assessment is frequently made during ceremonial practices, of songs and storytelling.

Most of my homeschool education after the third grade focused on knowledge transference through harvesting, ceremonial practices, songs, and the stories from our cultural teachings. Some key areas that have influenced my perspective today might be consolidated into what some may relate to as a literature review. For this literature review, I have organized it in a way that also reflects my perspective. I focus on the following topics: The colonization of our educational processes, creating a speaking environment, a natural

learning environment for ceremonial speech, re-creating relationships with the environment, and creating an environment for healthy learning.

Colonization of Our Educational Processes

Settler-colonialism has operated, in part, by using Western educational institutions to erode Indigenous intellectual growth through cultural assimilation and the brutal disconnection of Indigenous peoples from their sources of knowledge and strength: the land (Wildcat et al., 2014). Due to colonization, there are no longer monolingual Onkwehonwehnéha environments for second-language speakers to be immersed in. Like many second-language learners of Onkwehonwehnéha, I understand that linguistics has significantly contributed to understanding our morphologically complex language. According to Briggs-Cloud (2020), “Critical grammatical analysis of language, especially morphological and etymological analyses, reveals how our ancestors perceived the world around them before the colonial disruption of spiritual evolutionary processes within their respective geographic residential spaces” (p. 275). If done cautiously and with intention, Western knowledge can help Indigenous people piece together the knowledge embedded in our language and culture. However, to support our intellectual development, we need to bring our communities back to the land and always look first to Onkwehón:we collective knowledge, then to other Indigenous knowledge, then carefully consider if non-Indigenous support, knowledge, and technologies are necessary.

To understand formal language, such as ceremonial practices, one must first gain experience through repetitive observation and participation in the culture. Studying formal language and its structure can help us better understand our ancestors’ unique cultural and spatial perspectives. The relationships formed through this shared experience can cultivate language use and richer comprehension of the ties to the land and water (Corntassel & Hardbarger, 2019). When individuals engage with the water and land, this activity strengthens community and familial bonds and enhances connections with the language.

Grammatical analysis of the language provides insight and awareness into how our ancestors once

perceived the world and provides glimpses into how these perceptions took shape in the lived culture of their daily lives. Through these insights, an effort can be made to rebuild our culture through simple everyday actions. These everyday actions are sustainable ways to ensure the continuation of Onkwehonwehnéha. Sustainable gathering practices are essential to ensure that future growth is not hindered. Cultivating Indigenous foods comes with both responsibility and advantages. Sharing, cooking, and enjoying a meal together creates a chance for community bonding (Corntassel & Hardbarger, 2019). Everyday acts of working together to sustain ourselves are sustainable opportunities to rebuild Onkwehonwehnéha. Activists often try to overturn the language hierarchy by advocating for the minority language in areas currently controlled by the majority language (Romaine, 2006). However, by re-centering our Indigenous foods daily through hands-on, culturally based language learning opportunities, such as planting, harvesting, cooking, and eating, we exercise our sovereignty and promote the wellness of our people, language, and culture.

With inherently Indigenous methods and technologies, Indigenous peoples have continuously acclimatized to the ever-changing environment and world, utilizing formal and informal strategies to fulfill their environmental responsibilities. This is apparent in the many Indigenous efforts to address climate change (Corntassel & Hardbarger, 2019, p. 113). Reinvigorating Indigenous plants and food systems is crucial in restoring relationships within the community, family, and homeland (Corntassel & Hardbarger, 2019). Occasionally, Western methods and/or technologies can help us achieve our primary goal. However, simple everyday actions are most important for sustaining an Onkwehonwehnéha ecosystem.

Creating a Speaking Environment

Rethinking how we organize ourselves and focusing on creating closer relationships with the land allows the opportunity to develop deeper connections inherent in our Indigenous knowledge system embedded within Onkwehonwehnéha. Learning spaces should be considered a sacred environment for engagement with curriculum and pedagogy sup-

ported by Indigenous knowledge systems (Garcia & Shirley, 2012, p. 77). Creating my family's first Three Sisters' garden in my first year of home-schooling facilitated my relationship with our Three Sisters and the purpose of the harvest ceremonial practices. Language domains emerge with meaning and relationship when learning is done in natural environments.

Language can be broken into two categories: low language (informal speech, such as everyday chitchat) and high language (formal speech, such as ceremonial speech). Adults often use low language when speaking to children, and children also use it when speaking among themselves (Ferguson, 1959, p. 239). The low language children learn is considered the "natural" or "normal" way to acquire language. Children may overhear the high language, but knowing the high language is only accomplished through formal education (Ferguson, 1959, p. 239). Providing an ecocentric learning space for our children to learn allows Onkwehonwehnéha low language (informal speech) to develop naturally. Allowing low language development that occurs freely outdoors in nature allows indoor learning to focus more on high-level language education, such as ceremonial language.

Natural Learning Environment for Ceremonial Speech

Within Onkwehonwehnéha, ceremonial speech is a form of high language that uses metaphors, euphemisms, and embedded meaning within words (Mithun, 2001). This requires an understanding of the culture and context to reveal the importance of the vocabulary. Conversely, language must be understood to comprehend the ceremony's importance fully. Circumlocution and repetition are extremely important in Onkwehonwehnéha, as the ceremony's purpose is to ensure the continuation of the natural cycle and pass teachings to future generations.

Formal ceremonial speeches are characterized by their repetitive elements, intricate organization, and consistent features that serve as a memory aid to help the speaker articulate long passages (Mithun, 2001). Ceremonial language is one of the most critical registers of Onkwehonwehnéha because it reflects the Onkwehonwehnéha perspec-

tive based on observations of the natural world. When I was homeschooled, I remember hearing the elders classify everyday language as the more straightforward and ceremonial as more complex. In hindsight, I realized the first-language speakers of that time did not know our ceremonial teachings very well, as many attended boarding schools, were forbidden to practice our traditional culture, and/or were brought up as Christians.

Re-creating Relationships with Environment

In Onkwehonwehnéha, the Ohén:ton Karihwatéhkwén (the words that come before all else, also known as the thanksgiving address) is among the most highly prioritized practices. The Ohén:ton Karihwatéhkwén is a formal oratory practice that follows a ceremonial speech style that begins by thanking all living organisms and elements on earth and in the sky. Elements of nature are seen as relatives and acknowledged as familial relationships. This is apparent when analyzing the transitive pronominal prefixes used to describe our relationship with elements of nature, such as *iethi'nisténha tsi ionhontsiá:te'* (our mother the earth), *iethi-sothó:kon ratiwè:ras* (our grandfathers the thunder beings), *ehtshitewahtsi:'a enkiehkehnékha karáhkwa'* (our elder brother the sun), and *iethihsótha ahsontenhnhékha karáhkwa'* (our grandmother the moon). The elements within the Ohén:ton Karihwatéhkwén commonly begin with the people and continue with the earth, water, fish, berries, grasses, medicines (perennial plants), foods (the Three Sisters: corn, beans, and squash), animals, trees, birds, thunders, winds, sun, moon, stars, the four messengers, and our creator. The Ohén:ton Karihwatéhkwén is recited to gather our minds before all events and recited once more before going our separate ways. Every entity in the universe deserves to feel valued. Although children are taught each element individually, it is said that expert orators can interconnect the elements, poetically demonstrating their understanding of the interconnectedness of our universe. Plant life depends on soil and air; it is also understood that our words can promote their health and happiness. Therefore, the people of nature converse with the plants, urging them to persist in their way (Mohawk & Barreiro, 2010). Through the practice

of Ohén:ton Karihwatéhkwén, we demonstrate our value of bringing our minds together to restore and maintain our kinship with each other and the natural world.

Environment for Healthy Learning

Imparting our knowledge to individuals of all ages goes beyond the lessons taught. We need our bodies to be healthy to ensure a lifetime of learning and sharing, and we need connected minds to continue Onkwehonwehnéha. These teachings can influence various aspects of life that Native American communities encounter regularly, such as significantly higher rates of chronic health issues and challenges related to food access (House & Webster, 2021). We have endured due to the meticulous efforts of Native farmers who have safeguarded our seeds and traditional planting knowledge for thousands of years. However, these farmers are vanishing, taking with them the rich tradition of human connection to nature. Numerous varieties of corn, beans, squash, and other crops from Native gardens are also fading away (Mohawk, 1999). The first step in retaining this agricultural knowledge is ensuring that families have access to the land and Indigenous seeds.

Access to land and Indigenous foods is critical to the livelihood of Onkwehonwehnéha knowledge, language, and intellect. Given the current state of our communities, it takes years of planning and efforts to create an environment where our people can thrive. Every effort counts and every person has a role in rebuilding a community of speakers. Re-education is needed to learn how to grow and harvest according to Indigenous practices (House & Webster, 2021). Movements around food sovereignty have highlighted the importance of having access to healthy and culturally appropriate foods, such as Indigenous foods grown from heirloom seeds, wild game, fish, and edible perennials.

Akwesasne Freedom School: Projects to Restore an Onkwehonwehnéha Ecosystem

The following section outlines three initiatives focused on restoring an Onkwehonwehnéha ecosystem, which I had the chance to participate in while working with AFS: Ionkwatakia'takéhnhen

(We are strengthening ourselves), Sha'oié:ra Taonsetewatakientéhrha'ne' (We are getting to know each other again naturally), and Otsi'náhkwaikon (In the nest).

Ionkwatakia'takéhnben (We are strengthening Ourselves)

The AFS is a Mohawk-language immersion school providing a space for learners from infancy to the eighth grade. According to White (2015), "In 1979, an unprecedented effort to revitalize the Mohawk culture and language began with the establishment of the community-based Akwesasne Freedom School, which would, in time, become a Mohawk language immersion school" (p. 5). Using the Ohén:ton Karihwatéhkwen as the core of the AFS curriculum, education occurs in outdoor settings, allowing students to engage with the elements of nature (White, 2015). AFS continuously works to expand and adjust to the needs of the community.

AFS promotes the importance of speaking our languages in our natural environment and reinforces ceremonial knowledge and cultural practices. Being in a relationship with the land strengthens our understanding, which helps us better relate to the ceremonial and cultural teachings embedded within ceremonial songs, ceremonial language, culturally based stories, and the cultural practice of giving thanks. In contrast to typical public schools, a significant portion of the educational activities at the AFS occur outside in nature. These activities may include harvesting medicinal plants or traditional gardens (White, 2015). AFS seeks to reconnect with the earth through food, language, and cultural practices to promote a healthy community. AFS also seeks to validate further Indigenous knowledge and the benefits of land-based relationship-building through an Onkwehonwehnéha medium.

AFS has been and intends to continue further research to answer the question, "What are the benefits of learning Onkwehonwehnéha (original people, [Mohawk] language, and culture) in a land-based environment?" This project aims to contribute to research on the benefits of Indigenous food sovereignty and language immersion education. Recently, AFS has undergone a significant restructuring that intends to build relationships by recreat-

ing an environment that promotes daily relationship-building between families, plants, and medicines. AFS seeks to recreate a knowledge-sharing community for healthier and more sustainable ways of living in alignment with the natural world for the betterment of our people, the environment, and our language. An essential aspect of AFS's restructuring is the effort to renew and sustain the cultural values on which the school was founded.

Not long after the AFS occupied its current school location, hazardous polychlorinated biphenyls (PCBs) were detected in a cove on the St. Lawrence River at Raquette Point, New York, right beside the school (White, 2015). In 1983, the U.S. Environmental Protection Agency (EPA) officially categorized the site as a Superfund site. Regardless of the environmental contamination mentioned earlier, the AFS has operated from its current site since 1980 (White, 2015). In the spring of 2023, AFS broke ground for its long-awaited new school. It has taken AFS years of advocating and fundraising to reclaim a healthy and safe natural environment to learn, teach, and be Onkwehonwehnéha. For the first time, AFS students will have on-site access to healthy soil to plant in, wooded areas, and wetlands to forage and explore. While AFS has not yet fully secured the funding to complete the project, teachers and families look forward to all there is to learn within this space. AFS has begun transitioning to the new site by working to restore the environment to its intended state.

The new school site will serve as a domain where we can rebuild a land-based community of speakers. This project mimics nature, ensuring our children receive a more natural Onkwehonwehnéha living and learning experience. Repetition within ceremonial speech represents the value of repetition in the natural cycle. The students are taught Onkwehonwehnéha following the natural cycle of seasons. Activities related to the seasons are done yearly, and students continue to expand their knowledge by taking on increasing responsibility in the activity and ceremonial protocol. For example, during the planting season, students are taught the high language when learning traditional stories, songs, and vocabulary leading up to the planting season. When natural signs remind us that it is time to plant, students formally participate in a

ceremony to show their gratitude for our seeds and plant life. Students then participate in preparing the land and using the traditional protocol for planting the seeds. Students also learn math and science by planting and nurturing the seeds. Lessons related to planting climatically lead into ceremonial celebrations to acknowledge the green bean, then green corn, and finally harvest and the end of the seasons. Students learn new responsibilities each year to contribute to planting, harvesting, and participating in the ceremonial celebrations. Ideally, at the end of each season, students will have learned something to add to their rendition of the Ohén:ton Karihwatéhkwén.

AFS recognizes how Onkwehonwehnéha has become a “school language.” For example, in recent years, ceremonial language has been memorialized and spoken within ceremonial contexts, yet few understand its metaphoric meaning. AFS’s goal is to provide a natural, land-based learning experience so that children can apply their knowledge of the elements to their formal education on ceremonial Onkwehonwehnéha.

This formal education begins with a relationship to the land and all things from nature; despite being intentionally destroyed, relationships and knowledge-sharing have always been a part of Onkwehonwehnéha society. We are fortunate to have remnants of Onkwehonwehnéha within our collective knowledge and Indigenous ecological practices, which could improve our environmental impact.

AFS recognizes the immediate need to continue providing opportunities for traditional food education and improving how we have been seed-saving, growing, harvesting, and consuming our Indigenous foods. AFS is currently renovating the new school site to provide more space for educational opportunities around growing and harvesting Indigenous foods. For the first time, AFS will have appropriate classroom space for canning and processing foods, a butchering shop, and food and meal storage. AFS will also have temperature-controlled rooms for seed storage and appropriate seed-cleaning equipment. In addition, AFS will also have its very own automotive and shop classes.

The Akwesasne Seed Hub (ASH) is an organization that plans to help meet the school’s goal of

growing and harvesting enough Indigenous foods on-site to provide a year-round hot lunch program for the school’s population. ASH is a community initiative to support the AFS and the Akwesasne community by providing a learning and production center emphasizing language and culture. ASH seeks to enhance an understanding of farming, harvesting, cooking, and food preservation by instructing in sustainable methods and fostering a stronger bond with our land and culture for future generations. ASH is located 151 acres (61 hectares) at the new AFS site. It is a community-driven project run by community members since 2020.

Growing, harvesting, and consuming Indigenous foods is critical to providing the proper nutrients students need to learn and thrive within our communities. To recreate our natural learning environment and provide for the school’s population, AFS recognizes that we must use modern knowledge, resources, and tools that align with Onkwehonwehnéha values to help us achieve our goals. AFS maintains adaptability by recognizing the need for support, knowledge, and technologies from both the extended community and outside the community to restore Onkwehonwehnéha relationships and environments.

AFS family and staff work together to decide when outside support is needed and to what extent. We must ensure that outside support does not harm our practices and values as Onkwehón:we (Original [Mohawk] people). AFS used heavy machinery to clear the site of invasive plants and brush at the new school. However, many Indigenous and non-Indigenous earth workers have donated their time and resources by providing and planting Indigenous medicinal plants and trees. The everyday actions, continuous work, and intentional actions for the future ensure that our collective existence here on earth continues. An action that might seem as small as removing invasive plant species from Indigenous land can significantly contribute to revitalizing Indigenous food systems, which encompass all the community ties to land, water, and the plant and animal species that have supported Indigenous peoples for countless generations, as well as the connections to the land.

This project aims to unite our minds and

rebuild our relationships here. The AFS needs all the support it can get, from Indigenous people to non-Indigenous people, Onkwehonwehnéha speakers and nonspeakers alike, to teach various skills and knowledge related to Onkwehonwehnéha.

AFS intends to uphold its vision of educating children within the parameters of Onkwehonwehnéha. A common mistake that many Indigenous education systems make is separating the language and culture from the land. AFS promotes the use of Onkwehonwehnéha in domains where our language has thrived and survived since the beginning of time.

Sha'oié:ra Taonsetewatakientébrha'ne' (We are getting to know each other again naturally)

In 2022, three ongoing issues were identified by parents and teachers at the AFS. The most pressing issue was the reciting of the Ohén:ton Karihwa-téhkwen. This culturally significant register has become a memorized speech, and children do not fully understand its concepts. Children were being taught the protocol and value of the Ohén:ton Karihwa-téhkwen. However, because they are learning the Ohén:ton Karihwa-téhkwen in the form of a memorized speech, the Ohén:ton Karihwa-téhkwen is no longer an individualized poetic expression. Many children and adults do not have the awareness gained by lived experience in nature to understand what it means to be genuinely thankful. The second issue was the inadequate use of Onkwehonwehnéha in the schoolyard, a domain that shapes our children and reinforces their learning. The third issue was the lack of family support in providing language and reinforcing values being taught in the classroom.

Friends of Akwesasne Freedom School (FOAFS)¹ is a nonprofit organization that supports the AFS's efforts and secures funding from private and public foundations to help support the AFS's increasing budget. FOAFS staff began to intentionally design our schoolyard to recreate a natural domain for our students to participate in the growing, caring for, harvesting, and year-round observa-

tion of Indigenous plants to promote relationship-building to restore meaning in Ohén:ton Karihwa-téhkwen. During the summer of 2022, Rob Greenfield and Earth Minded Landscapes offered a giveaway on Instagram for a Permaculture Design Certification with Era Keyes. I was awarded the scholarship and traveled from upstate New York to Asheville, North Carolina, four times throughout the summer. I designed the AFS site as my final project for my Permaculture Design Certification (PDC). Permaculture is a form of agriculture based on Indigenous knowledge for growing and harvesting food that follows natural arrangements found in natural systems (Morel, 2019). Since Haudenosaunee farmers did not plow or scrape the soil, there remained a higher level of organic matter that likely provided higher yields of corn than Euromerican farming methods (Mt. Pleasant & Burt, 2010). Therefore, permaculture is more aligned with AFS values: In environments that are less mechanized and industrialized, polycultures offer clear benefits compared to monocultures due to more effective utilization of scarce resources, greater ecosystem stability, and minimized risk (Innis, 1997; Mt. Pleasant, 2006; Vandermeer, 1989; Willey, 1979, as cited in Mt. Pleasant & Burt, 2010). With new allies, mentors, and support, I learned many new skills that I could use to help achieve our dream of rebuilding our communities. During the spring of 2023, we began planning to implement the permaculture design for the AFS site.

In the early spring of 2023, a group of Onkwehonwehnéha speakers and I set out to Hudson Valley to receive 100 plants and bare-root trees donated by Root to Heaven,² an organization established in late 2020 that aims to collaboratively plant one million Indigenous plants over the next five years. We understood that as a part of this project, we would speak aóskon Onkwehonwehnéha (entirely the original language) in the presence of our plants and trees. Despite often speaking Onkwehonwehnéha among the four of us who collected the plants, communicating during the 6-hour drive was a challenging and unique experience. Maintaining aóskon Onkwehonwehnéha is psycho-

¹ <https://www.foafs.org>

² <https://www.roottoheaven.com>

logically and cognitively draining. I had begun to get comfortable about a quarter of the way into the drive, which quickly brought on fatigue around the fourth hour. Attempting to remain in the language was an eye-opening experience for me. I pushed myself to stay true to my efforts in the hope that they would be taken seriously by others just the same. The group of Onkwehonwehnéha speakers I traveled with provided excellent support, and I was thankful to be in their presence, creating new domains for Onkwehonwehnéha.

During the next week, we arranged for groups of students from AFS and the local Adult Mohawk Immersion class to come help plant the trees. To facilitate these groups, I had to learn new vocabulary in advance, such as the names of the trees and plants and the vocabulary necessary for describing how to find the contour lines across the land. I felt unprepared and incapable as I stumbled through, trying to express new knowledge with new vocabulary. Teachers and students were understanding and supportive, providing me with the specialized vocabulary needed, examples of how to direct the children, and correcting grammar when necessary.

The next task was to build fencing to protect the plants, mulch the base of the trees, and plant cover crops between plants. While working the land, the people are encouraged to speak aóskon Onkwehonwehnéha. With the support of our first language speakers and allies with knowledge and resources, AFS was able to rebuild relationships in Onkwehonwehnéha with the natural world. The students planted 50 Orà:se (elderberry trees) and over 500,000 cover crop seeds (alfalfa, peas, red clover, white clover, and wheat) coated in mycelium while singing traditional seed songs. Coating cover crop seeds in mycelium effectively enhances soil health and contributes to environmental sustainability and crop productivity. The following spring, families of the schoolchildren were required to participate in planting over 2,000 Indigenous fruit and medicinal trees, and we planted 30,000 cover crop seeds on soil exposed due to construction. This was important as we worked to protect and build our soil for future gardens and Indigenous plants. This experience helped students, families, and teachers bond with our food by investing their time, physical effort, and mental effort into

being mindful of what was said in front of the plants, hoping that they would one day sustain us.

Parental and familial participation is an ongoing challenge; However, families were required to participate in the tree planting, but not all attended, and some children were not dressed appropriately for the weather. As a result, some staff had concerns about the children planting in the rain, and the event was cut short. To transition our families back into a relationship with the natural world, we recognize the need for the appropriate outdoor gear and equipment, and more importantly, as adults, we must challenge our learned fears and beliefs and demonstrate our values by sacrificing our comfort to be more immersed with nature. AFS is working to transition families into the school by restructuring the language nest “Otsi’náhkwaakon” (In the nest).

Otsi’náhkwaakon

During the second year of a restructuring of the AFS, the AFS Language Nest was one of the significant changes implemented through Ionkwatákia’takéhnhen and Sha’oié:ra Taonsetewatákientéhrha’ne’. Otsi’náhkwaakon was restructured to restore Onkwehonwehnéha familial relationships between generations and the natural world.

In the fall of 2023, the AFS Language Nest was renamed Otsi’náhkwaakon. Otsi’náhkwaakon is a full-time, two-year, intensive adult language immersion program that allows children to learn alongside their caregivers. Otsi’náhkwaakon works to provide an Onkwehonwehnéha medium to strengthen the family’s language proficiency through interactive family-to-child language learning and land-based parent language lessons on the morphology of Onkwehonwehnéha.

The overall objective of this project is to rebuild multigenerational speaking relationships between children, AFS families, first-language speakers, second-language speakers, nonspeakers with cultural knowledge, community programs and schools, and allies throughout and beyond Rotinonhsión:ni (People of the Longhouse) communities. Otsi’náhkwaakon is also an opportunity to strengthen the school’s foundation and overall succession planning by preparing future students, parents, and teachers of Onkwehonwehnéha speakers.

The outcome of Otsi'náhkwa-kon is increased parent and guardian language use. Parents are the first teachers, and by offering new parents the opportunity to learn along with their babies, we are creating an environment that supports and encourages ongoing language development. The indicator for this will be oral proficiency interview (OPI) testing for parents at the beginning and end of each year.

Before 2022, the Language Nest operated more like a Kanien'kéha (Mohawk language) day-care with some incorporation of cultural practices, such as the Ohén:ton Karihwátehkwen (the thanksgiving address) at the start and end of each day, and some education in the cycle of ceremonies. At the beginning of the 2022 school year, the Language Nest was restructured to involve parents and their infants and toddlers so that land-based language learning took place as a family unit and became a family practice. At that time, the program took place twice a week with activity days a couple of times a month. Partway through the winter of 2022, the language nest hired an Elder and first-language speaker who has raised another generation of first-language speakers in her own family and has become an invaluable resource to the Nest, as second-language speakers and learners have access to a first-language speaker during school hours.

In 2022, the nest initiated a one-year pilot program to introduce multigenerational language transference in a formal learning environment and gain insight into the school and community's needs. Applications were created, and a call-out was issued to the community for caregivers with children ages 0–6 years who were willing to commit to 4 days a week, from 9 am to 3 pm, to Otsi'náhkwa-kon. Otsi'náhkwa-kon follows the AFS calendar, beginning in early August and ending in late June, with five-week sessions and a one-week break in between. Due to a lack of funding, participants of Otsi'náhkwa-kon are not funded for being present. Despite not being funded, participants are still expected to be present and are allowed only 10 consecutive absences.

In 2023, the first two-year cohort began, consisting of seven families. At that time Otsi'náhkwa-kon was also open to first-language speakers and second-language learners from the outside commu-

nity to drop in. Daily lessons begin with smudging, a ceremonial practice of cleansing ourselves and our surroundings by burning medicinal plants. During sit-down circle time, we gather our minds by reciting the Ohén:ton Karihwátehkwen and end circle time by reviewing the phonetic sound chart and singing. Lessons integrating food, cooking, and eating terms happen during snack time and lunch. Teacher aids lead an outdoor lesson and free play while parents are taught a morphology lesson. During the children's afternoon nap, caregivers continue their grammar, morphology, and conversational language lessons.

The cohort Otsi'náhkwa-kon staff included a language Nest manager, a first language mentor, a morphologist, and two child-care assistants. Staff began by creating a curriculum calendar to implement with the incoming and continuing group of parent-students and their babies; the calendar will include cultural, land-based, and age-appropriate lessons and activities that follow the Cycle of Ceremonies. The language Nest manager and mentor work closely with the morphologist to build a comprehensive educational curriculum so that parents are building their knowledge in an Onkwehon-wehnéha medium that is relevant to their lives, such as words for the home, commands and responses for parents and children, and upcoming ceremonial terms. Participants are required to document words in a digital lexicon. Otsi'náhkwa-kon also follows a morphology-based curriculum provided by Á:se Tsi Tewá:ton, a local two-year adult immersion program. This collaboration also includes sharing activities and teaching methods and connecting speakers and learners in nature.

Throughout the first year, Otsi'náhkwa-kon faced many challenges. One major obstacle was student dropouts due to insufficient funding. Of the six adult students who began at the start of the year, only two adults and three children (along with a teacher's child and the class mentor's grandchild) remained throughout the year. One of the two adult students gave birth to her third baby at the end of the first year and quickly returned for the second year. After completing nine curriculum units in the first year, the two adult students increased their proficiency by two levels. After the first year in the Nest, the eldest child could recite

the Ohèn:ton Karihwatéhkwén and understand and speak well enough to move into the school.

In 2024, Otsi'náhkwa-kon took in six additional adult students, nine nursery-aged children, and 21 students (including both first—and second-year students) within the Nest. The most significant change in the second-year program was an increased effort to spend time outdoors.

Otsi'náhkwa-kon began introducing year-round outdoor hammock napping for babies and toddlers to build a trusting relationship with nature and promote overall wellness. Otsi'náhkwa-kon also removed all the tables and chairs from the classroom and increased contact hours to 30 hours per week.

To solidify the second-year students' morphological understanding and increase their confidence and proficiency, second-year students must teach the first nine units to the year-one adult students. Encouraging learners to take on the role of teaching promotes shared communal responsibility. These efforts were made intentionally so our children will have better support systems by creating a solid foundation for family and home language. Additionally, children who enter the school with a basic understanding of the language have an easier time adjusting to daily school life than those who come into AFS having never heard the language and/or spending much time outdoors. Parents who attend the program will strengthen their Onkweh-onwehnéha skills enough to enter the school as parents or even Teacher Apprentices and Teachers after two years.

Moving forward, this will be a multiyear project that will involve a network of communities to accomplish recreating the natural environment of the new school site: "We all have to have as a goal that we should see nature restored" (John Mohawk, as quoted in Mohawk & Barreiro, 2010, p. 276). In this space, students and teachers can build relationships throughout the year as they harvest, eat, play, heal, and learn. We anticipate that providing our families an opportunity to restore our natural environment will reinforce their formal education and improve their likelihood of using Onkweh-onwehnéha to show their respect for their environment. This will contribute to our community's mental, spiritual, and physical wellness.

Conclusion

Bringing together a community of people who value Indigenous ecological knowledge is directly linked to revitalizing Indigenous language and culturally based epistemology. Revitalizing natural and more sustainable ways of living in alignment with the earth allows for bettering our people, the environment, and our language. Indigenous communities interested in revitalizing Indigenous food systems, languages, and culture are inherently interested in revitalizing Indigenous epistemology. Indigenous people can use the school day or workday by working together to recreate a natural learning environment. Indigenous education for Indigenous people should go beyond the confined walls of Western educational institutions (Garcia & Shirley, 2012). Garcia and Shirley (2012) promote the perspective of Indigenous schools being sacred places where Indigenous knowledge is respected and viewed as an opportunity to revitalize Indigenous epistemologies and ontologies in a contemporary setting. They state that traditional Indigenous wisdom would shape and determine our understanding of ourselves and our communities concerning the complexities of Western education in schools (Garcia & Shirley, 2012). However, while working on these projects, I realized that recreating a natural learning environment within the confines of a school is difficult as it continuously threatens deeply imposed and embedded beliefs around education.

To indigenize Western systems requires accountability for parents, teachers, administration, funders, and policymakers to continuously reflect, challenge, and change their habits and beliefs. I believe AFS will continue to put forth effort in rebuilding our environment to align with Onkweh-onwe values. This reflective essay shares the story of how one community of Indigenous people is working together to reverse the effects of genocide.

To rebuild healthy Indigenous communities, we must challenge ourselves to reconnect people and the earth by cultivating our traditional foods, speaking our Indigenous languages, and practicing our traditional ceremonies to express our gratitude. AFS is committed to continuously growing this project through everyday actions toward building

Onkwehonwehnéha relationships in the natural environment. While working at AFS, my vision has broadened with the realization that limiting ourselves through factions that divide our people, such as nationhood, communities, dialectical differences, religious beliefs, and imposed social structures, such as Western institutional structures, is not sustainable. This experience has reminded me of the importance of promoting familial roles and responsibilities to rebuild the community. To heal our language, land, and people, I must commit to a lifetime of learning that encourages myself and others to work together as families to support our holistic health and wellness.

We must also continue to nourish our familial relationships with creation, beginning with our Indigenous nurturing of our medicinal plants,

protecting our Indigenous seeds, and learning skills to care for each other and our environment. One of the biggest challenges of this project was accepting that not everyone shares this vision, and some may not be ready to fully commit to the challenges of participating in an Onkwehonwehnéha environment. The burnout I experienced while working on this project is teaching me the importance of prioritizing my energy and shifting my focus from proposing systemic change to focusing on setting an example for how families can make conscious everyday efforts to improve their relationships with each other and the natural world. Amid the exhaustion, my vision to fully experience and share the beauty of our ancestral knowledge by living in a relationship with our universe has been strengthened.



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THE ECONOMIC PAMPHLETEER JOHN IKERD

Government regulation: Too much or too little

Published online October 30, 2024

Citation: Ikerd, J. (2025). The Economic Pamphleteer: Government regulation: Too much or too little. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 101–104.
<https://doi.org/10.5304/jafscd.2024.141.001>

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On June 28, 2024, the U.S. Supreme Court reversed a 40-year-old Court decision that had made it easier for the federal government to enforce regulations that protect the environment, public health, workers, and consumers from economic exploitation. The six-to-three majority ruling was widely considered a victory for corporate and conservative political interests that have worked for decades to weaken government regulations.

The case has been called “the conservative-dominated court’s clearest and boldest repudiation yet of what critics of regulation call the administra-

tive state” (Sherman, 2024a, para. 3). The same justices, by the same majority, stripped the Securities and Exchange Commission of its primary means of fighting fraud by requiring jury trials for accused violators of SEC rules (Sherman, 2024b). In other words, the current Supreme Court has demonstrated a commitment to weakening the government’s ability to write and enforce rules and regulations.

Many in both conventional and sustainable agriculture circles may see these decisions as a logical response to government regulatory overreach.

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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 available at <https://bit.ly/ikerd-collection>

According to the politically powerful American Farm Bureau Federation (AFBF, n.d.),

Federal regulations have a direct impact on farmers and ranchers, and over the years, the breadth and extent of that regulatory landscape have increased. AFBF has taken a stand against regulatory overreach and is working to reform the federal regulatory process and preserve farmers' and ranchers' land-use and water rights. (para. 1)

The AFBF claims to represent America's farmers.

Many in the sustainable organic, regenerative, and local food movements may also see government regulations as unnecessary obstacles rather than public necessities. Several articles in this journal have identified government regulations as a major obstacle to market access and economic viability for small farms and local food enterprises:

Food safety regulations designed for industrial-scale food producers can create insurmountable challenges when applied to small-scale food producers. These challenges can make for a frustrating environment for food consumers, producers, and regulators, at times leading to tensions between food producers and people working in food safety. (Martin & Perkin, 2016, p. 13)

Food safety regulations involve a tradeoff: the costs of regulatory compliance in exchange for a reduction in the risk of foodborne illness. But local food advocates point out that these costs have a disproportionate impact small food producers, and that this impact threatens the viability and continued growth of the farm direct marketing sector. (Brekken, 2013, p. 95)

Seven perceived barriers to urban and peri-urban agriculture in the greater Chicago metropolitan area are identified [in this article] ... All

seven perceived barriers involve unclear or agriculture-unfriendly regulations governing urban and peri-urban agriculture. Results suggest that urban and peri-urban farmers commonly are being forced to operate within a legal limbo or petition for exceptions to a variety of current regulations. (Castillo et al., 2013, p. 155)

No two municipalities approach the urban livestock question in the same way; however, each seeks to place limits on raising livestock in urban areas through some combination of regulatory land use tools. (Butler, 2012, p. 193)

Local food pioneer Joel Salatin expresses his frustrations with government regulations in his 2007 book, *Everything I Want to Do is Illegal*. Salatin

concludes that the most reasoned approach is to distrust everything that comes from the government. In explaining why, he quotes Lord Acton, a nineteenth-century British historian, who famously said, "Power corrupts, and absolute power corrupts absolutely."

But what about the power of courts? The Supreme Court ruled that individuals and corporations have a right to a jury trial when they sue government regulatory agencies for

damages resulting from what they consider inappropriate regulations. Juries will now decide whether regulated business practices threaten consumers, workers, the environment, or public health, and if so, by how much. Juries will now decide whether corporations have violated the rules necessary to ensure the competitiveness of markets.

Corporate lawyers can now focus on persuading juries that government agencies have overreached their authority. Decisions of government scientists and academic experts can be overruled by juries composed of people with little knowledge or expertise in assessing the threats posed by the business practices in question. Juries

Many in the sustainable organic, regenerative, and local food movements may also see government regulations as unnecessary obstacles rather than public necessities.

will decide how much corporations are to be compensated for damages caused by government overreach.

In cases where regulatory agencies have been *captured* by corporate interests, the new Supreme Court rulings will allow public interest groups to sue regulatory agencies to force the government to regulate more effectively (Hempling, 2014). Small farms and businesses that are currently overregulated also could sue the government for regulatory relief. However, new court cases are far more likely to be initiated by corporate interests than by public interests. Many large corporations have teams of lawyers that can be expected to rely on negative public perceptions of the government among jurors to weaken or eliminate regulations that are already too weak or too weakly enforced to protect the public interest.

I agree that smaller, diversified farming operations, local food enterprises, and small businesses in general are currently overregulated. Such operations simply do not pose the same, or even similar, threats to the environment, public health, and consumers as large, specialized farming operations, agri-food corporations, or large corporate businesses in general. Small, independently owned and operated enterprises should not be forced to deal with the level of regulatory scrutiny, restraint, inspection, and paperwork that is necessary to regulate large corporation organizations.

Small, diversified farms, for example, don't concentrate chemical and biological wastes in quantities greater than nature can utilize or neutralize. Food producers and processors who rely on local markets must maintain the confidence and trust of their customers to survive. The same is true of small local businesses in general. Once a betrayal of trust were revealed, the word would spread within a community, and potential violators know they would soon be without customers.

However, large operations use their political power to ensure that smaller, low-risk operations

are forced to comply with the same regulations as their large, high-risk operations. This helps them solicit support from smaller producers in opposing regulations, and they can spread the costs of unavoidable regulations over more units of production.

Small farms and local food systems need government regulations that protect them from the suppressive and predatory tactics of industrial agri-food corporations. They need government regulations to restore competitiveness to agricultural markets and ensure transparency in product labeling and marketing. They don't need the same regulation as large, agribusiness corporations because they do not pose significant risks to the environment or public health.

I have long advocated for legalizing and

formalizing a system for contractual relationships between local food producers and their customers that would absolve the government of its current response to ensure the safety and integrity of food products and production processes. Whenever a personal sense of trust exists between consumers and producers, there is no logical justification for regulatory oversight or verification. Any disputes arising from such relationships could be

addressed using existing contract laws.

Industrial agri-food systems, however, will always need to be regulated because the relationships are impersonal and there is no justification for placing public trust in purely economic entities. In the absence of effective regulations, the industrial agri-food system will continue to degrade natural resources, pollute the environment, threaten public health, and deprive those with better ideas of economic opportunities. It is in the economic interest of the corporate agri-food system to do so. It's not a matter of the government regulating *too much* or *too little*, but of regulating *better* when needed and knowing when regulation is and isn't needed.



Large operations use their political power to ensure that smaller, low-risk operations are forced to comply with the same regulations as their large, high-risk operations.

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COMMENTARY

Policy implications for nutritional health and food security among transgender and gender-diverse individuals in the United States

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Submitted October 23, 2024 / Published online December 13, 2024

Citation: Schier, H. E., & Gunther, C. (2025). Policy implications for nutritional health and food security among transgender and gender-diverse individuals in the United States [Commentary]. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 105–110. <https://doi.org/10.5304/jafscd.2024.141.023>

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Introduction

In 2021, an executive order from the Biden Administration declared a policy promoting respect, dignity, and freedom from discrimination for all individuals, regardless of gender identity or sexual orientation. The order directed agencies to review and, if necessary, revise existing policies to align

with this principle, emphasizing the enforcement of laws prohibiting sex discrimination (Exec. Order No. 13988, 2021). Despite this, as of June 2023, more than 540 bills affecting the LGBTQIA+ community have been proposed in various states throughout the U.S. Among these, 220 bills specifically focus on transgender, gender-diverse, and gender-nonconforming individuals (TGD). Notably, over 125 of these bills seek to impede or restrict access to essential gender-affirming healthcare services, including interventions like puberty

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Contributions

HS: Conceptualization, methodology, administration, data curation, analysis, writing—original draft, writing—review & editing; CG: Conceptualization, methodology, writing—review & editing, supervision

Acknowledgments

Whitney Linsenmeyer for reviewing late-stage drafts, Henry Westbrook for formatting.

Financial Disclosure

This research received no specific grant from any funding agency or from the commercial or not-for-profit sectors.

Conflict of Interest Disclosure

None

Artificial Intelligence Disclosure

Copilot was used to copyedit the final manuscript draft.

suppressants, hormone therapy, and surgical procedures (U.S. Department of Agriculture Food and Nutrition Service [USDA FNS], 2022). These policies are expected to have far-reaching effects on health, which in turn have significant implications for nutrition outcomes, such as disordered eating patterns and food insecurity (Lessard et al., 2021). This commentary informs nutrition professionals, including dietitians, public health nutritionists, healthcare providers, and policymakers, who work with diverse populations, including TGD individuals. It explores the downstream implications of existing and proposed policies on the nutritional health and food security of TGD individuals. Furthermore, it explores opportunities for action and advocates for inclusive policy reforms and improved access to resources.

The Impact of Policy on TGD Individuals' Nutrition and Health

Policy is one of the social determinants of health and has downstream nutritional health implications. Discriminatory policies spanning legal, school, health, and employment domains can profoundly impact the nutritional health of TGD individuals. Legal barriers to procuring identification that aligns with one's gender expression may prevent participation in federal and state safety-net programs, such as federal food assistance (Tan et al., 2020). Insufficient anti-bullying and anti-discrimination policies in schools (National Center for Transgender Equality, n.d.), school curriculum and topic censoring, and other bans and restrictions may further alienate TGD individuals and promote discrimination (Restar et al., 2020). In the U.S., for example, discriminatory bathroom bills exacerbate stress and stigma among TGD people, impacting their eating behaviors and access to nutritious food (Schwartz & Rothbart, 2020). Further, policies often impede access to vital healthcare services, including gender-affirming care, thereby hindering individuals from receiving necessary medical guidance and nutritional counseling (Cohen et al., 2016). The psychological toll of discrimination and societal stigma can lead to disordered eating—irregular or unhealthy behaviors such as restrictive dieting, binge eating, or purging (Peele, 2023).

Discriminatory policies not only violate the rights of TGD individuals but also indirectly harm their nutritional health, highlighting the need for inclusive policies that prioritize the well-being of all individuals. This commentary discusses the expected impact of existing and proposed policies that span legal, school, health, and nondiscrimination domains on the nutritional health of TGD individuals (Table 1), and opportunities for action.

Discussion

Legal and policy barriers can significantly impact food access and nutritional health for TGD individuals. Discrimination and bureaucratic hurdles in areas such as name and gender marker changes on identification documents, healthcare access, and employment rights can lead to stress, anxiety, and food insecurity. These challenges, while not always directly related to nutrition, can influence eating behaviors and overall well-being. In this discussion, we explore how legal and financial barriers, combined with insufficient support systems in healthcare, school environments, and employment policies, contribute to health disparities and hinder access to essential resources for TGD individuals. Addressing these barriers through policy reform and cross-sector collaboration is critical to ensuring equitable access to food, care, and a supportive environment for TGD communities.

Legal Barriers and Influence on Food Access

There are legal and financial barriers to changing one's names, identification, and records to align with gender expression. For example, the cost of and process for legally changing state-issued identification varies from state to state (e.g., US\$30 in North Carolina, US\$435 in California) (National Center for Transgender Equality, n.d.). The discordance between identification and gender expression can result in harassment, being denied access or entry, and other forms of embarrassment. While these barriers may not directly affect nutritional health, they may contribute to stress and mental health issues, which in turn may affect eating behaviors and overall well-being.

Further, these barriers may deter individuals from accessing social safety-net programs (e.g., Medicaid, food assistance programs) and limit one's

Table 1. Direct, Adjacent, and Tangential Policy Areas that can Affect Nutritional Health Outcomes Across Gender Diverse Individuals

Category	Impact	Policy	Direct impact	Nutrition-related downstream impact
Legal	Tangential	Barriers and/or cost of legally changing name, identification, records	↑ harassment; stress	↓ participation in food assistance programs; insurance
	Tangential	Insufficient anti-bullying	↑ perceived unsafe; bullying; stress	↑ eating disorders; ↑ allostatic load; ↑ overweight or obese
	Direct	School meals (e.g., universal school meals)	↑ free and reduced meals	↑ dietary quality
	Tangential	Bans on transgender athlete participation	↓ attraction to physical activity; belongingness; mental health ↑ discrimination, bullying, stress	↑ eating disorders; allostatic load; overweight or obese
	Tangential	Curriculum and topic bans (i.e., “Don’t say gay” bills)		
School Environment	Adjacent	“Bathroom bills” (that aim to regulate restroom access in public spaces, mandating individuals use facilities based on their sex assigned at birth rather than their gender identity)	↓ belongingness; mental health; ↑ discrimination, bullying, stress	↑ eating disorders; allostatic load; overweight or obese
	Adjacent	Banning and/or restricting access to gender-affirming care	↓ access to life saving care; ↑ untreated gender dysphoria; distress; suicidality	↑ eating disorders; allostatic load; overweight or obese
	Tangential	Employment discrimination (e.g., absence of legal protections against discrimination based on gender identity or expression in the workplace)	↓ income; ↑ poverty; stress; ↑ risky behavior	↑ food insecurity; ow/ob; chronic disease; HIV/AIDS
	Tangential	Healthcare discrimination (e.g., insufficient gender inclusive training in medical school curriculum)	↓ likelihood of seeking routine or necessary care; ↑ risk of untreated conditions; ↑ stress	↑ allostatic load; overweight or obese; primary disease complications (e.g., Type 2 diabetes)

Note: ↑ / ↓: elevated/reduced

willingness to seek healthcare services (Restar et al., 2020). Cross-sector efforts in collaboration with TGD support groups to support legal transitions and offer help with enrolling in food assistance programs may help reduce these barriers. Otherwise, updated policies to improve the pathways to change identification documents are needed.

School Environments

Policy shortcomings across various domains, such as insufficient anti-bullying measures, restrictions on school meal programs, bans on transgender athlete participation, curriculum restrictions like “Don’t say gay” bills, and “bathroom bills,” have profound implications for the nutritional health of TGD youth. Inadequate anti-bullying measures leave TGD youth vulnerable to harassment and stress, which can affect their eating habits and overall nutritional intake. Restrictions on school meal programs or the absence of universal access to nutritious meals may lead to further alienation for TGD youth experiencing food insecurity. Exclusion from sports activities due to bans on transgender athlete participation can disrupt the physical activity levels of TGD youth, impacting their metabolism and nutritional requirements. Similarly, limitations on LGBTQ+ education in school curriculums contribute to an environment where TGD youth may feel marginalized or unsupported, potentially affecting their mental well-being and, consequently, their relationship with food. Additionally, “bathroom bills” mandating restroom usage based on one’s sex assigned at birth can force TGD youth to avoid restroom use altogether or face harassment, disrupting their eating and drinking patterns to avoid needing to use public facilities. In essence, these policy shortcomings create barriers to accessing supportive environments, adequate nutrition, and essential resources, exacerbating health disparities and negatively affecting the overall well-being of TGD youth.

Compounded barriers and microaggressions experienced by TGD youth may foster anxiety during school meals (Tan et al., 2020). This may contribute to skipping meals and poor overall dietary intake, which is known to have cascading effects on academic performance (Schwartz & Rothbart, 2020). Evidence-based strategies to improve the

school meal experience include:

- (a) Universal school meals for all: this reduces the stigma associated with receiving a free or reduced meal and provides access to at least one meal to all students (Schwartz & Rothbart, 2020).
- (b) Increasing lunch duration. If a student is feeling anxious during this period, increasing the time to consume their meal may reduce distress, rather than compounding the experience with the stress of consuming a meal quickly (Cohen et al., 2016).
- (c) Effective and inclusive anti-bullying policies that safeguard TGD students, including during school meals (Lessard et al., 2021).

A recent study reported an association between low school safety perception (how safe youth felt across school locations) and negative weight control behaviors among transgender youth (Lessard et al., 2021). There is a need and opportunity for policy change that minimizes disordered eating behaviors among TGD youth. Actions might include establishing gay-straight alliances (GSA) at schools; top-down messages of inclusion from school administrators, policymakers, and teachers (e.g., school psychologists may offer professional development training with teachers to raise awareness of the ubiquity and consequences of stigma); enumeration of sexual and gender identities in school anti-bullying policies; promotion of effective intervention by leadership (e.g., teacher, school counselor) when gender-based mistreatment occurs (Lessard et al., 2021).

Healthcare Policies and Access to Gender-Affirming Care

Bills that ban or restrict gender-affirming care have been introduced across several states in the U.S. This will result in untreated gender dysphoria, a severe level of gender-related distress, which increases the risk of stress, eating disorders, mental health issues, and suicide, particularly among transgender youth (Redfield et al., 2023). Proponents of these bills often cite the dearth of randomized control trials that demonstrate gender-affirming care is safe. However, there are several parallel paradigms, such as the period of lactation, Turner’s

syndrome, menopause, and others, which share similarities with gender-affirming hormone therapy (GAHT). These paradigms involve comparable metabolic processes and routinely employ similar medical modalities in a safe manner. For example, both lactation and gender-affirming hormone therapy can affect bone mineral density through hormonal changes and alterations in calcium metabolism. Lactation-induced bone loss is typically reversible. The long-term effects of gender-affirming hormone therapy on bone health require further research. However, individualized monitoring can ensure optimal outcomes. Further, it has been argued by endocrinologists and psychologists that the benefits of gender-affirming care far outweigh the potential risks. The American Medical Association and American Academy of Pediatrics oppose bills that restrict minors' access to gender-affirming care (Kremen et al., 2021). Das and Drolet (2022) argue that these bills will have economic repercussions at the state and individual levels.

Employment Non-Discrimination Policies

Poverty and food insecurity erode [TGD] people's physical and mental health and support systems. [TGD] people faced substantial barriers—including *unemployment* and *underemployment* and multilevel *discrimination*—which prevented them from affording adequate food. Public health solutions include implementing employment nondiscrimination policy to protect [TGD] people in the workplace and building relationships between local food pantries and LGBT organizations to create safer environments for all persons in need of food assistance. (Russomanno et al., 2019, p. 89)

TGD individuals disproportionately experience unemployment (threefold) and poverty (twofold) compared to the general population (James et al., 2016). A qualitative study reported TGD adults with food insecurity living in U.S. Southeast attributed the geopolitical climate as the primary driver of poor employment outcomes (Russomanno et al., 2019). In many jurisdictions in the U.S., TGD individuals lack explicit legal protec-

tions against workplace discrimination based on their gender identity or expression. This absence of legal safeguards exposes TGD employees to various forms of discrimination in the workplace, such as biased hiring practices, discriminatory policies (e.g., denying access to restroom facilities that align with their gender expression, deadnaming, enforcing dress codes that do not support gender expression), unequal treatment (e.g., promotions, access to benefits, advancement), harassment from co-workers or supervisors, and termination. TGD individuals may encounter barriers during job searches, including employers refusing to hire them based on their gender identity. Once employed, they may face unequal treatment, harassment, and a hostile work environment.

These discriminatory practices can have far-reaching consequences, including economic instability, limited career advancement opportunities, and adverse effects on mental health. Addressing employment discrimination against TGD individuals necessitates the enactment of comprehensive legal protections, inclusive workplace policies and education initiatives to promote awareness and respect for TGD rights and issues in the workplace. Nondiscrimination policies that enumerate TGD individuals (e.g., U.S. Office of Personnel Management guidelines on prohibiting discrimination based on gender identity; corporate nondiscrimination policies enacted by companies like Google, Microsoft, and IBM) and are effectively implemented may reduce employment and workplace discrimination (Russomanno et al., 2019).

Conclusion

Policies significantly influence the nutrition and health of TGD individuals, making it imperative to address these policy implications to enhance their well-being. By critically examining existing policies and proposed interventions, and understanding their impacts on nutritional health, we can identify actionable opportunities for policy reform and preventative intervention. Creating inclusive environments and eliminating barriers to essential resources, such as healthcare and food assistance programs, are vital steps toward achieving equitable nutrition and health outcomes for individuals across the gender spectrum.



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COMMENTARY

Food recalls: An unnecessary and preventable factor in food waste

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Submitted September 18, 2024 / Published online January 15, 2025

Citation: Morawicki, R. O. (2025). Food recalls: An unnecessary and preventable factor in food waste [Commentary]. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 111–114. <https://doi.org/10.5304/jafscd.2025.141.026>

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Introduction

Food recalls are initiated by food manufacturers or mandated by regulatory agencies when a problem that can harm the public is identified. Recalls take place after the products have left the processing facility and are no longer under the processor's control, and their primary goal is to minimize harm by retrieving as much product as possible from the market. Not all recalls have the same gravity. In the U.S., food recalls are classified by the U.S. Department of Agriculture (USDA) and the U.S. Food and Drug Administration (FDA) into three classes based on the severity of health risks, with Class I being the most severe; a Class I recall is for defective products that can cause severe health effects or death (FDA, 2024, p. 7-1; USDA Food Safety and Inspection Service [USDA FSIS], 2024-b).

Recalls can be partial or total, depending on how efficient a processor is in codifying and trac-

ing different lots of products. Depending on the issue, if the lot sizes are relatively small, recalls can be contained to just the affected lots. However, if there is no clear separation between lots or their size is significantly large, more expansive recalls are required. When lots are not clearly identified, a total recall of all products in the market may be necessary. An example of this was the multistate recall by the Peanut Corporation of America in 2009 due to its peanut butter being contaminated with *Salmonella typhimurium* (CDC, 2009). In this recall, more than 3,900 different types of products were retrieved from the market from 46 U.S. states (Flynn, 2009).

Once the recalled product is in the processor's hands, the next step is determining what to do with it. This may involve rework, utilization for other uses, or disposal, the latter being, in most cases, the safer and most cost-effective choice. When disposal is chosen, landfilling and incineration are options for solid products, while liquids are generally dumped into a drain. Regardless of the discarding method, the once-edible product becomes food waste.

Despite not being the primary source of all food waste, recalls contribute significantly to the

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issue, impacting the circular food system where the goal is to minimize waste and reuse resources. Nevertheless, food recalls produce one of the most significant impacts because of the embedded resources, such as energy, water, fertilizers, and materials to grow or raise, process, pack, and transport the product, with the corresponding impacts on resource depletion and emissions. The type of food disposed of also dictates the level of the impact, with animal products having significantly more impact than vegetables because of the conversion factor of feed into muscle. And the consequences do not end here. Once in the landfill or a wastewater treatment facility, additional carbon dioxide and methane emissions contribute even further to global warming.

Another adverse effect of recalls is that they affect consumers' perceptions. It has been observed that during some recalls, the public avoids complete food groups, even when the problem was with just one particular brand (Marsh et al., 2004). The consequence of this avoidance is that products, especially perishables, are not purchased and become food waste.

The top cause of FDA-regulated recalls is undeclared allergens on labels (approximately 50%), followed by contamination by microorganisms such as *Listeria* and *Salmonella* (30%) (author's calculations from data at FDA, n.d.). In the USDA jurisdiction, unreported allergens represent 20%, product contamination is around 30%, and lack of inspection is 13% (author's calculations from data at USDA FSIS, n.d.). While some issues, such as *Listeria* contamination, can be more challenging because of the persistence of these microorganisms in processing plants, mislabeling and lack of inspection are entirely avoidable. Mislabeling, especially regarding allergens, is a severe issue, as a significant portion of the population suffers from food allergies. Avoiding allergens is the only way for those with allergies to prevent reactions, making accurate labeling crucial.

Microbial contamination that leads to recalls sometimes takes years to be discovered. Five years before the 2015 *Listeria* outbreak and recall associated with Blue Bell ice cream products, the U.S. Centers for Disease Control and Prevention (CDC) isolated the strain of *Listeria* from patients that was

then matched with strains found in Blue Bell ice cream (Ellis & Yan, 2015). FDA inspections in 2015 identified many problems that eventually led to the recall, such as poor sanitation practices, improper cleaning equipment, and deteriorating processing facilities (Siegener, 2015). As a result of the ongoing outbreak, three people died, 10 were confirmed ill, and millions of pounds of recalled ice cream resulted from the outbreak.

When this article was written in 2024, the Boar's Head recall of liverwurst and dozens of other products was ongoing. The recall was initiated in July 2024, but signs of trouble appeared at least two years before the recall, when USDA inspectors identified severe violations in the processing facility, including mold growth, holes in walls, leaks, and pest infestation. It was apparent that the violations were not wholly addressed because on July 25, 2024, after many people got sick with listeriosis after eating their products, Boar's Head initiated a recall of their liverwurst products (and at least a dozen products followed), and on July 31, the USDA withheld the federal mark of inspection because the facility "failed to maintain sanitary conditions" (USDA FSIS, 2024a). The magnitude of the recall was in the order of several million pounds of product.

The final fate of Blue Bell ice cream or Boar's Head deli recalled products is unknown because companies are not generally forthcoming about their disposition method of recalled products. But, based on the defect—microbial contamination—it is likely that the recalled products were disposed of or, perhaps, redirected for other use, which could lessen the impact to some extent. The ingredients used in both companies' products come from animal sources, so it is worth mentioning that to produce one pound of meat under the feedlot system requires 25 pounds of grain (Smil, 2002), while one pint of milk takes approximately one pound of feed (Wolf, 2010). Therefore, disposing of these types of animal products is a considerable waste in the supply chain from raw material production to disposal.

Unfortunately, recalls continue to occur due to preventable causes. Producing safe food products is a complex endeavor, and some products, due to their nature or the origin and type of ingredients,

are more complicated than others, but it is not impossible to reduce the incidence of recalls. The key is having a food safety management system in place and a solid commitment to safety. For almost three decades, USDA-inspected plants have followed the principles of Hazard Analysis and Critical Control Points (HACCP) as a food safety management system, while the FDA has followed a similar approach, named food safety plans, which stems from the Preventive Controls for Human Food rule mandated by the Food Safety Modernization Act (FSMA; 2011) passed by Congress in 2011 (Food Safety Modernization Act, 2011). The FDA also uses HACCP in some industries, such as juices and seafood. Even when both systems are similar, they have critical differences. A HACCP plan follows a process-centered approach, while a FSMA's food safety plan focuses not only on the process but also on sanitation, allergen, and supply-chain preventive controls to address potential hazards.

HACCP and food safety plans are preventive approaches that systematically identify potential hazards in the production of food products and develop strategies to minimize the chances of occurrence. If any nonconformity occurs, a well-

designed and implemented HACCP or food safety plan will contain and minimize the damage. In addition to needing to be well designed and implemented, a HACCP or food safety plan must be followed in day-to-day operations. However, a factor that often conspires against these tools is complacency. If not reminded of these principles continuously, operators will start missing steps and jeopardizing food safety. Moreover, this becomes even more detrimental when management is not entirely on board.

Based on the U.S. Environmental Protection Agency Wasted Food Scale (EPA, n.d.), food waste must be prevented from reaching the landfill, incinerator, or drain by all means. On top of the scale, there is avoiding waste generation, followed by upcycling, using as animal feed, composting, using anaerobic digestion, and disposing of the product as a last resort. Except for avoiding waste generation, all the other choices represent palliative actions to minimize something that should not have occurred in the first place. Of all the food waste generated, recall-related waste is, in most cases, completely avoidable. It is just a matter of having the right management system, trained operators, and managers committed to food safety. 

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POLICY BRIEF

Sustainable agriculture impacts in urban settings make the case for federal investments



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Submitted September 26, 2024 / Published online October 30, 2024

Citation: Capnerhurst, H., Quigley, H., & Hawes, J. K. (2025). Sustainable agriculture impacts in urban settings make the case for federal investments [Policy brief]. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 115–127. <https://doi.org/10.5304/jafscd.2024.141.002>

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Summary

Urban agriculture has flourished in American cities under the care of communities, but its growing popularity faces a number of challenges related to scant funding, insecure land tenure, and environmental pollution. Both local and national policy in the U.S. have struggled to adequately address those challenges and meet the demand for fresh food, local production spaces, and resilient communities. In this policy brief, we explore an emerging apparatus to support urban agriculture in the U.S. Department of Agriculture: The Office of Urban Agriculture and Innovative Production. We describe the relationship between urban agriculture's many benefits and future funding, technical assistance, and data collection initiatives through this office. Specifically, we call for consistent, permanent funding that is not subject to the annual federal budget process, which could power more tailored technical assistance programs, reformed granting initiatives, and expanded data collection to inform future policy and

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Disclosures

The authors declare no direct conflicts of interest. The authors and authors' organizations are or have been the recipients of USDA and other federal funding, but no funds have been received from the Office of Urban Agriculture and Innovative Production, and the funders of past and present work had no influence on the contents of this policy brief.

practice. Urban agriculture has the potential to transform communities and the future of farming, and federal policy has the potential to provide important support for this transformation. The policies outlined here offer a roadmap for this support.

Keywords

urban agriculture, U.S. federal policy, USDA, Office of Urban Agriculture and Innovative Production, indoor farming, beginning farmers, climate resilience, community food systems, food security

Introduction

The accelerated growth of urban agriculture in the past few decades reveals it as a critical space for advancing local food sovereignty, urban business development, revitalization, and well-being in cities across the United States (Hardman & Larkham, 2014; Porter, 2018; U.S. Senate Committee on Agriculture, Nutrition, and Forestry, 2023). Often led by communities of color, urban agriculture has proven to be a resource for those farm communities historically marginalized and dispossessed of land and resources (Horst et al., 2017). Despite this, support for urban agriculture has largely been limited to local policy. In 2007, the American Planning Association argued that its members had missed a critical sector of urban spaces in urban farms and gardens, and it took until 2018 for the U.S. federal government to enact meaningful support for urban agriculture (American Planning Association, 2007; Pothukuchi & Kaufman, 2000; USDA, 2022).

This gap in federal support for urban agriculture has left the responsibility for documenting, supporting, and sharing urban agriculture largely in the hands of nonprofit organizations, academic researchers, community activists, and urban agriculturalists. Despite this, there is increasing evidence that production farms in urban settings, under the right circumstances, can reduce carbon emissions in the food sector, create jobs, empower workforce development, and support communities (Cohen et al., 2024; Hawes et al., 2024; Ilieva et al., 2022; Kafle et al., 2023). These diverse needs of urban communities have demanded increasing innovation in farming practices as urban farmers and gardeners grapple with soil health limitations, development pressures, land tenure uncertainty, restrictive local laws and regulations, and widespread ambivalence from federal policy stakeholders (Castillo et al., 2013; Whittinghill & Sarr, 2021).

This brief summarizes the current landscape of urban agriculture in the U.S. in practice and policy. The recommendations offered represent only the views of the authors and do not necessarily represent the views of this journal, the urban agriculturalists who share their stories here, or any funders associated with the authors.

Recent History of Federal Urban Agriculture Policy in the United States

The concept of growing food in urban areas is not a new one, and the definition of urban agriculture varies across contexts, but this brief is primarily focused on the cultivation and distribution of agricultural products in urban and suburban areas. This may include commercial or communal production and can be found in production farms; community gardens; rooftop farms; high tunnels; and hydroponic, aeroponic, and aquaponic facilities.

Despite this diversity of cultivation in urban areas, the U.S. Department of Agriculture (USDA) has not historically dedicated explicit resources to these growers. Congress, led by Senator Debbie Stabenow, sought to rectify this in the Agriculture Improvement Act of 2018 (also known as the 2018 farm bill), which established the Office of Urban Agriculture and Innovative Production (henceforth referred to as

the Office) to support the production of urban, indoor, and other innovative agricultural practices, especially those serving food-insecure communities (USDA, 2022). The Office is housed under the Natural Resources Conservation Service (NRCS) at USDA and offers a wide range of programming, grants, and cooperative agreements. While it was authorized in 2018, it did not receive funding until fiscal year (FY) 2020, when it was funded at \$5 million, well below its authorized level of \$25 million¹ (National Sustainable Agriculture Coalition, 2023a).

Since its first appropriation, the Office has acted quickly to implement the suite of its programs, with inaugural awards announced in 2020 (National Sustainable Agriculture Coalition, 2023c). Beyond direct program offerings, the Office also coordinates input opportunities for urban producers and stakeholders through the work of the Federal Urban Agriculture Advisory Committee and 27 urban county committees across the nation, 17 of which are paired with a USDA service center (USDA Farm Service Agency, 2023).

Since the Agriculture Improvement Act of 2018, there have been a number of barriers to full implementation of the Office and other activities. Although Congressional members and stakeholders have delivered repeated requests (National Sustainable Agriculture Coalition, 2024a), the Office has seen only modest growth in funding levels and was left out of initial appropriations bill proposals altogether in FY2024 (National Sustainable Agriculture Coalition, 2024a). Direct program offerings within the Office have remained nimble and responsive to community input and needs. However, there are still several barriers for urban and innovative producers who attempt to access services offered under the USDA's NRCS and Farm Service Agency (FSA).

Policy Considerations for Strengthening Support for Urban Agriculture in the United States

Even with limited funding, the Office of Urban Agriculture and Innovative Production has demonstrated initial success. Studies and stories from urban producers illustrate that as urban agriculture grows, so does the ability for job creation, workforce development, farmland retention, conservation, community food security and resilience, and production innovation to increase (Ackerman et al., 2014; Colson-Fearon & Versey, 2022; Orsini et al., 2020). Congress has an opportunity to expand upon this success by offering practical reforms to the Office and stabilizing funding.

The following are a few key policy considerations that would provide the necessary reforms and investments to leverage and expand existing efforts.

Job Creation

Diversified farm businesses are common in urban settings, with mixed crops and livestock, unique production methods, and diversified market channels (USDA Climate Hubs, n.d.). Not only does this diversification decrease financial and weather-related risks to businesses, but it also provides a range of job opportunities to grow the local economy (Dürr, 2016; Orsini et al., 2020).

The Office of Urban Agriculture and Innovative Production sought to invest in job creation early in its programming. Common Ground Producers and Growers, a mobile market in central Kansas, received one of the first seven awards from the Office in 2020. Donna Pearson McClish, founder and CEO of Common Ground, described the award as a “game-changer.” Common Ground received the funding during the initial months of the COVID-19 pandemic, and it opened doors for it to expand its operation by serving new, expanded markets, working with additional farmers, and offering farm and

¹ The currency throughout this policy brief is in US\$.

market jobs to community youth (USDA, 2024). This project demonstrates one of many ways that an urban agricultural production venture can meet many community needs.

Necessary Change

The Office of Urban Agriculture and Innovative Production has been significantly underfunded since its establishment, receiving an average of 30% of its authorized funding level (National Sustainable Agriculture Coalition, 2023a). Underfunding, coupled with significant demand for grants, has created a shortfall, and the Office funds less than 25% of eligible applications (National Sustainable Agriculture Coalition, 2024b). If offered consistent, permanent funding that is not subject to the annual federal budget process (i.e., “mandatory funding”), the Office could better serve program demand. At a minimum, there should be annual mandatory funding of \$10 million with an authorization of appropriations at \$50 million annually.

Workforce Development

Urban Agriculture and Innovative Production grants have an explicit purpose to provide mentoring, job training, and resources for underserved populations, including for adults, youth, and kindergarten through high school (K-12) settings. These projects often offer job training to food system workers, strengthen urban communities’ abilities to fill open jobs, build skills along the food supply chain, and produce economic growth in lower-income communities (USDA, 2024).

For example, in Cincinnati, Ohio, Jackson Street Farms has evolved to offer a youth agricultural workforce development program, the Urban AgriAlliance (Jackson Street Farms, n.d.). Jackson Street Farms partners with its local county employment program to operate as a worksite, offering a 10-week program for youth aged 14 to 21. Director Celeste Treece says the program, now in its third year, responds to the needs of participating youth by offering multiple training tracks to meet kids where they are. These include topics on farming, composting, arboriculture, branding and packaging, and upcycling textiles to create workwear. Not all youth want to work directly on the farm, so the program exposes them to careers both directly in urban agriculture and ones adjacent to it, such as local Cooperative Extension offices and the Environmental Protection Agency. Program graduates are also offered the opportunity to maintain their employment on the farm. Jackson Street Farms embodies the type of agricultural venture that the Office of Urban Agriculture and Innovative Production is tasked to support. However, due to program demand and organizational structure complexities, it has never been awarded a grant from the Office.

Necessary Change

Beyond securing mandatory funding for the Office of Urban Agriculture and Innovative Production to fund more projects like Jackson Street Farms, Congress could enable additional changes to provide more workforce development opportunities in agriculture. For example, the existing Urban, Indoor, and Emerging Agriculture program (<https://www.nifa.usda.gov/grants/programs/urban-indoor-emerging-agriculture>) is well suited to fund the development of specialized innovative agriculture curricula, professional credentialing, and workforce development programs in technical, community, and four-year colleges.

Maintaining Farmland

The 2022 Census of Agriculture documents the ongoing pressure of consolidation and development on farmland (USDA NASS, 2024). As many urban growers operate as nonprofits or on land with leasing

agreements that prohibit profit-generation, they feel the costs of farmland retention even more in competitive urban land markets (Kafle et al., 2022). While no formal studies have looked at the instability of urban farmland tenure specifically, there are numerous examples of urban growers facing shortened leases or sudden sales (Rosen & Ruhf, 2018). This makes it all the more remarkable that urban agriculture has continued to expand (Cohen & Wijsman, 2014).

A growing body of evidence indicates that this repeated cycle of land loss and redevelopment not only robs communities of vital resources and food production (up to 15–20% of food globally, according to Payen et al., 2022), it may also cause carbon emissions on urban food growing sites to skyrocket unnecessarily (Hawes et al., 2024). Although many urban farmers deploy climate-friendly practices to mitigate carbon emissions, most of the carbon footprint of urban agriculture sites is invested during the construction of the site, in the form of food-growing infrastructure (Dubbeling et al., 2019). If sites are forcibly displaced on a regular basis, then carbon investments in this infrastructure cannot be amortized across many years of food production. This makes secure land tenure not just a community resilience and food justice issue, but also a requirement for effective climate change mitigation. Activities supported by the Office can include research and development of strategies and municipal-level policies that can support secure land tenure for farms and gardens, while also supporting investment in surrounding neighborhoods.

For example, American Farmland Trust (AFT) received an Urban Agriculture and Innovative Production grant for 2021–2023 (USDA Press, 2022). This project built on its existing *Farms Under Threat* research by looking at urban agriculture in Oneida County, New York. Through a series of surveys and stakeholder conversations, and a county-level policy analysis, AFT sought to assess the potential demand for and supply of farmland and recommend local policy strategies that would support local food system development.

The results of a survey deployed as part of the project revealed that despite robust interest in farming in the urban metro area, most individuals cited water access, zoning codes, and regulations as primary barriers to them securing additional land. To address this gap in local policy, AFT collaborated with the Pace University Haub School of Law to complete a policy assessment and craft recommendations for the state, county, and municipal level, eventually producing *Growing the Landscape for Urban Agriculture in Oneida County, New York* (AFT, 2023). The result is a tool replicable in other settings, and AFT is hopeful of implementing the assessment across a wide number of locations in the future.

Necessary Change

Land access for agriculture and cultivation is a hyperlocalized issue, and support for agricultural producers should reflect unique local considerations. USDA could address this by utilizing local resources at USDA Service Centers. If funded, staff at Farm Service Agency offices would be trained on how to support growers in navigating local zoning requirements to access land in the surrounding service area. Conservation specialists would support those producers in pursuing federal resources to protect the land.

Community Food Security and Resilience

Urban agriculture goes beyond increasing food security for communities; it can also enhance a city's self-sufficiency and resilience against potential disruptions in food supply chains, which is especially important for disinvested communities (Barthel & Isendahl, 2013; Siegner et al., 2018). For example, localized, cooperative food systems played important roles in the face of the COVID-19 pandemic, providing

rapid responses to urgent needs while the global supply chain struggled to adapt to the new circumstances (Jones et al., 2022; Schoen et al., 2021; Taylor et al., 2022). During the pandemic, many local food producers, distributors, and organizations gained recognition as they filled this gap in food supply by investing in cooperatives, farmer networks, and organizational partnerships (University of Kentucky et al., 2021).

In Detroit, Michigan, the Black local food movement demonstrates how urban agriculture is forming new systems and institutions of liberation and autonomy that promote community food security in marginalized communities (White, 2017). Organizations like Detroit Black Community Food Sovereignty Network,² Freedom Growers,³ Oakland Avenue Urban Farm,⁴ Georgia Street Community Collective,⁵ Detroit Black Farmer Land Fund Grow-op,⁶ and many more have laid the foundation for community members and land stewards to organize around ideas of environmental justice, food sovereignty, and land equity.

Out of the need for communal autonomy and resilience, Black communities have utilized strategies such as forming cooperatives, community land trusts, and other mechanisms for sharing power and resources reciprocally. Most importantly, this work has given Black people faced with divestment and systemic injustice a tangible opportunity to transform their circumstances into greater states of freedom, peace, and resilience.

The Detroit Black Farmer Land Fund Grow-op, a group of Black farmers, growers, and agrarians in Detroit, is a prime example of how far cooperatives of farmers can go in transforming urban foodscapes. shakara tyler shares that this group is striving toward “the beauty of Black food sovereignty” (s. tyler, personal communication, May 8, 2024). To do this, tyler says,

We provide our community [with] healthy, clean food as a necessity to life while supporting living wages for Black farmers and the opportunity to be thriving farmers in a system not set up for us. We are making Black food sovereignty real through community ownership over our resources, mutual aid, and deep relationships (s. tyler, personal communication, May 8, 2024)

Detroit serves as a leader of urban agriculture around the world, and the leaders of the Detroit Black Farmer Land Fund Grow-op believe that Detroit’s representation of Black agrarian cooperativism “will set the stage for what Black revival through land and food could look like... [by mentoring] new and aspiring growers and [donating] fresh produce to build the community power” (s. tyler, personal communication, May 8, 2024). The Grow-op is in its third season and has already doubled individual growers’ incomes and generated more than \$90,000 through sales in 2023.

Necessary Change

The Office of Urban Agriculture and Innovative Production is a limited funding source for urban growers and their networks, and the funding currently excludes farmer cooperatives. If Congress expanded the program eligibility, it would allow cooperatives access to upfront financial investments. This could lead to self-sustaining systems and economic autonomy for urban agricultural cooperatives (White, 2018).

² <https://www.dbcfnsn.org/>

³ <https://freedomfreedom.wordpress.com/about/>

⁴ <https://www.oaklandurbanfarm.org/>

⁵ <https://www.georgiastreetcc.com/>

⁶ <https://www.detroitblackfarmer.com/>

Beyond Legislation

Newer programs, such as the Office of Urban Agriculture and Innovative Production, require changes in their statute to address issues associated with the original authorization of the program. However, there are several existing services within USDA that have the potential to promote the growth of agricultural cultivation in urban areas. Previous Congressional authority and existing regulations provide USDA with flexibility to tailor services to the evolving needs of the country's agricultural producers. The following are recommendations for existing programs and services that would improve program access for producers in urban areas.

Implementing Conservation in Urban Areas

The Office is tapped as the primary source for programs and services for urban and indoor agriculture; however, the Office has also been directed to collaborate across USDA agencies to better integrate products and services that serve the unique needs of underserved growers (USDA, n.d.-a). In light of the significance of urban agriculture to communities of color, the historic lack of resources from the USDA, and the persistent attempts to remove these communities' access to land, the Office is associated with new and emerging efforts to direct resources to Black farmers, farmers of color, and underserved communities (Collison, 2023; Milligan, 2016; Worthy, 2022).

Among the programs critical to underserved producers are the working lands conservation programs administered by the Natural Resources Conservation Service (USDA NRCS, n.d.-a). NRCS supports agricultural producers in identifying and implementing conservation solutions that protect water resources, promote soil health, and drive economic gains in communities. As extreme and unpredictable weather patterns increase in prevalence and elicit compound events with things like pollution in urban areas, farmer demand for conservation programs continues to expand (National Sustainable Agriculture Coalition, 2023b; Singh et al., 2023). NRCS working lands conservation programs are also among the very few USDA programs that offer direct financial and technical assistance to farmers for producing food in a more efficient and climate-friendly way. Across their four most popular programs, NRCS received requests for almost \$3 billion in FY2023, more than three times the amount of funding available (USDA, 2023). The combined high demand and program barriers for urban and innovative producers warrant changes to increase program accessibility.

NRCS programs support farmers in implementing a myriad of practices on their farms such as crop rotation, cover crops, planting buffers, and much more. While applications for these services are ranked by the environmental benefit of the practices, the amount of funding provided to the grower considers the cost of implementation by acreage (USDA NRCS, n.d.-b). This often disadvantages urban and small-scale growers, despite historical urban land use and pollution making access to soil and water conservation programs essential for urban farmers to better understand their growing environments and mitigate any potential risks (Lupolt et al., 2021; Ugarte & Taylor, 2020). While grants from the Office of Urban Agriculture and Innovative Production can fund organizations to support urban farmers in navigating these issues and accessing program resources, individual farmers are not eligible to receive grants directly from the Office to implement these practices on the farm, causing a disparity. This also makes NRCS program support even more important for urban farms to utilize climate-friendly agricultural practices, like composting food and yard waste into soil supplements, utilizing rainwater recovery for irrigation, and reusing construction materials that would otherwise be wasted (Hawes et al., 2024).

In order for urban farmers to participate in NRCS programs, they rely on local staff's familiarity with implementing conservation practices in a variety of innovative production techniques and scales

(Reynolds, 2011). Due to the USDA's short history of serving urban farms, NRCS staff do not often have the expertise or experience to effectively support urban cultivation. To address gaps in USDA's understanding of urban farming systems, it is important for NRCS to inventory commonly and successfully implemented conservation practices in urban areas and adequately train field staff on the planning and implementation of practices in these settings.

Necessary Change

The Office of Urban Agriculture and Innovative Production should evaluate the most commonly utilized and successfully funded conservation and management practices in urban and small-scale operations. These examples and their corresponding technical plans can be collected at the national level and distributed to local offices, further supporting field agents in understanding conservation practices for urban farming operations and innovative production methods. Field staff should be trained on these practices to support them in offering urban producers adequate technical assistance. In addition to addressing the availability of information, NRCS should evaluate the way in which applications are ranked for award consideration. In order to ensure equitable access to conservation programs for urban producers, NRCS should consider the compounding effect of environmental pollutants in urban areas that exacerbate the costs associated with production.

Implementing Innovative Production Data Collection Initiative

The best practices shared here have largely been documented by academics, community members, or nongovernmental partners working closely with existing urban farmers and gardeners. As a result, this is only a snapshot of the innovative and impactful practices of urban growers. Although urban agriculture continues to expand and plays an increasingly important role in communities and food systems, we will never understand the full extent without the implementation of more systematic data collection. An Urban Agriculture and Innovative Production Data Collection Initiative was mandated in the 2018 farm bill, yet implementation has lagged, and the breadth of urban farmers and their business impact remain unknown.

Necessary Change

In order to fully implement the data collection initiative under the USDA National Agricultural Statistics Service (NASS), Congress would need to fund the Urban Agriculture and Innovative Production Data Collection Initiative. To ensure that urban and small-scale farmers are adequately reached, NASS should pilot data collection strategies with known urban agriculture groups to identify the survey techniques that most effectively characterize innovation and best practice in urban settings. The initiative must be implemented in the 2027 Census of Agriculture, including near-term work with urban and innovative production organizations to explore mail and digital methods of making contact with a meaningful portion of urban agriculturalists by 2027.

Conclusion

As demonstrated through this brief, the urban and innovative agricultural production sector is growing and serving community economic, environmental, human health, and social needs. However, as a result of decades of disinvestment and limited coordination between national, state, and local authorities, much

remains unknown about the current state of urban agriculture and innovative production. There are a variety of changes that can be made legislatively and administratively for the federal government to better serve this sector. At a minimum, it must adequately fund, expand, and study urban agriculture and innovative production in the U.S. Based on research gathered by nonprofit organizations, academic researchers, and food producers themselves, we have summarized a series of four key next steps for enabling equitable and climate-friendly urban agricultural production:

1. In order to meet the demands that are consistently received, the Office of Urban Agriculture and Innovative Production needs to receive annual mandatory funding of \$10 million, with appropriations up to \$50 million.
2. Congress should work with community experts to identify appropriate legislative reforms to increase the provision of tailored technical assistance. Related legislative reforms should consider eligibility requirements, funding prioritization, and best practice scope for Office and other NRCS initiatives.
3. Given sufficient funding, the Office must be charged with pairing its granting programs with data collection, cataloging and sharing the innovative practices supported through the program.
4. The USDA National Agricultural Statistics Service must prioritize (and Congress must fund) data collection strategies that effectively capture urban and innovative production. Pilot testing must begin immediately in order to deploy these data collection strategies in the 2027 Census of Agriculture.

Acknowledgments

The authors would like to acknowledge the following collaborators for their contributions of stories, quotes, feedback, or ideas to this policy brief:

- Andy Chae, Fisheye Farms
- Leslie Hoey, University of Michigan
- Molly Johnston-Heck, American Farmland Trust
- jøn kent, Sanctuary Farms
- Qiana Mickie, New York City Mayor's Office of Urban Agriculture
- Donna Pearson McClish, Common Ground Producers and Growers, Inc.
- Mark Schonbeck, Research Associate, Organic Farming Research Foundation
- Lindsey Shapiro, PASA Sustainable Agriculture
- Russell Thorsen, PASA Sustainable Agriculture
- Celeste Treece, AgNoire
- shakara tyler, Detroit Black Community Food Sovereignty Network
- Nicole Wolcott, Ohio Ecological Food and Farm Association

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POLICY BRIEF

Racial equity and the USDA's Office of Urban Agriculture granting program and urban offices



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Submitted November 18, 2024 / Published online December 30, 2024

Citation: Reynolds, K., Gottfried, C., & Thomas, T. (2025). Racial equity and the USDA's Office of Urban Agriculture granting program and urban offices [Policy brief]. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 129–139.
<https://doi.org/10.5304/jafscd.2024.141.025>

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Summary

Urban agriculture (UA) has long been practiced in the U.S. by socially disadvantaged and low-income people for the purposes of subsistence, community and resilience. Government support for UA, however, has waxed and waned, including in city and federal policy. The 2018 farm bill established the Office of Urban Agriculture and Innovative Production (OUAIP) with the mission to encourage and promote “urban, indoor, and other emerging agricultural practices” (Agriculture Improvement Act of 2018, Title XII, Sec. 12302). The inclusion of UA in federal agriculture policy was a welcome change for many urban farmers and gardeners who had long sought recognition of urban production. Yet, historical discriminatory policies and practices on the part of the U.S. Department of Agriculture (USDA) have led some farmers and advocates to be wary of

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Funding Disclosure

The study was supported through the Socially Disadvantaged Farmers and Ranchers Policy Research Center, Alcorn State University (The Policy Center) through a U.S. Department of Agriculture National Institute for Food and Agriculture [USDA NIFA] subaward.

Author Note

The full study findings were previously published as a publicly available final report (Reynolds et al., 2024).

the department, and may suggest reticence to engage with USDA programs. This brief shares key findings and policy recommendations from a study that sought to understand the roll-out of the OUAIP and connected programs through a racial equity lens. We used a multimethod data collection approach that included national surveys of UA stakeholders; in-depth interviews with UA stakeholders in two case study cities, New York City and Atlanta; informational interviews with Urban Service Center (USC) Leadership in cities with urban county USDA Farm Service Agency (FSA) offices; GIS mapping of publicly accessible data; review of relevant policy documents; and participant observation, including meetings of the federal-level Urban Agriculture and Innovative Production Advisory Committee (UAIPAC). The study was supported through the Socially Disadvantaged Farmers and Ranchers Policy Research Center (The Policy Center) at Alcorn State University. In this policy brief, we introduce the urban agriculture provisions in the 2018 farm bill in the context of historical discrimination within the USDA. We then provide a short overview of our 2023–2024 study exploring the establishment and outreach of these provisions among Socially Disadvantaged Farmers and Ranchers (SDFRs) urban stakeholders followed by the key findings. We conclude with a set of policy recommendations, and reflection on how these recommendations may be relevant in 2025 and beyond.

Keywords

urban agriculture, food policy, agriculture policy, USDA, Socially Disadvantaged Farmers and Ranchers, racial equity, farm bill, New York, Atlanta

Abbreviations

Office of Urban Agriculture and Innovative Production.....	OUAIP
Socially Disadvantaged Farmers and Ranchers.....	SDFRs
Socially Disadvantaged Farmers and Ranchers Policy Research Center at Alcorn State University	The Policy Center
United States Department of Agriculture	USDA
USDA Farm Service Agency.....	FSA
USDA Natural Resources Conservation Service	NRCS
Urban agriculture	UA
Urban Agriculture and Innovative Production Advisory Committee	UAIPAC
Urban Agriculture and Innovative Production grants	UAIP grants
Urban Service Center	USC

Introduction and Overview of the OUAIP

Over the past 20 years, state and city policies supporting urban agriculture (UA)—the growing of food and nonfood products and the raising of livestock in and around cities (Mougeot, 2006; Smit et al., 1996)—have been gaining momentum. These include the California legislature’s 2013 act to allow cities to provide incentives for commercial production (Reynolds & Darly, 2018) and citywide UA plans in Baltimore in 2013 (Baltimore Office of Sustainability, 2013) and Philadelphia in 2023 (Philadelphia Parks & Recreation, 2023). A handful of cities, including Atlanta in 2015 (R. Stephens, 2019), Philadelphia in 2019 (Jaramillo, 2019), Washington, D.C., in 2020 (Maryland Department of Energy & Environment, 2020), and New York City in 2023 (City of New York, 2022) have also recently created UA director positions in city government.

These city and state policy moves follow a history of waxing and waning government support for urban food production. This includes the Pingree Potato Patches supported by Detroit’s mayor in the late 19th century, Victory Gardening programs during both world wars, such as that at Spelman College (Reese, n.d.), that were supported by the U.S. federal government, and the creation of municipal urban gardening programs beginning in the 1960s. It also includes city administrations’ attempts (at times successful, at times not) to sell city land made previously available to urban gardeners and farmers to the highest bidders, including real estate developers (Reynolds & Cohen, 2016).

In terms of support from the U.S. Department of Agriculture (USDA), urban agriculture historically has been supported by two key programs. These are the long-standing Master Gardener Program, which since the 1960s has provided horticultural education for home horticulturalists and community gardens, and the now-defunct Urban Gardening Program (UGP), which provided broader support for urban food production in low-income communities from the 1970s to the mid-1990s (Hynes, 1996; J. M. Stephens et al., 1996). However, between the defunding of the UGP (in 1996) and 2018, urban food producers did not have access to a broader scope of services and programs provided by USDA (Reynolds, 2010, 2011; Reynolds et al., 2024).

This changed in 2018. The 2018 farm bill established the Office of Urban Agriculture and Innovative Production (OUAIP), with the mission to encourage and promote “urban, indoor, and other emerging agricultural practices” (Agriculture Improvement Act of 2018, 2018, sec. 222(a)(3)). The bill also established an Urban Agriculture and Innovative Production Federal Advisory Committee (UAIPAC), a competitive grant program for UA, and 10 pilot “urban and suburban county committees” (UCOCs). Seventeen initial UCOCs were announced between August 2020 and June 2022 (USDA, 2020a, 2020b, 2022a). Subsequently, 10 additional UCOCs were announced in July 2023 (USDA, 2023a, 2023b). It was also announced in July 2023 that Urban Services Centers (USCs) would be established and jointly run by the USDA’s Farm Service Agency (FSA) and Natural Resources Conservation Service (NRCS) in the cities where the 17 first UCOCs are located.

The inclusion of UA in federal agriculture policy in 2018 was a welcome change for many UA practitioners, who had long sought recognition of urban production as legitimate agriculture (Reynolds & Darly, 2018). Yet, historical discriminatory policies and practices on the part of the USDA have led some farmers and advocates to view the department as the “last plantation” (Hoffmann, 2009) and may suggest that these groups may be reticent to engage with USDA programs. Recognizing such dualities, this policy brief explores certain racial equity implications of the 2018 farm bill’s UA provisions, drawing from a study conducted in 2023–2024 and supported by the Socially Disadvantaged Farmers and Ranchers Policy Research Center at Alcorn State University (Reynolds et al., 2024).

In this policy brief, we introduce the UA provisions in the 2018 farm bill in the context of historical discrimination within the USDA. We then provide a short overview of our 2023–2024 study exploring the establishment and outreach of these provisions among SDFR urban stakeholders, followed by the key findings. We conclude with a set of policy recommendations, developed prior to the November 2024 general election, and brief reflection of how these recommendations may be relevant in 2025 and beyond.

USDA and Urban Ag through a Racial Equity Lens

The historical context of USDA discrimination has been well documented in legal and formal policy contexts. Examples include several class-action lawsuits against USDA on behalf of Black farmers (Pigford I and II; Cowan & Feder, 2013), Hispanic farmers¹ (Garcia v. Vilsack; Treviño, 2009), Native American farmers (Keepseagle v. Vilsack; Martin, 2010), and women farmers (Love v. Vilsack; Bennett, 2011). Additionally, findings from the USDA’s National Commission on Small Farms in the late 1990s identified discrimination as a significant driver in the decline of small farms in general and “socially disadvantaged” farmers and ranchers—largely U.S. minorities²—in particular (USDA National Commission on Small Farms, 1998). And while the above examples are well-known among many farmers, advocates, and academic researchers, discrimination within USDA also runs deeper than these high-profile cases. This includes histories of the FSA County Committee system being used to maintain white control of farmland alongside the heirs property system (Daniel, 2013; Gilbert et al., 2002), and the offering of agricultural extension services at locations that can be difficult to access by farmers without easy transportation and/or in environments that require access to and comfort in white-dominated spaces (Penniman, 2018; White, 2018).

¹ Current usage in many spaces is Latinx or Latine, but the cited legal cases use the term Hispanic.

² We use the term “minority” in this brief to include diverse groups that are minoritized in U.S. society.

The USDA itself has commissioned dozens of studies and working groups to address discrimination and equity in the department (USDA Equity Commission, 2024), yet policy measures and public contestations pertaining to USDA discrimination and racial equity continue. Notably, after the Biden Administration in 2021 established a loan forgiveness program for Black farmers as recognition of past USDA discriminatory practices (USDA, n.d.-d), a lawsuit was filed against the Biden Administration (also in 2021) on the behalf of white farmers claiming that the loan forgiveness program was discriminatory against white farmers, which ultimately resulted in its repeal (Associated Press, 2024). In 2022, a class action lawsuit was filed on behalf of minority farmers for the repeal of the 2021 program. In recognition of past discrimination, the 2023 Discrimination Financial Assistance Program was created, as part of the Inflation Reduction Act, and allocated US\$2 billion in financial assistance to farmers, ranchers, and forest landowners who reported discrimination in USDA farm lending prior to 2021 (USDA, n.d.-a).

In February 2022, the USDA launched an Equity Commission to “advise the Secretary of Agriculture and provide USDA with an analysis of how its programs, policies, systems, structures, and practices that contribute to barriers to inclusion or access, systemic discrimination, or exacerbate or perpetuate racial, economic, health and social disparities and recommendations for action” (USDA, n.d.-b, para. 3.³ In February 2024, the commission issued its 91-page report (USDA Equity Commission, 2024), which included 66 recommendations to advance equity in the USDA, the first of which is to “institutionalize equity.” While the findings of the 2024 Equity Commission report are not specific to UA, its report provides important context regarding contemporary efforts, during the Biden Administration, to address racial equity in USDA as they may be relevant to the OUAIP. And, while the subsequent administration may not continue the Biden administration’s equity initiatives, the historical precedent is important to document, particularly given the previous Trump Administration’s actions to reorganize the USDA (e.g., by moving the USDA Economic Research Service from Washington, D.C., to Kansas City in 2019 [USDA, 2019; U.S. Government Accountability Office, 2022]).

Examining This Urban Agriculture Policy Landscape

Within the political, legal, and policy contexts above, we conducted a study (Reynolds et al., 2024) that sought to understand the roll-out of the OUAIP programs through a racial equity lens. A key goal of the study was to propose research-based recommendations to inform future improvement of USDA UA programs such that they contribute more thoroughly to social and economic equity for socially disadvantaged farmers, ranchers, communities, and landowners in and around urban areas. The study was supported through the Socially Disadvantaged Farmers and Ranchers Policy Research Center at Alcorn State University (The Policy Center) via a USDA National Institute of Food and Agriculture (USDA NIFA) subaward.

At the time of this study, many of the 2018 farm bill UA provisions had been put in place: three cycles (2020, 2021, 2022) of UAIP grants, administered by the NRCS, had been awarded (USDA, n.d.-e); UCOCs had been formed and leadership staff hired to direct USCs within the USDA FSA offices in 17 cities (USDA, 2024)^{4, 5}; partnerships with community-based organizations had been established; and the UAIPAC had been formed. However, data were needed on outreach and equity dimensions of the OUAIP’s implementation,

³ The Equity Commission was established following Executive Order 13985 from the Biden Administration in 2021. A subsequent direction in the same year via the USDA in Section 1006 of the American Rescue Plan created the Equity Commission in the department.

⁴ Note that the 2018 farm bill did not mandate or prescribe which agencies should house the UAIP grant program or the UCOCs. These decisions were made upon roll-out, and in terms of legislative statute could in theory change over time. However, this section notes that “Nothing in this paragraph requires or precludes the establishment of a Farm Service Agency office in a county in which a county committee is established under subparagraph (A).”

⁵ In summer 2023, USDA partnered with the nonprofit organization To Improve Mississippi Economics (TIME., Inc.) to spearhead establishment of UCOCs in 10 additional cities, including one tribal government. Given the timing of this development, our study, which was designed prior to this date, did not examine details pertaining to the 10 additional cities.

particularly in light of the USDA's historical discriminatory practices noted above, as well as a potential gap in common contemporary understanding about what UA is. (The 2018 farm bill does not provide a clear definition of UA, and previous research has observed a lack of understanding of the practice, especially as it relates to federal agricultural policy [Reynolds, 2010, 2011]).

The research objectives were organized along two focus areas. First, we aimed to document and understand the county-based USCs as well as understand Socially Disadvantaged Farmers and Ranchers' (SDFRs', defined below) awareness of and access to the USC services. Second, we aimed to understand SDFR's awareness of and baseline information about the implementation of the UAIP grant program at the national level, study the public lists of grantees, and map the distribution of awardees to date.

The study took place over a one-year period, from June 2023 to May 2024. We used a multimethod data collection approach consisting of an online survey of urban farmers and additional stakeholders, nationally; in-depth interviews with UA stakeholders in two case study cities, New York City and Atlanta; informational interviews with USC leadership in cities with urban county FSA offices; geographic information systems (GIS)-based mapping of publicly accessible data; review of relevant policy documents; and participant observation, including that of UAIPAC meetings. Building on the principal investigator's (PI's) previous work (Reynolds, 2010; Reynolds et al., 2020; Reynolds & Cohen, 2016), the study used an action research approach that centered racial equity, which included engaging as active participants in professional and social movement settings supporting racial equity in agriculture; and in situ learning (e.g., through field visits) about UA in New York City and Atlanta. The research was approved by The New School's Institutional Review Board.

Terminology

We used the following groupings in our analysis:

Socially Disadvantaged Farmer and Rancher (SDFR). Following the NRCS definition, SDFRs are farmers and ranchers who are "members of a group who have been subjected to racial or ethnic prejudice because of their identity as members of that group without regard to their individual qualities. This includes the following groups: American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, Hispanic" (USDA, 2022a, p. 5).

SDFR/Minority. After consultation with The Policy Center, we use the word "minority" to broadly describe racial and ethnic minority groups discussed in the study.

USC Leadership or USDA Interviewee. We use "Urban Service Center Leadership" and "USDA Interviewee" interchangeably to refer to the USDA USC staff members we interviewed.

Non-USDA Interviewee. We use "Non-USDA Interviewee" to refer collectively to UA stakeholders in this study not representing a USDA agency. Among the *Non-USDA Interviewees* and survey respondents, we make specific reference, where relevant, to "*SDFR/Minority*" or "*Non-SDFR/Minority*" interviewee/respondents.

What This Study Was Not

Many previous studies have documented what UA is; its potential benefits and challenges; and city policy and planning strategies to support it (Bailkey & Greenstein, 2024; Cohen et al., 2012; Cohen & Reynolds, 2015; Draper & Freedman, 2010; Gonzalez et al., 2023; Ilieva et al., 2022; Reynolds, 2011; Reynolds & Gottfried, 2024; Smit et al., 1996). Our study did not further examine characteristics or municipal policy needs of UA.

Key Findings from Our Study on the OUAIP and Racial Equity

Our research uncovered findings ranging from administrative challenges to more structural ones, particularly related to the acknowledgment of the legacy of discrimination on the part of the USDA, summarized as follows:

- Across the surveys and Non-USDA interviews, SDFR/Minority participants were less connected to USDA agencies and programs than were Non-SDFR/Minority participants. This included SDFR/Minority participants having applied proportionately less for USDA grants in general, and for UAIP grants in particular, than had Non-SDFR/Minority participants; and SDFR/Minority participants reporting more negative experiences with USDA and more hesitant attitudes toward the USDA than did Non-SDFRs/Minorities. We also found that SDFRs/Minorities in the surveys and Non-USDA interviewees less frequently reported attempting to contact USDA and that they were more aware of histories of USDA discrimination than Non-SDFRs/Minorities, with many relating personal, family, or community experiences with USDA discrimination.
- We also found that representation on UCOCs and in USDA agency staff was a concern among survey and Non-USDA interviews, including racial and ethnic representation in these bodies and a desire for USDA representatives with “cultural competence” working in specific racial or ethnic urban agriculture communities.
- Among USC Leadership in this study there was awareness of and attitudes about historical USDA discrimination, although at different levels, with some taking proactive steps to confront these legacies. Some interviewees mentioned the need to confront what one characterized as the “sordid history” of the USDA when it comes to discrimination and another expressed a need to “[lean] in” to this history in order to rebuild trust. Others avoided expressing strong views about the historical discrimination.
- We learned about constraints placed on USC outreach to urban SDFRs/Minorities and urban producers by USDA guidelines on external communications, as well as specific outreach strategies used by individual USC Leadership. Constraints were characterized by a reliance on exclusive channels of communication (such as email newsletters that only reach those subscribed to them) and restrictions on the use of social media despite the reality that such channels are increasingly important in reaching diverse audiences. Some USDA interviewees expressed frustration that the limitations hindered their outreach efforts given their hopes to reach more urban farmers, and they engaged in community-based strategies and/or collaboration with local community-based organizations to reach these populations.
- Multiple barriers were discussed by survey respondents and Non-USDA interviewees when applying or considering to apply for USDA UAIP grants and/or attempting to access assistance from USDA. This included grant application and management processes being confusing and/or onerous, especially for farms or organizations with limited staff resources. And among those smaller, SDFR/Minority-led organizations who had learned how to navigate these USDA processes, several reported providing pro bono assistance to other SDFR/Minority farmers in their areas.
- In our observations of the UAIPAC and in the interviews with USC Leadership, we observed a lack of clarity in terms of how UA is defined by USDA, how the FSA (where UCOCs are currently situated) can best serve UA, and whether situating the USCs within FSA is the most effective arrangement. We also observed a disconnect between federal and local levels of the OUAIP and related USDA urban agriculture programs, illustrated by a lack of frequent, consistent communication or collaboration between the USCs, UCOCs, and the UAIPAC and/or OUAIP director.
- Finally, in line with the action research approach in this study, we learned from Non-USDA interviewees and survey respondents about their suggestions for improving USDA’s outreach to SDFRs in urban areas. These suggestions ranged from the very specific (e.g., more transparent deadlines for grant applications) to on-the-ground (hoping for more involvement on the part of USCs in day-to-day UA activities and policy) to structural (e.g., fully confronting the historical legacy of USDA discrimination).

Policy Recommendations

Based on the findings above, we developed a set of policy recommendations to improve UA and USDA programs, including as they intersect with the imperative for racial equity. Writing in mid-November 2024, we acknowledge that our recommendations about working toward racial equity in UA may not be in line with the priorities of the presidential administration that will take office in January 2025. Nonetheless, these recommendations may provide useful insight for any ongoing and future actions to address racial equity in USDA urban agriculture programs—at federal, but also state and local levels—in addition to the broader application of our recommendations in state and city policies and government UA programs.

Our recommendations were as follows:

1. Implement OUAIP-wide education and action on USDA legacies of discrimination to confront gaps observed in our study. We recommended that the Secretary of Agriculture mandate that all OUAIP, NRCS urban agriculture staff, FSA urban agriculture staff, USC staff, UCOC members, and UAIPAC members be required to undergo education about USDA's histories of discrimination as a part of their onboarding into any OUAIP position. We also recommended that the OUAIP director convene a working group to examine the 2024 USDA Equity Commission report and develop a strategy and timeline to implement the commission's goal to "institutionalize equity" within OUAIP.
2. Cultivate systematic understanding of urban agriculture and innovative production within and across the OUAIP. We recommended that the OUAIP director work with the USCs and community-based organizations to refine the working definition of UA in USDA programs and policies to ensure systematic and inclusive understandings of the practices and innovations in urban farming and gardening. We also recommended that Congress reconsider the use of "innovative" production in federal UA policy, insofar it is currently used as a catch-all for controlled environment agriculture or high-tech, for-profit production, in order to contribute to an equity-centered approach supporting SDFRs.⁶
3. Reduce administrative hurdles in the UAIP grant program and increase technical assistance with grant writing for Urban SDFRs/Minorities. We recommended that the UAIP grant program be improved in terms of outreach, assistance with grant writing, allowable regranting and subgranting, and accessible application processes for urban SDFRs. To do so, we recommended that the UAIP grant application and reporting processes be simplified, shortened, and redesigned to allow grantees and potential grantees to describe their work in every day, nontechnical language; the OUAIP provide more assistance with grant writing; and UAIP grants continue (as is currently the practice) to not require preliminary fund matching for small producers and nonprofit farms, and allow regranting.
4. Reconsider the institutional location of USCs and UCOCs. Given the historical discrimination in which FSA has engaged (see above in this brief), and the questioning on the part of USC Leadership interviewed for this study about the applicability to UA of the programs that FSA offers, we recommended that the situating of UCOCs within FSA should be reconsidered. Specifically, we recommended that OUAIP examine whether locating the UCOCs in another USDA agency may be more effective and accessible to a broader diversity of UA practitioners.
5. Ensure that USC leadership, staff, and the UCOCs represent the demographics of the urban farming and gardening communities that they serve. We recommended that USDA provide systematic guidance on county election processes and provide and make publicly available UCOC election reports, with detailed demographic statistics on eligible ballots, as is does for non-urban county committees.⁷

⁶ See Guthman and Fairbairn (2024) for an analysis of the potential limitations of controlled environment agriculture and what they discuss as 'agri-food tech.'

⁷ County committees election reports are available from 2002 through 2021 on the FSA website. No reports are therefore available to account for election results after the establishment of the Urban County Committees. See <https://www.fsa.usda.gov/about-fsa/county-committee-elections>

6. Improve and modernize communication and outreach to reach urban SDFRs. We recommended that USDA revise its communications policies to allow local agencies and offices to hold social media accounts to reach broader and more diverse communities of urban farmers; OUAIP provide guidance on outreach to UCOs to better and more consistently reach SDFRs in their areas and make resources available to follow through on such guidance; and Congress authorize funding for USCs continue to work with FSA community-based organizations for outreach and to better target the communication of information in local areas.

Conclusion

This study was designed in March 2023, and data collection concluded in May 2024. During and immediately following this time period, several changes took place. As noted in this brief, 10 additional urban areas were added to the list of FSA Urban County Committees in mid-2023, (although no Urban Services Centers have been announced for these areas as of this writing). Additionally, in October 2024, FSA announced changes allowing producers to report acreage-based crops at a minimum size of .000001 acre or 0.0000004 hectare (about a 2.5-inch by 2.5-inch or 40 square cm area), a move that expands flexibility in eligibility requirements for FSA services (USDA, 2024). We also observed UAIPAC meetings throughout the period and observed deliberations leading the committee to change recommendations supporting earmarked funding for 1890s (Historically Black) land-grant universities (LGUs) to instead recommend funding for all LGUs; and recommend additional funds for 1890s LGUs.

As of this writing, in early November 2024, the next farm bill has not been finalized. (The 2018 bill ran through 2023, and was extended in November 2023 through September 30, 2024, but is expired as of this writing [USDA, n.d.-c].) Several marker bills addressing UA have been introduced in Congress, and both Senate and House agriculture committees have put forth language and versions of a next farm bill that include urban agriculture (U.S. Senate Committee on Agriculture, Nutrition, & Forestry, 2024; House Committee on Agriculture, 2024). We continue to observe this policy landscape, and our analyses will be the subject of future publications.

Finally, the outcome of the 2024 general election suggests that there may be less political will in the near term to prioritize racial equity in UA through federal policy or programs. However, as a research team, we will continue to engage with such efforts through the action-oriented approach to racial equity in urban agriculture that grounded this study. There is much work to do.



Acknowledgments

We thank the following groups and individuals for their participation, communications, and support in this pilot study: Constance L. Smith, masters candidate in environmental policy, The New School; Farm School NYC; National Black Food and Justice Alliance; BLACKAG, INC.; Alexander Little, Atlanta urban agriculture practitioner; Dr. Cindy Ayers Elliott, CEO, Foot Print Farms and President/CEO, TIME, Inc.; Austin Bryniarski, legislative assistant to Congresswoman Alma S. Adams; Andy Fisher, project co-director, ISED Solutions; and Sebastean H. Pujols Aquino and Claire Hearn McGinley, New School Ph.D. students.

We especially thank all individuals who participated in the online survey and/or formal interviews for this study, and Dr. Kara Woods and Dr. April Love, Esq., at The Policy Center. This research was supported by funds from the Socially Disadvantaged Farmers and Ranchers Policy Research Center.

Any errors and omissions are those of the authors of this policy brief.

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Transportation barriers in local and regional food supply chains

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Submitted January 26, 2024 / Revised August 15, October 4, and October 26, 2024 /
Accepted October 29, 2024 / Published online December 13, 2024

Citation: Krejci, C. C., Marusak, A. A., Mittal, A., Sadeghiamirshahidi, N., & Beckwith, S. (2025). Transportation barriers in local and regional food supply chains. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 141–168.
<https://doi.org/10.5304/jafscd.2024.141.018>

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Abstract

Large-scale food supply chains in the U.S. are cost efficient but lack resilience to external shocks. One approach to increasing food system resilience

is through regionalization, in which a large and distributed network of diverse and independent farms provides redundancy and spreads out risk. However, the decentralized structure of regional food supply chains (RFSCs) inhibits transportation efficiencies, which increases producers' costs and limits their market reach. Outsourcing transportation to commercial carriers and collaborating with other producers are two highly recommended strategies for improving RFSC transportation efficiency, but research on producers' perceptions of these strategies is limited. This paper describes research that seeks to understand the major transportation barriers that prevent RFSC pro-

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Funding Disclosure

This work was supported by the U.S. Department of Agriculture (USDA) Southern Sustainable Agriculture Research and Education (SARE) program (project number LS19-312).

Statements and Declarations

The focus group methodology for this study was approved by the Institutional Review Board of The University of Texas at Arlington (declared “exempt”). The authors have no relevant financial or nonfinancial interests to disclose.

ducers from efficiently reaching broader markets and how these barriers might be overcome. Focus groups with RFSC producers throughout the U.S. state of Texas were administered, with results indicating that participants view transportation as a significant barrier to their businesses' growth and financial success. Outsourcing transportation to commercial carriers is viewed as a highly desirable alternative to self-delivery but is also considered to be expensive and insufficiently flexible. Nearly all participants were excited about the idea of collaborative transportation, but there were serious concerns about competition and logistical coordination. Despite these barriers, the results suggest that the formation of regional transportation cooperatives and/or the development of information and communication technology infrastructure to facilitate collaboration could provide a path forward. Moreover, the criticality of transportation for RFSCs underscores the need for public funding to support implementation of these strategies.

Keywords

local food logistics, regional food supply chains, resilient food system, small-scale farming, focus group research, horizontal collaboration, collaborative transportation, farmer perspectives on transportation, Texas, COVID-19, pandemic

Introduction

Uncertainties surrounding the ability of global food supply networks to withstand and rapidly recover from the impacts of adverse events have become a major concern (Béné, 2020; Rotz & Fraser, 2015). Under normal conditions, these networks can cost-efficiently produce and distribute large volumes of food (Food and Agriculture Organization of the United Nations [FAO], 2017). However, their efficient structures lack diversity and redundancy, making them vulnerable to a wide variety of potential shocks and stresses, including weather and climate-related disasters, pest infestation, disease outbreaks, contamination, trade or pricing shocks, and political instability or conflict (Fan et al., 2021). For example, the streamlining of operations and logistics to minimize inventory and excess pro-

duction capacity has made food supply networks more cost-efficient (Hobbs, 2020), but as the COVID-19 emergency revealed, inadequate buffering against sudden shifts in demand and supply can lead to food price spikes and shortages during disasters (Simchi-Levi & Simchi-Levi, 2020). Global food supply networks are also characterized by relatively few large farms, with centralized production located in a few specific regions and distribution occurring along large-scale, vertically integrated networks of farmers, agribusinesses, wholesalers, retailers, and logistics providers (Hendrickson et al., 2020; Howard, 2021). While vertical integration facilitates tight connections between these actors, enabling efficient transactions, it also introduces vulnerability including cascading risks and series of shocks, in which problems can quickly spread and adversely impact multiple points across the network (Béné, 2020; Fan et al., 2021; Zurek et al., 2022). The risk of major disruptions to this tightly interconnected system is concerning for all participants, especially considering that food supply networks are increasingly exposed to shocks and stresses (Tendall et al., 2015), and their large scale and complexity can obscure the early warning signs of system failure (Campbell, 2009; Toth et al., 2015). As a result, there have been numerous calls from policymakers and food systems advocates for increased food system resilience (Oliver et al., 2018), including the ability to prepare for, respond to, and recover from disruptions.

Most discourse on increasing food system resilience has focused on how to return the supply network quickly and cost-effectively to the status quo after disruption (Zurek et al., 2022). However, system resilience is not intrinsically positive if the status quo is not delivering positive outcomes (Jacobi et al., 2018). Indeed, global food supply networks fail to meet the basic needs of many stakeholders and continue to fall short of meeting multiple United Nations (UN) Sustainable Development Goals (SDGs), including ending hunger, achieving food security and adequate nutrition for all, promoting sustainable agriculture, and providing meaningful livelihoods for producers (Oliver et al., 2018; Savary et al., 2020). It can be argued that increasing the resilience of this existing system,

while benefiting some powerful actors in the short term, would undermine long-term resilience and sustainability (Jacobi et al., 2018; Oliver et al., 2018). Rather than incremental adjustments for short-term harm reduction and mitigation, long-term food system resilience will require major structural changes to the global food supply system (i.e., a transformation) to promote the resilient delivery of the SDGs to benefit society (Oliver et al., 2018; Zurek et al., 2022).

What might such a transformation look like? One possibility is a network with increased regionalization of food production and distribution. Regionalized food supply chains (RFSCs) are characterized by many small-scale producers, with short distances and few or no intermediaries between producers and consumers, and a structure that is disaggregated and not vertically integrated (Woods et al., 2013). Compared with the prevailing global food supply network, the disaggregated structure of RFSCs tends to have lower interconnectivity, higher diversity, and greater redundancy at a system level, all of which have been identified as key principles for system resilience (Biggs et al., 2012; Hertel et al., 2021; Stein & Santini, 2022). Indeed, a large and distributed network of diverse and independent farms provides redundancy, spreads out risk, and increases the likelihood that at least some farms can continue producing in the event of a disruption (Oliver et al., 2018), thereby increasing regional self-reliance and mitigating the damaging effects of adverse events (Dahlberg, 2008; Garmestani et al., 2006; Rotz & Fraser, 2015). The autonomy and decision-making authority that characterizes most RFSC farms also increases their capacity for resourcefulness, adaptability, and flexibility, which is needed for rapid recovery from a disruption (Tendall et al., 2015). For these reasons, the COVID-19 crisis prompted calls by policymakers to improve food system resilience through greater functional diversification, decentralization, and regionalization (FAO, 2020; Rosenzweig et al., 2020; UN, 2020).

However, regionalization of the food supply does not guarantee resilient delivery of the SDGs. In particular, food system sustainability and resilience require individual producers to be economically viable (Toth et al., 2015; Stein & Santini, 2022).

Economic viability is a major challenge for small and medium-sized RFSC producers for many reasons, including a lack of affordable land (Calo et al., 2021), high labor intensity (Bruce & Castellano, 2017), agricultural policies that benefit the large-scale global system (Spangler et al., 2020), and difficulty reaching profitable urban demand centers and broader regional markets (Stein & Santini, 2022). One barrier to reaching broader markets is transportation. Indeed, the very qualities that increase RFSC resilience also limit their ability to transport and distribute food efficiently. RFSC producers have high transportation costs because they lack the economies of scale achievable with high load factors and full truckloads (Day-Farnsworth & Miller, 2014). In fact, the low handling and fuel efficiency per unit of product hauled often outweighs the benefits of short transport distances (King et al., 2010; Mundler, 2012; VanWechel et al., 2007). As a result, transporting food from rural RFSC farms to distant urban demand centers can be cost-prohibitive, especially when refrigeration is required (Lindsey & Slama, 2012; Miller et al., 2016). Indeed, small-scale RFSC producers use a variety of different types of vehicles for deliveries, including light-duty trucks, cars, and vans (Pirog et al., 2001), thereby avoiding the costs associated with owning and operating a refrigerated truck (Rizet et al., 2012). However, a lack of temperature control risks product degradation and raises food safety concerns, especially as time in-transit increases (Day-Farnsworth & Miller, 2014). These transportation inefficiencies limit producers' ability to reach broader markets, especially for mid-sized RFSC producers—the so-called “agriculture of the middle”—with volumes that are too small to distribute through large, vertically integrated grocery chains but are too large for direct-to-consumer channels (Kirschenmann et al., 2008). Such barriers have led many small and midsize producers to give up on farming (Berti & Mulligan, 2016) and have limited the ability of RFSCs to contribute significantly to food system resilience, with 97% of U.S. food distributed through nationally and globally organized food supply chains (Woods et al., 2013).

One approach to overcoming transportation and distribution challenges is for producers to

scale up, such that the volumes they produce individually will allow them to participate in larger food systems. However, for many RFSC producers, scaling up production is neither possible nor desirable. Another possibility is for producers to adopt innovative transportation strategies (FAO, 2020), which can enable RFSCs to reduce transportation and inventory costs while continuing to provide benefits to the communities in which they are embedded (Marusak et al., 2021). A review of the literature on logistics best practices for RFSCs revealed two frequently recommended strategies: producer collaboration for transportation and outsourcing transportation to commercial carriers (Mittal et al., 2018). These strategies may be able to reduce producers' transportation costs, alleviate their logistics burden, and help them to access wholesale distribution and new, larger, and financially lucrative markets. However, examples in the literature of actual adoption and implementation of transportation collaboration and outsourcing by RFSC producers are relatively sparse and anecdotal, suggesting that producers may face significant barriers.

The questions addressed in this research are: What major transportation barriers prevent RFSC producers from efficiently reaching broader markets, and how might these barriers be overcome? As a starting point in answering these questions, we administered focus groups with RFSC producers in the state of Texas. Participants were asked about the transportation challenges they face, their views on outsourcing transportation to commercial carriers or independent crowdsourced drivers via an app, and their thoughts on collaborating with other RFSC producers for shared transportation. We then analyzed the transcripts from these focus groups to distill producers' perceptions of the potential benefits of these strategies, as well as barriers to adoption. This paper describes the results of this analysis, which emphasize the importance of solving transportation issues in RFSCs and suggest some potential approaches. The paper is organized as follows: first, the literature on transportation collaboration and outsourcing in both large-scale supply chains and RFSCs is reviewed, followed by a description of the research methods and the focus group results, and concluded with a discus-

sion of results and practical implications for RFSCs.

Literature Review

This section provides an overview of the benefits and challenges associated with outsourcing transportation to third-party providers, for organizations participating in large-scale supply chains as well as producers who distribute their products via RFSCs. Then, the advantages and disadvantages of transportation collaboration are reviewed.

Outsourcing Transportation

Outsourcing transportation to commercial carriers has often been recommended by food systems researchers for RFSCs to improve their logistics efficiencies (Mittal et al., 2018). Because commercial carriers serve multiple shippers (i.e., farmers shipping products to buyers), they benefit from cost efficiencies via economies of scale, especially through load consolidation and increased vehicle capacity utilization (van Damme & Ploos van Amstel, 1996). These efficiencies can translate into lower transportation costs for the shipper, as well as potentially enabling them to operate with lower inventory levels (Stank & Goldsby, 2000). Increasingly, online freight and crowd-shipping platforms (e.g., uShip, Uber Freight) enable shippers to connect directly with independent carriers to outsource transportation, offering lower freight rates than traditional less-than-truckload (LTL) brokerages or courier services (Dolan, 2019). A dependable commercial carrier can provide quality service and flexibility and can even enhance a shipper's ability to meet customer requirements (e.g., just-in-time delivery), such that shippers need not invest in assets and new technology (Bardi & Tracey, 1991; Pani et al., 2022). Outsourcing transportation also allows shippers to leverage carriers' expertise so that they can focus on their own core competencies (Hsiao et al., 2010).

Some RFSC producers, especially producer cooperatives, have reported cost savings from outsourcing transportation to regional distributors (for example: Bittner et al., 2011; Clark et al., 2011; Matson et al., 2015; Nelson et al., 2013; Van Dis, 2012). Because these distributors are already transporting material for larger companies, they can al-

low RFSC producers to piggyback on those deliveries to increase vehicle utilization (Bittner et al., 2011). Some RFSC producers have also found that outsourcing transportation improves their on-time deliveries (Flaccavento, 2009) and facilitates cross-docking with other distributors to extend their market reach (Bittner et al., 2011). Other producers have been able to extend their market reach by using national carriers and third-party logistics providers (3PLs) (Matson et al., 2015; Muldoon et al., 2013; Stevenson, 2013). Another option is outsourcing transportation to a regional food hub, which can aggregate across multiple producers to achieve wholesale volumes, such that producers do not need to scale up production on an individual basis to sell to institutional and retail buyers (Berti et al., 2017).

However, outsourcing transportation is often challenging and can yield mixed results, even in large-scale supply chains. Indeed, LTL and standard parcel delivery services can be slow, expedited services are expensive, and commercial providers may increase their service fees over time (Ackerman, 1996). Insufficient responsiveness to customer needs can also be a problem (van Damme & Ploos van Amstel, 1996), requiring shippers to invest significant time and money into managing and monitoring carrier performance (Maltz & Ellram, 1997). Moreover, evaluating the cost savings of using these services can be difficult for the shipper (Selviaridis & Spring, 2007), and some shippers report that outsourcing limits their control over their transportation capabilities and reduces their contact with customers (Ellram & Cooper, 1990). The limited literature on RFSC transportation outsourcing provides some evidence that RFSCs struggle with many of the same challenges as large-scale supply chains. Indeed, some RFSC producers report that the benefits of outsourcing do not outweigh the costs (Berney et al., 2007). For example, RFSC producers often cease using a food hub's transportation services because they perceive the fees to be too high (Craven & Krejci, 2017). Furthermore, using a food hub or 3PL that commingles products can reduce food traceability and prevent producers from building their individual brands (Cantrell & Heuer, 2014).

Transportation Collaboration

Collaboration is another highly recommended strategy for RFSC transportation, wherein organizations share transportation resources and information with one another with the aim of collectively obtaining greater benefits than each organization can achieve individually (Audy et al., 2012). Successful transportation collaboration can help organizations to reduce costs (Crujssens et al., 2007; Ergun et al., 2007), achieve better service levels and improved responsiveness (Chabot et al., 2018), and reduce greenhouse gas emissions through more efficient use of pooled resources, fewer empty truck runs, and reduced travel distances (Andriolo et al., 2015; Christ et al., 2017; Pérez-Bernabeu et al., 2015). Collaboration in supply chains can be either vertical or horizontal. Vertical collaboration occurs between different types of organizations located at different echelons in the same supply chain (i.e., upstream suppliers collaborating with downstream customers), with a goal of improving overall supply chain performance (Mason et al., 2007). By contrast, horizontal collaboration involves the sharing of assets or resources between two or more organizations that are fulfilling similar purposes at the same echelon of different supply chains (Barratt, 2004). These supply chains may be in the same or different industries and may be competitive or noncompetitive (Naesens et al., 2007).

Many transportation collaborations are maintained at an operational level, in which only transactional information is exchanged between partners to facilitate day-to-day business activities (Verstrepen et al., 2009). For example, partners might share information on delivery schedules to facilitate backhauling, in which trucks that would otherwise be empty on a return trip could be used to haul product for a partner (Guajardo & Rönnqvist, 2014). Longer-term and strategic collaborations are also possible, in which partners plan their logistics operations jointly according to shared objectives and performance indicators, as well as sharing infrastructure and sensitive information (e.g., demand data, forecasts, operational capacities) (Frisk et al., 2010). For example, two organizations distributing in the same regions might share vehicles and trucking routes to opti-

mize vehicle utilization and loaded traveling time, or they might split the cost of hiring a 3PL (Basso et al., 2019; Pan et al., 2019). Collaborators can also pool their loads and negotiate better rates from carriers (Chabot et al., 2018), extend their market coverage to include all partners' networks and help smaller organizations to participate in large contracts (Verstrepen et al., 2009).

To establish a transportation collaboration, participants must make a series of decisions. First, decisions regarding the size and constituency of a collaboration, often termed "partner selection" decisions, must be made. Having too few members may not yield significant benefits, but large coalitions are more likely to fail, as the potential for problems and challenges with coordination tend to increase as the number of collaborators increases (Audy et al., 2012; Christ et al., 2017). The objectives, goals, size, culture, and philosophy of the collaborating members should be similar; sharing a common vision is a strong predictor of a successful collaboration (Basso et al., 2019). Once the partners are established, they must decide on the appropriate level of collaborative intensity. This can be measured in terms of the amount of time and/or assets dedicated to maintaining the collaboration, the amount and type of information exchanged between collaborating organizations, the level of risk and potential benefits involved, and the range of activities performed (Verstrepen et al., 2009). Finally, the allocation of collaboration risks, costs, and benefits must be clearly defined and should be fair and acceptable to all participants according to their roles and responsibilities (Audy et al., 2012; Cruijssen et al., 2007). These terms can be formalized via contracts, which can help to encourage long-term relationships (Cygler et al., 2018), maintain a satisfactory balance of power, and facilitate negotiations between partners (Basso et al., 2019; Christ et al., 2017).

While the literature does not offer many examples of transportation collaboration in RFSCs, some RFSC producers have indicated that sharing and combining delivery routes has reduced their transportation costs and increased their logistics efficiency (Bittner et al., 2011; Diamond & Barham, 2012), as well as enabling them to deliver to customers more frequently (Van Dis, 2012).

Other producers have reduced transportation costs by sharing vehicles for long hauls (Pirog et al., 2008). Some small-scale producers reported that transportation collaboration helped them to respond to the challenges and opportunities associated with the COVID-19 emergency (Marusak et al., 2021).

However, collaborative transportation partnerships are challenging to establish and maintain, they can be complex and costly to coordinate (Cygler et al., 2018; Martin et al., 2018), and insufficient trust between partners is a major issue (Barratt, 2004; Pomponi et al., 2015), particularly because they may also be competitors. To be successful, partners must commit to common objectives and a fair cost/benefit sharing mechanism (Audy et al., 2012; Cruijssen et al., 2007), but this is often a challenge, especially when there are power imbalances (Frisk et al., 2010). As partners become more interdependent, they may lose control over resources and autonomy in decision making (Basso et al., 2019; Cygler et al., 2018). Furthermore, to facilitate the information sharing needed to jointly plan, implement, and control the flow of materials, services, and information, collaborative partners must often adopt information and communications technologies (ICT), such as radio-frequency identification (RFID) or electronic data interchange (EDI) (Pan et al., 2019; Verstrepen et al., 2009). However, standardization of materials and information system interoperability is usually necessary (Montreuil, 2011), which can be a major challenge, especially if one or more partners lacks the resources to implement new systems.

Indeed, some RFSC producers have indicated that they view collaborating with other producers for transportation as risky, especially if it requires producers to share sensitive information with competitors. Some producers have expressed concerns about careless handling of their products by partners, which can damage customers' perceptions of their brand (Bloom & Hinrichs, 2011). Collaboration for backhauling in RFSCs has proved to be challenging because it increases routing complexity and requires significant planning and coordination (Bittner et al., 2011). Thus, collaborative transportation partnerships in RFSCs tend to be unstruc-

tured and informal and rely heavily on trust (Lutz et al., 2017).

Methods

The relative sparsity of the literature on RFSC transportation suggests that there are significant gaps in our understanding of how RFSC producers transport their products to buyers, the challenges they face, and their receptiveness to strategies like outsourcing and collaboration. In particular, producers' own views of these strategies and their experiences with them have not been sufficiently studied. This is a critically important gap to address because producers are definitive stakeholders in regional food systems. Therefore, attempting to increase transportation inefficiencies in RFSCs without understanding producers' requirements and objectives (i.e., what are the key problems and how do they prevent producers from achieving their version of "success?") and their preferences (i.e., what are culturally and technologically appropriate methods for addressing the problems?) is likely to meet with failure.

To gain a greater understanding of RFSC producers' experiences, beliefs, and ideas with respect to transportation, producer focus groups were administered in the state of Texas. While focus groups have inherent limitations (i.e., the resulting data is likely to yield only tentative and geographically specific results), they have the advantage of being able to capture producers' knowledge and preferences in their own words.

Analysis was performed in three phases to follow a rigorous and systematic process that would increase the transferability of results: data collection, data consolidation, and data interpretation. The research design for each of the three phases is described below.

Data Collection

First, potential participants were identified and recruited. The Texas Center for Local Food (TCLF), a key partner on this research project, led the effort to recruit participants, sending individual and personalized emails to key organizations in its professional network and the networks of its partners, including Texas Small Farmers & Ranchers Community Based Organization, Texas Organic Farm-

ers & Gardens Association, and the Growers Alliance of Central Texas. TCLF asked these organizations to extend the recruitment to their members and their own networks to maximize outreach, and they did so. In this way, TCLF leveraged its influence and long-standing relationships in the Texas regional food community to increase the quality and quantity of participants. Targeted participants were small and medium-sized farmers and ranchers with gross revenues of US\$10,000-\$4,000,000 with at least 80% of revenue derived from Texas buyers or buyers from the border states of Oklahoma, Louisiana, Arkansas, and New Mexico. The target focus group size was six participants each.

Existing literature and results from prior preliminary interviews with Texas farmers and ranchers informed the design of the focus group protocol used for data collection. The protocol was reviewed by project partners from the National Center for Appropriate Technology to ensure credibility. The protocol was divided into four parts to ask producers (1) about the transportation barriers ("pain points") preventing them from reaching urban buyers; (2) their own ideas on how to overcome these barriers; (3) their feelings on outsourcing transportation to independent individuals (i.e., crowd-shipping) or to commercial carriers and distributors, as well as the possibility of collaborating with other producers for transportation; and (4) the types of software that they are currently using for transportation and general farm management, and their feelings about using an app to connect with carriers and producers for transportation. The list of questions asked in each focus group is provided in the Appendix.

The data collection protocol was submitted to the University of Texas at Arlington Institutional Review Board (IRB) for review and was approved and assigned "exempt" status (protocol number 2021-0427.2). Upon IRB approval, virtual focus groups were conducted throughout the summer of 2021 using Zoom, due to restrictions in place for the COVID-19 pandemic. Six focus groups were conducted, with a total of 17 participants, including farmers and ranchers from five distinct geographic regions across Texas (see Table 1 for details).

The participants included 10 white males, 3 white females, 1 Black male, 1 Black female, 1

Hispanic male, and 1 Hispanic female. Table 2 summarizes key characteristics of the participants' operations, including items produced, total acres in crop production, total herd or flock size, and distance from the nearest major market (i.e., Dallas, Houston, Austin, San Antonio, or El Paso). None of the participants' farming or ranching businesses had a gross cash farm income of more than US\$200,000. While this sample is biased toward relatively small producers and differs from our targeted sample (US\$10,000-\$4,000,000 gross), it should be noted that in Texas, 89% of farmers (representing 223,569 farms) gross less than US\$50,000 on their farm or ranch operation (Texas State Small Producers Initiative, n.d.), which suggests that the data collected from our sample is likely to reflect the experiences of many Texas producers. Further-

more, while the small sample (17 producers out of a population of 223,569 producers in Texas) and geographic focus on Texas limit the generalizability of study results, we believe that, as one of the first to explore RFSC producer perspectives on transportation barriers and potential solutions, this study can nevertheless offer novel and valuable insights to food systems researchers, advocates, and practitioners. Transportation in RFSCs is not the focus of extensive research or extension efforts, nor is it a topic that often comes up among producers unless they are prompted. Indeed, when considering major barriers to their business' success, producers do not necessarily have transportation at the forefront of their minds: according to a 2019 needs assessment of 184 Texas small producers, the top five challenges they identified were access to capital, aversion to acquiring debt to finance their operation, financing, organic certification requirements, and costs of regulations and permits (Texas State Small Producers Initiative, n.d.). However, anecdotal evidence suggests that, when asked specifically and in person about their transportation and logistics challenges, RFSC producers will often acknowledge major frustrations with inefficiency and inadequate capacity. We believe that the use of focus groups specifically targeting the topic of transportation and facilitated by a trusted and familiar former producer (from TCLF) gave producers "permission" to open up and voice their opinions and ideas about an operational problem that does not always get much attention.

Each focus group session lasted approximately 90 minutes, and participants were compensated US\$100 for their time. For consistency, three research team members attended each focus group session, with one member (from TCLF) facilitating the meeting using the script described above, one member responsible for providing technical support and monitoring the chat, and one member taking notes. Prior to participation, research team members provided informed consent forms to all participants, explained participants' rights, risks, and benefits, collected a signed form from each

Table 1. Focus Group Descriptions

Focus group	Number of participants	Texas regions represented
1	4	Central
2	1	North
3	2	North, West
4	3	East, North, South
5	2	South
6	5	Central, West

Table 2. Participant Farm and Ranch Characteristics

Items Produced	Number of Participants
Fruits and Vegetables	11
Meat	7
Eggs and Dairy	3
Bees	0
Grains and Fiber	1
Other	1
Total Acres in Crop Production	Mean (Range; Std. Dev.)
# of acres	3.6 (.001-15; 4.7)
Total Herd or Flock Size	Mean (Range; Std. Dev.)
# of animals	122.5 (7-570; 200.9)
Distance from Nearest Major Market	Mean (Range; Std. Dev.)
miles	97.6 (15-257; 84.5)

participant, and provided a copy of the form to participants to keep.

Data Consolidation and Interpretation

The focus group sessions were digitally recorded, and the research team transcribed the recordings verbatim, with participants' names redacted to provide anonymity. Four research team members were then responsible for data cleaning and consolidation. To maintain consistency across team members, each followed a systematic and iterative process that began with identifying relevant quotes from the transcripts and categorizing them according to the four sections of the protocol. To facilitate a common approach to categorizing quotes, the research team jointly designed a Microsoft Excel template for data entry and specified the following procedure: first, each researcher would independently read through a transcript and highlight relevant quotes; then they would identify the most appropriate category for each highlighted quote and enter it into their own copy of the Excel template. After everyone had completed this procedure for a particular transcript, one researcher compiled all four sets of categorized quotes into a single spreadsheet. The team then met to jointly review all the quotes, cleaning and organizing the material to remove redundant quotes and reach consensus on the most appropriate categorization for all quotes. This process was followed for each of the six transcripts. Upon completion, the extracted quotes from the entire data set were integrated and organized by category.

Next, each research team member independently reviewed all quotes in each category and grouped them according to self-generated subcategories. The team then met to discuss and compare everyone's subcategories, with a goal of eliminating redundancies and deciding on the most appropriate subcategories. If a researcher's proposed subcategory was determined to be too specific (i.e., it only contained one or two unique quotes and/or seemed very similar to another subcategory), the team combined it with another closely related subcategory. For example, under the category "transportation pain points," the researchers had originally proposed four subcategories ("lack of distribution services," "waiting on LTL service,"

"finding a delivery driver," "no one to collaborate with on transport"), and it was decided to consolidate them into a single subcategory ("lack of transportation outsourcing/collaboration opportunities"), which contained five unique quotes. In some cases, a researcher proposed a subcategory that was too general (e.g., "cost"), so the team would reassign its quotes to more specific subcategories generated by the other researchers (e.g., "challenges with cost estimation," "vehicle/fuel cost," "cold storage cost"). After multiple iterative sessions, the team reached consensus on the most relevant subcategories and the assignment of each quote to a subcategory. The number of independent quotes in each subcategory was then counted; this number was used as a proxy for the subcategory's relative importance; that is, more quotes indicated greater importance. While the number of quotes is an imperfect measure of a subcategory's importance, it provided a helpful first step in identifying the strongest and most frequently occurring focus group themes. Finally, the consolidated data set was interpreted to develop key themes and insights.

Results

This section describes the results of the focus groups in two sections: first, four overarching themes associated with producers' transportation pain points are described, followed by three themes that examine the potential of three different strategies to address these pain points.

Producers' Transportation "Pain Points"

The 11 subcategories of producers' quotes regarding transportation pain points were ranked according to the number of unique quotes associated with each, as shown in Table 3. This ranking helped to identify the most frequently recurring concepts, which were then organized according to four overarching themes that highlight the challenges RFSC producers face with respect to markets, temperature control, limited time, and being responsive to buyers' needs.

"Pain points" theme 1: Many RFSC producers struggle to reach markets

The "mismatched supply and demand" pain point was the most frequently mentioned across all focus

Table 3. Subcategories of Producer Transportation “Pain Points”

Subcategory name	Number of unique quotes
Mismatched supply and demand	17
Temperature control in transit	16
Long transportation distances	11
Lack of sufficient temperature-controlled on-farm storage capacity	9
Transportation takes too much time	7
Inadequate vehicle	7
Difficulty accommodating customer delivery schedule preferences	7
Lack of transportation outsourcing and/or collaboration opportunities	5
Difficulty setting customer minimum order size	5
Difficulty estimating transportation costs	4
Transportation costs are high	3

groups, and at first, it did not appear directly connected to transportation. Instead, it seemed to reflect well-known challenges associated with producing and selling food on a relatively small scale. While this apparent disconnect might seem surprising, since the participants were asked specifically to discuss their challenges in reaching urban buyers *with respect to transportation*, it aligns with what we know from previous research on RFSC transportation. Because transportation is not a core business or “value-adding” activity for most producers, they do not tend to view it as a key opportunity for cost reduction or strategic business growth (Marusak et al., 2021). Instead, they tend to focus on finding new markets and customers to increase their revenues. Therefore, it is perhaps unsurprising that perceived issues of mismatched supply and demand would inform producers’ discussion of transportation challenges.

Some participants felt that local demand was lacking, while others believed that the demand was there but required increased marketing effort, as one producer explained:

If I could just figure out how to get people to

find me, we do create a good product. It’s just how do I get people to find me that seems to be still a challenge.

Nearly all participants expressed strong interest in increasing their sales. One approach is to attend more farmers markets, but as several producers mentioned, this requires additional time and personnel, and there is already too much competition, according to this producer:

There’s so many pastured pork providers at all of the local markets now. I don’t know how we would compete. I think we’d just be cannibalizing business, and that’s not something I’m interested in doing.

Another approach to increasing sales is selling wholesale. However, wholesale buyers are typically looking for large volumes, which small farms are often unable to produce consistently. Several producers argued that they would struggle to achieve wholesale volumes even if they aggregated across multiple farms in their region, simply because there are not enough farms. One producer also commented on the lack of commitment from wholesale buyers:

I have looked at some wholesale options but find it very difficult to get anything going there. There’s a lot of people that talk a good talk, but then they never follow through and are very difficult to get ahold of and gain any commitment from.

By contrast, one producer pointed to potential solutions from other regions:

I had worked with a bunch of Mennonite communities ... up in Iowa, and they have a massive produce auction. ... [But] small growers here in anywhere in Texas ... just don’t have things like that as a resource to help us move product when we have excess that needs to get moved.

Many producers were clearly frustrated by the limitations of selling only to their local markets.

However, when the idea of expanding distribution to reach wider regional markets was brought up, the challenges associated with transportation immediately became a focus of the discussion.

“Pain points” theme 2: Insufficient cold chain infrastructure limits RFSC distribution capacity

When participants focused their discussion on transportation, it became clear that maintaining temperature control in-transit in the Texas heat was a major concern, particularly for the producers who did not own refrigerated vehicles and were relying on coolers to protect their products. Many producers reported that their distribution range was severely limited by a lack of robust temperature control. This was an especially serious problem for meat producers, as one rancher noted:

If I didn’t have frozen items, the game changes, because I don’t have to worry about the heat. In winter, I don’t have much problems at all. So, it limits me to where I can only basically do local deliveries.

Ranchers also expressed concerns about risks to food safety and quality when transporting live animals and frozen meat to and from processing plants in the summer. With so few processors willing to work with small-scale producers, the closest available options are often one to two hours away. Three of the eleven participants growing fresh vegetables also noted that a lack of on-farm cold storage made scheduling deliveries challenging. Without sufficient refrigerated storage capacity, their deliveries must be made shortly after harvest. Alternatively, to give themselves greater flexibility, they may be forced to rely on cost-inefficient workarounds, as exemplified by this producer:

Our biggest problem is we don’t have onsite cold storage right now due to local policy issues and zoning ... so, what we’ve been doing is using our refrigerated truck for storage. We were able to get this refrigerated truck through a USDA microloan ... so now we can make deliveries, but the biggest struggle is keeping it on while we’re harvesting, and sometimes, if [the customer] wants it on a cer-

tain day, we’ll have to keep it on overnight to deliver on the next day. So, there’s cost involved in not having cold storage.

“Pain points” theme 3: Time spent on transportation takes away from time spent managing the farm

With so many demands on a producer’s time, transportation was viewed as a major burden, and nearly all participants expressed significant interest in reallocating the time spent on transportation to on-farm activities and management. Time spent on transportation was mainly viewed as a consequence of long transport distances from rural farm locations to urban markets, as well as traffic in and around cities. Even when transportation is outsourced, it can take producers a significant amount of time to get their products to the carrier, with one rancher noting that the nearest United Parcel Service (UPS) store was 45 minutes away from their ranch.

Not having enough time to distribute to distant urban markets was perceived by several producers as a major barrier to their business’s growth. Although they have sufficient production capacity to sell to larger markets, two producers noted:

If I wanted to drive to Austin, I could have a lot bigger markets. But it takes me an hour to get to Austin. ... That eats up a huge portion of my day when you’re also in charge of the production side of things, and wanting to have a life as well.

I’m sure we can sell way more in different parts of Texas, but we don’t have the transportation to San Antonio or Austin. ... That’s like 9 to 10 hours from El Paso.

However, transportation time was not always described as a function of distance; sometimes it was a consequence of having to make a large number of delivery stops, or in the case of this producer, time spent coordinating and packing product for deliveries:

My freezer has gotten so disorganized that it takes me probably an extra 30 to 45 minutes, maybe even an hour, to pack orders sometimes

because I can't find what I need. But I literally cannot stop to organize my freezers because I do not have the time to stop and do it without not doing something else. [It would probably] take four to six hours [to have somebody else do it] ... and if you pay someone 20 bucks an hour, and it saves you that much time every time, why wouldn't you just pay someone? Well, that's a great idea, but I could look at 30 other things I need done on my farm that I could say the same thing about, and at some point, I'm out of money.

*"Pain points" theme 4: Transportation limits
RFSC producers' ability to meet buyers' needs*

Many customers expect frequent and flexible deliveries of small volumes, which is a frustration for many producers, who observed that low-value orders are often not worth the time and fuel required to make a long-distance trip. One producer described the tradeoff between responsiveness and efficiency:

I have heard from a few customers that they ... wish my delivery day was Monday instead of Wednesday, or Thursday instead of Wednesday, or Friday ... any day but Wednesday, right? And they're so accustomed to being able to go and order groceries and get them tomorrow or the next day. I can't go to town every day. It's two hours round trip for me to do that and a lot of people are not placing big enough orders. ... I keep trying to get them to get a whole hog, so I'm not driving to San Antonio for a half, but they don't have the freezer space for it. ... It would be great if there was somebody else who's going to be in Antonio that I could say, hey, could you take this?

However, this producer felt uncomfortable insisting on minimum order quantities, based on the assumption that they would lose sales, which would affect their cash flow:

The one day a week that I currently do delivery, I might have a \$25 order in Round Rock and a \$30 partial box order is really far South

Austin. People will say, well, why don't you just set a \$50 order minimum? Well, yes, except if somebody is not going to order because they can't spend \$50, then I either have \$25 or I have no dollars, and which do I pick? I'm going to spend \$50 worth of my time and gas money to take \$30 worth of stuff to Round Rock because it gives me \$30 I didn't have and it gets the product out of my freezer.

Other producers also expressed concerns about losing sales because of transportation limitations. One producer described their frustrations in meeting a large wholesale customer's delivery requirements:

The biggest struggle I've had with wholesale is finding [transportation] going, for example, to Austin, on the same day that the buyer wants the product. Sometimes I have product ready and they'll say, oh, I need a Monday delivery, but the shipping company that I'm using—I'm piggybacking on someone else's order—will say, well, we're not gonna ship out until Tuesday. I've had orders canceled because they're not gonna get there at the time that the buyer wants it.

Another producer had been discouraged from scaling up their production, knowing that a lack of transportation would prevent them from being able to meet wholesale customers' requirements:

It's a little difficult for me to think about getting any bigger than what I have right now in production, just because of delivering. ... I would need somebody to come and pick it up, to ship it out to where it would go to. For example, if I wanted to get into H-E-B or to Sprouts or Whole Foods, who is going to take that for me?

Addressing the Pain Points

After analyzing the producers' transportation "pain points," the five subcategories describing producers' ideas about how to mitigate the pain points were ranked according to the number of unique quotes, as shown in Table 4.

Table 4. Subcategories of Potential Approaches to Addressing Transportation “Pain Points”

Subcategory name	Number of unique quotes
Collaboration with other producers	16
Outsourcing transportation or logistics to a food hub	13
Outsourcing transportation to a commercial carrier	11
Changing marketing or distribution strategy	11
Networking with other producers	3

The two most frequently mentioned ideas for addressing transportation challenges were outsourcing and producer collaboration. The 11 unique quotes in the subcategory “Changing marketing or distribution strategy” covered a wide variety of ideas on how to reach more customers or make deliveries more efficient. For example, several producers described how they plan their delivery routes and schedule strategically to reduce travel time. Others discussed the strategy of offering a home delivery service, which provides highly valued convenience to customers. One producer emphasized the importance of critically evaluating what the “optimal” distribution radius for a farm ought to be. Depending on the locations of the farm and its customer base, as well as the size and density of the customer base, increasing the farm’s distribution radius is not always an appropriate goal and may result in diminishing returns.

Because most of the producer-generated ideas on how to address transportation pain points were related to outsourcing and collaboration, these ideas were integrated with their responses to the follow-on questions regarding who producers feel comfortable outsourcing to, according to three themes: (1) hiring independent crowdsourced drivers, (2) outsourcing to commercial third-party carriers or food hubs, and (3) collaborating with other producers.

“Addressing the pain points” theme 1: Hiring crowdsourced drivers for transportation is too risky

The research team had hypothesized that farmers might find the flexibility and low cost of outsourcing transportation via “crowd-shipping” to be

appealing, and indeed, some participants acknowledged that it would likely save them time. However, most were strongly opposed to the idea. The issue of trust was paramount, with concerns about a lack of service reliability, and more prominently, drivers’ lack of knowledge on how to handle products appropriately, especially regarding temperature control. One producer’s comment exemplified these concerns:

I don’t know how I feel about a stranger. Having an Uber delivery guy do it. I don’t know that I could do that. I don’t think there would be the understanding of how vegetables needed to be treated. That would seem a little iffy one to me. I think there have to be some kind of training about how to handle food and how to store food? All of those things that we have to know. I don’t know.

Other producers believed that direct interaction with customers helps build and maintain relationships, and a crowdsourced driver would not do this adequately:

I would not want to just like literally call Favor or Uber Eats or something and have them deliver my produce to a customer. I think that there are some values to that faced visionary interaction between the supplier and the customer.

In one focus group, there was discussion about risk to personal safety, as one rancher explained:

I’m at the end of a dead-end road and I have 100 acres and with my house being in the front, if I’m working in the back, you can easily get up to my house and I would not know it. ... I don’t let people know where our physical address is just because security is just a huge issue. The first year I think I got robbed like four times. ... They brought a vehicle into my property and took a whole bunch of tools. ... So yeah, we take issues of security very high.

Participants agreed that it would be necessary to have strong mechanisms for monitoring and accountability, such as customer feedback, user reviews, and temperature control monitoring, as well as risk mitigation strategies, like packing products in disposable coolers. In general the option of hiring a crowdsourced driver was quickly dismissed due to major concerns about trust. No one brought up the potential of cost savings associated with this option. In fact, one producer viewed it as being both risky and expensive:

As for the third parties like Uber and all those other companies, [they] are not financially viable, they're just backed by either Wall Street or they eventually get bought up... Those numbers just don't work either. They charge too much. I know some of the breweries who use that service. Those guys take like a 30–40% cut to do that and that just hurts your bottom line.

“Addressing the pain points” theme 2: Commercial carriers are trustworthy, but this comes at a cost
Outsourcing transportation to a commercial carrier appealed to most producers, as it takes the transportation burden completely off their plate. It was viewed as a way to reallocate time to more important strategic tasks that would help to grow their businesses, as exemplified by this producer:

That would be the dream, right? That someone is going to [make my] deliveries, and then that's going to free up my time to do the marketing that brings me ... more orders.

Most producers indicated that they would trust commercial drivers with their products. They could see value in hiring carriers offering refrigerated transport and other convenient services, such as product tracking and delivery confirmation, as well as driver screening and training. Other participants trusted that transportation companies would be held liable for any missing, damaged, or unsafe products, as this producer commented:

Most third-party companies are going to be bonded. If product gets contaminated ... [and] they served it to somebody and somebody got

sick, the lawsuits come back on me. [But] that logistics company is bonded, and they would be able to carry the burden of any out of spec product while it was in their custody.

However, several producers were concerned about reduced flexibility and high costs. A producer who had explored using a commercial delivery service said:

Third-party companies ... want anywhere between \$4 to \$7 per delivery. They'll be here, whenever I tell them to, but it's going to come at a cost, and we tend to work with small quantities, but a lot of [orders], so, a lot of different delivery stops.

A rancher commented on the cost of temperature control:

With UPS 3-day shipping, I can deliver to San Antonio ... [but] I can't sell to Houston, for example, because people there just don't want to pay for the for the dry ice that it takes.

Another producer found commercial services to be not only cost-prohibitive but also unable to cover their market territory:

I've looked into Favor, but they only work within like a 10-mile radius. And that's not enough reach for us ... and they charge \$15 and other fees per delivery.

By contrast, one participant noted that the value of time savings could outweigh the cost of the service:

I did use [a] third party, which I thought was really good and very trusted. They delivered on time. ... They did take a slight percentage of what we had made, but it was a nominal cost whenever I weighted out having to drive in traffic and use all of that time.

Another producer suggested that a group of producers could jointly pursue third-party trans-

portation and take advantage of lower bundled costs:

I could see where a group of farmers could share in ... some sort of a delivery service that comes around and picks up and takes everyone's stuff at one time ... taking that [burden] off of all of the farmers. ... If we've got enough farmers who are using [the service] then ... there'd be a cluster, which would give you a lower rate.

Other farmers suggested creating a farmer-run aggregation point that would enable them to leverage commercial carriers' underutilized truck capacity on existing transportation routes:

This is where FedEx and UPS and even the local post office ... you could go to these existing delivery services and say, [you'll] be our drop-off point, and then use their current distribution mechanisms to deliver to those end customers, because they're already going to those customers' regions.

While some farmers viewed food hubs positively, others noted that they require relatively large volumes and only offer wholesale prices. One farmer commented that a food hub that is appropriately scaled for small producers is needed:

I think if someone would really step up to the plate, like Common Market, and focus more on the small farm, I think that would definitely help all of us. I mean, on two acres ... you can produce a heck of a lot of produce if you do it right.

"Addressing the Pain Points" Theme 3: Collaborating with other producers is appealing but challenging

The idea of collaborating with other producers for transportation was met with enthusiasm and generated significant discussion. Several participants mentioned that they would appreciate the opportunity to connect and build relationships with other like-minded producers in their communities. Many also said that they would be comfortable collaborating with other producers because they under-

stand the business and could be trusted to handle products. Several participants pointed to the time and cost savings achieved by sharing the burden of transportation, as these two producers' comments exemplified:

We had another farmer within half an hour of us and we are kind of on their way. So, they would swing by and pick up our product. ... I would pay them half the gas plus some for doing the actual deliveries. ... And I was very comfortable with that. ... It certainly cut everybody's cost down to be able to do deliveries together.

We had the experience of working with farmer friends to make deliveries. We take turns to deliver to 12 to 15 different restaurants in El Paso. ... [When we work together] we invest like 3 to 4 hours per month each in delivery, and if we do it by ourselves, is going to be like 12 to 15 hours per month.

Several producers welcomed the opportunity to aggregate products with other producers, and a few mentioned the idea of pooling inventory and jointly marketing their products to leverage complementary offerings (e.g., vegetables and meat) and to fill gaps in offerings during low-productivity seasons to maintain continuity with customers. One producer took this concept a step further, suggesting that producers could work together to establish a virtual food hub:

The thought that's exciting about this to me is the opportunity for identifying new customers, right? It almost kind of creates like a crowdsourced food hub or distribution network, where like I've got a bunch of X and you've got a bunch of Y and your customer wants X and my customer wants Y. So, I could see it being to everyone kind of a mutual benefit.

However, one producer had concerns about relying on another person to make timely and safe deliveries:

I would never do that unless I absolutely trust them. ... I can invest all this money into growing X amount of dollars per pound, and then we drop the ball or we fumble on the delivery, and there goes potentially a \$300 invoice. ... And if that accumulates across the year, you're talking five figures.

Another producer worried about losing connection with their customers:

I think ... the face of the farm changes if you have another farmer making the delivery, and it's a personal relationship with that chef. I mean, if you're just delivering it to the stocking boy and he doesn't know Adam from me, then it's not as big of a thing, but as we all know in this smaller farm situation, it's a lot more relationship driven than just the product.

The biggest and most frequently mentioned concern was competition. Several farmers stated that they would never share transportation with another producer, while others said that they would only collaborate with trusted friends. Their concerns were exemplified by this farmer's comment:

If I hand my product over to another producer that has a friend that produces the same thing that I produce now, all of a sudden they know who my customers are and they can then share my customers with their friend, or they can ... take that customer away from me ... or they may go ... find somebody down the road that has the same product and come in and undercut me. So you gotta have some way to protect yourself ...

Indeed, one producer described their prior experience of a transportation collaboration failing due to competitiveness between farmers:

We did have a what we thought was going to be a partnership ... where we were going to take advantage of one member's cold storage and vehicle, but what we've kind of found out was that there's a lot of politics between the

different growers and not as much collaboration as what you might see in some other regions. ... I think it boils down to just our socioeconomic situation that we have here. ... We don't have the amount of customer base locally for what we're all trying to do—making higher quality product than what you can get at the grocery store and making that extra money to where our farms are self-sufficient.

Others emphasized the importance of having structures in place to support accountability, even when collaborating with trusted partners. Another producer who had successfully shared transportation with a small group of producers in their community pointed to the importance of choosing partners strategically. When asked about issues of competitiveness and mistrust, they responded:

I guess that was not my experience. Granted I knew the farmers really well and we sold slightly different products, so it wasn't like we were both competing to sell the same person tomatoes, you know? And we had different restaurants we were selling to for the most part.

However, even when competition is not an issue, producers face the challenge of farms' geographic remoteness and distance from one another, as well as the complexity of coordinating multiple harvest and delivery schedules, as in this producer's experience:

The coordination of getting [multiple farmers' products] there at the same time [for] third-party shipping [was stressful]. ... We would be waiting for product [and be] rearranging it on the pallet, trying to make everything fit. ... We would have to use our staff and time, and we weren't really compensated for ... fixing up the pallet and keeping it at a cold temperature, if [the farmer dropped off product] to us at 12 and the pallet wasn't leaving until 8 or 9.

This comment also points to an issue that came up repeatedly: how to share costs, and how to fairly compensate producers for the time spent

making deliveries for other producers. Moreover, a broader concern emerged regarding which producers would actually be willing to take on the task of transportation and how it could be made profitable for them. Producers who had collaborated for transportation in the past described informal arrangements where partners would take turns making deliveries, or they would split the cost of fuel. However, without proper incentives in place, a well-intentioned collaboration can fall apart in the face of self-interest. One producer gave such an example:

Our original plan was a rotating farmer program. Each week it would be one farmer's turn to go out and pick up and deliver to the restaurants ... [but] if it became their week to do the delivery, and they didn't have much [of their own] harvest, then it wasn't worth their while to ... take their turn and drive around. ... So, [it] didn't work.

None of the participants viewed transporting other producers' products as a way of making money. Most indicated that they would only collaborate if it was convenient, as explained by this producer:

I would want to help another farmer if they asked me to take their stuff for them, but if it wasn't fairly easy and convenient for me to do it, it would just add more burden to my day that I don't need. ... What are the odds that I'm getting paid to deliver someone else's stuff in a way that is actually gonna make me money?

Indeed, another participant gave an example of a transportation collaboration that never got off the ground because making deliveries for other producers was not cost-efficient:

[One] farmer got a very large grant which allowed them to buy some refrigerated warehouse space and refrigerated trucks, [but] they ran into the problem of only delivering their own produce because it was less profitable for them to go pick up other

people's produce, despite being paid for that delivery.

To overcome these issues, several producers suggested a cooperative model, either regionally or across the entire state. One producer described how this structure and its shared goals had helped to successfully maintain their current collaboration:

I'm a part of a farmers' co-op and we [collaborate for transportation] all the time on an informal basis. We all pretty much trust each other and have this vested interest in making the business be successful so I think that's motivating for people ...

Another producer pointed to the practical benefits of forming a cooperative to facilitate shared storage and transportation:

A valley-wide cooperative can be formed, and part of the training involved with that, and even a requirement as a member, is that you use a certain box, and do things a specific way when you're doing your packing and everything, so that there is a specific way everything is coming into that one cold storage unit.

This comment also points to the role of aggregation and shared cold storage in supporting transportation collaboration, which was mentioned by multiple participants. One producer shared their experience:

We did hire an aggregator who would go to each farm and pick up the product, and it would be stored at one farmer's farm in their cold storage, and if everything was gathered together, she would go and do the deliveries. ... The key was having that reliable person that didn't miss a delivery.

To support a larger transportation collaboration, some producers suggested renting cold storage space at a centralized location for producer drop-off (e.g., using underutilized refrigerator space at a restaurant or convenience store). One producer emphasized the criticality of

this type of infrastructure:

[We need a] facility where people could come from the rural areas, bring it to outside the city, and have it as a jumping off point to being sold to the urban population. That type of infrastructure is what we are sorely missing. ... Until we build our own infrastructure, it's very hard to stay competitive with the stores.

Finally, when the idea of using information and communications technology (ICT) was suggested to participants, such as an app to connect producers to one another to facilitate coordination, scheduling, and payment. Nearly all the participants responded positively and indicated that they would be very happy to have technology to help them collaborate and alleviate their transportation burden. However, one producer anticipated barriers to adoption:

Early adopters ... I think that's what that would take. Because the 50, 60, 70 year-old men and women that I work with aren't gonna do that. Some of the newer, younger kids are getting into that.

Discussion of Results

The results of this study indicate that RFSC producers in Texas view transportation as a significant barrier to their businesses' growth and financial success. Long distances and high temperatures, especially in summer, make transportation costly, in terms of time, energy, and fuel, and in terms of the investment in refrigerated vehicles and cold storage. These costs limit producers' distribution range and their ability to reach large urban markets. Moreover, RFSC producers recognize that increased transportation efficiency would free up time and energy to focus on their core competency: managing production operations on their farm. While RFSC producers could potentially compete with grocery stores by offering a high level of service and responsiveness to customers (e.g., frequent and home deliveries), they lack the transportation capacity to do so. Investing in refrigerated vehicles and on-farm cold storage could yield significant returns, in terms of new market opportuni-

ties, but this is cost-prohibitive for most producers.

Focus group participants viewed outsourcing transportation to commercial carriers as a highly desirable alternative to self-delivery, but it was also considered to be expensive and lacking the necessary flexibility. Nearly all participants were excited about the idea of collaborative transportation; however, concerns about the risks involved with cooperating with competitors (also known as coopetition) were frequently mentioned. Practicalities like coordinating harvest schedules and the long travel distances between farms were also viewed as barriers. To address this, the idea of aggregating product in a shared storage location for predelivery staging held strong appeal among many participants. However, few participants had a clear idea of how vehicles and storage spaces could be jointly operated in a cost-effective way. Rules governing cost/benefit allocation and accountability would be needed, but it was unclear to producers how to define these rules. Producers who were currently or previously engaged in transportation collaborations typically managed them informally via reciprocity. In the face of these challenges, few participants were actively collaborating.

While these findings have practical value for Texas RFSCs and provide a foundation for future research on RFSC transportation, this study does have limitations. The use of focus groups limits the generalizability of this study's findings. In particular, all participants are located in Texas, which has characteristics that are distinct from other geographic regions. For example, producers located in regions that do not experience extreme summer heat might not emphasize the role of temperature control as heavily, and producers located in more densely populated regions, or regions having more established RFSCs with greater productive capacity, might face different challenges or prioritize them differently. Additionally, with 17 total participants, some of the resulting subcategories (in Tables 3 and 4) contained relatively few unique quotes, such that their generalizability to other producers and regions is uncertain. Furthermore, all 17 participants were producing at a small scale, so the perspectives of midsized farms were not captured.

However, as the larger subcategories indicate, there were clear recurring themes that emerged

across multiple participants' responses, irrespective of their farm's characteristics (e.g., size, location, product types). Interestingly, these themes are reflective of some of the most frustrating and persistent transportation challenges cited in the broader supply-chain literature. Specifically, similar perceived costs and risks associated with outsourcing, especially for small and medium-sized enterprises, have been identified as significant barriers to improved transportation efficiency (Holter et al., 2008). Furthermore, the supply-chain literature repeatedly illuminates that the complexity and cost of coordination (Cyglar et al., 2018; Martin et al., 2018), insufficient trust between partners (Barratt, 2004; Pomponi et al., 2015), and difficulty in creating fair cost/benefit sharing mechanisms (Audy et al., 2012; Cruijssen et al., 2007) are major barriers to horizontal collaboration.

The commonalities between the results of this study and major themes in the broader supply-chain literature suggest that, while a larger-scale study is needed for generalizability, it is likely that these same themes will emerge in other regions and among other types of RFSC producers. This also suggests that implementing adapted versions of transportation best practices in conventional supply chains to RFSCs may offer potential. Specifically, the establishment of strategic clusters for logistics collaboration, as well as the adoption of shared ICT infrastructure to facilitate fast, efficient, and secure transactions, have been recommended in the supply-chain literature to overcome transportation challenges (Cruijssen, 2020; Sheffi et al., 2019). While RFSCs may not be able or willing to adopt these solutions in the same way as other supply chains, the concept of strategic clustering (e.g., establishing cooperatives) or implementing cost-effective ICT infrastructure (i.e., an online transportation collaboration app) could provide a path forward.

Transportation Cooperatives

Multiple focus group participants indicated that for producer transportation collaboration to work, a cooperative model would be needed to facilitate trust, establish common objectives, establish a fair cost/benefit sharing mechanism, and ensure con-

formity in packaging and labeling. A cooperative is a formalized legal structure for a business that is owned and controlled by its members and returns profits back to those members based on their level of participation (Cooperative Development Institute [CDI], 2023). Cooperatives can help small-scale producers increase market reach and sales and reduce their risk through pooled resources and jointly achieved scale (South Carolina Center for Cooperative and Enterprise Development [SCCEED], 2023). Cooperatives' formalized structure, including mechanisms to ensure accountability, may be able to address common challenges in collaboration, including insufficient trust between partners. Indeed, Saulters et al. (2018) found that successful RFSC cooperatives rely on trust-based relationships, where members view each other as strategic partners and work collectively to support the overall reputation of the cooperative's brand. Furthermore, successful cooperatives often focus on shared values, such as social justice, environmentally sustainable production practices, or fairness to farmer members (e.g., receiving the same transportation rates irrespective of production volume) (Saulters et al., 2018).

Despite their potential, however, cooperatives among RFSC producers often fail (Beratan et al., 2014). Common pitfalls for new cooperatives include not having a clearly defined common mission, a lack of leadership, a lack of member commitment, and inadequate business plans, risk assessment, and financing (University of Wisconsin Center for Cooperatives, 2024). Perhaps more problematically, cooperatives may require standardization of product, leading to a loss of an individual producer's farm identity (Gray, 2014). Indeed, in their study on civic food networks, Anderson et al. (2014) emphasized the importance of a farm's identity as a brand in direct marketing, finding that producers tend to strongly oppose participating in any venture that is perceived as undermining their individual autonomy and farm identity.

Nevertheless, there are some examples of successful RFSC cooperatives that focus on providing transportation services to their producer members while preserving producers' brand identity. La

Montanita Co-op¹ is a food hub that aggregates products from regional producers and provides transportation throughout New Mexico. The Wisconsin Food Hub Cooperative² operates a trucking LLC to distribute members' products throughout Wisconsin, Minneapolis, and Chicago. The LLC operates at cost and transports other items in the farming off-season, to ensure that drivers are retained (Freedman 2023). Regional cooperatives can also jointly form federations, which can further extend producers' geographic reach (Sumner et al., 2014). For example, the Northwest Food Hub Network³ is a network of farmer-owned cooperative food hubs that has the collective scale to distribute to large institutional buyers located across multiple states in the Pacific Northwest.

However, a producer cooperative need not necessarily establish a full-scale food hub to reap the benefits of collaborative transportation. A more modest approach could be the creation of micro-aggregation nodes at convenient peri-urban locations, where producers could independently drop off products and then collaboratively outsource the outbound transportation from the node to urban buyers. In this way, producers' travel distances are reduced, issues of coordinating pickups and drop-offs with multiple producers are less problematic, and concerns about competitors coming into direct contact with a producer's customers and luring away business could be mitigated.

Transportation ICT

Another possibility, which could complement or replace the idea of a formal transportation cooperative, is the implementation of an online transportation platform, designed for a specific regional food community. While participants in this study consistently rejected the idea of hiring independent crowdsourced carriers, the concept of using an online platform (i.e., an app) to connect with trusted members of their communities (e.g., other producers, neighbors, friends) for transportation was appealing. Similar to a crowd-shipping app,

producers with items to ship could post their delivery requirements on the platform, and other community members could then bid to serve as carriers for that job. The shipper could then choose their preferred bid (according to the price and carrier characteristics) and work with the carrier to schedule the pickup and delivery (Kulkarni et al., 2023).

However, there are challenges with this approach. Mittal et al. (2022) determined that there are no existing commercial online transportation platforms suitable for meeting the needs of small-scale RFSC producers. While there have been efforts to design platforms to facilitate transportation collaboration between producers, food hubs, and buyers, these proposals are all still in the research stage (e.g., Doshi et al., 2015; Matson et al., 2013; Mittal et al., 2017). Even if a suitable platform could be designed for an RFSC, there is no guarantee that producers would use it, and without active participation, it would fail (Frehe et al., 2017). Indeed, the supply-chain literature indicates that ICT for collaborative transportation faces many challenges, particularly with respect to process standardization and data governance and privacy policies (Pan et al., 2019). Furthermore, requiring large up-front investment in ICT would be a major barrier for small-scale RFSC businesses.

Public Funding to Support RFSC Transportation

While forming transportation cooperatives and utilizing a collaborative transportation app have potential to help RFSC producers with transportation outsourcing and collaboration, actual implementation faces many barriers. As noted previously, many producer cooperatives fail due to insufficient resources—both financial and human (e.g., time and energy). Furthermore, the design, development, and implementation of an online transportation platform requires technical capabilities (or hiring of consultants or software developers), and most RFSC producers lack the necessary funds, time, and technical or organizational know-how. Grant funding and technical assistance provided by university researchers or extension per-

¹ <https://coopdistribution.coop/>

² <https://wifoodhub.com/trucking/>

³ <http://www.nwfoodhubnetwork.com/>

sonnel could help. For example, a simple online transportation platform could be developed at low cost, particularly if the app were to be managed and maintained regionally, rather than becoming a for-profit commercial venture. However, an efficient transportation system that operates successfully and supports RFSCs in the long term cannot rely solely on grant funding, nor should it rely on a single organization or individual to champion and sustain it.

The results of this study point to the criticality of transportation in regional food systems and, more broadly, food system resilience (FAO, 2020). It is therefore in the public interest to improve regional food distribution systems, suggesting a rationale for public funding. Similar to public transit systems, cities could subsidize these costs, or even set up their own secure and professionally run transportation systems for bringing perishable local and regional foods into the city.

Conclusion

The research described in this paper sought to reveal the major transportation barriers that prevent RFSC producers from efficiently reaching broader markets and how these barriers could be overcome. The use of Texas-based focus groups, as well as the relatively small operational scale of the participants (i.e., all had gross cash farm incomes less than US\$200,000) may limit the generalizability of this study's findings to other regions and other types of RFSC producers. Self-selection bias is another potential issue: the nature of the study may have attracted participants who are keen to address their transportation problems, while those producers who have already found solutions to these problems may have been underrepresented. Because of these limitations, it was expected that the main contribution of this study would be to provide a foundation for future research. Surprisingly, however, the strength of the recurring themes that emerged from the focus

group data, as well as their clear parallels with the broader supply chain literature, offered insights and promising strategies that are likely transferable and actionable. Nevertheless, the findings from this study indicate the more research on RFSC transportation is needed, in terms of understanding major barriers and appropriate solutions for different regions and producer types and sizes, as well as the suitability of conventional supply chain best practices and solutions for RFSCs.

Increasing RFSC transportation capacity and capabilities is critically important. Infrastructure to facilitate efficient transportation can help producers who want to scale up their production to access larger wholesale markets, and it can also help producers who wish to maintain their current scale by allowing them to reduce their time and resources invested in transportation while increasing flexibility and responsiveness to buyers. This has significant implications for helping regional food systems to reach their potential to transform the prevailing global food supply system. If regionally produced food can reach more buyers and fill more demand, regional food systems can grow and strengthen, making them sufficiently resilient to withstand and recover from the impacts of adverse events and serve as a sustainable and reliable source of food security for communities. 

Acknowledgments

We are deeply grateful to the Texas farmers and ranchers who took time out of their busy schedules to participate in this study. We also thank Shakera Raygoza of Terra Preta Farm for her many contributions to this research. We would also like to thank our project partners Mike Morris, Robert Maggiani, and Darron Gaus with the National Center for Appropriate Technology for helping us to design the study, as well as providing us with guidance and encouragement. We also thank two anonymous JAFSCD reviewers for their thoughtful and valuable input.

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Appendix: Focus Group Playbook

Questions: [Facilitator and team cues in square brackets.]

1. Let's talk about barriers that are preventing you from reaching urban buyers.
 - a. What are your top 3 challenges or "pain points" with respect to *transportation*?
 - b. Describe your current *storage and transportation equipment*. How does the current equipment you have impact your transportation?
 - c. Other barriers (including non-transportation barriers)?
 - d. What, if anything, would help you reach urban markets better?

[Show video introducing delivery sharing notion] <https://vimeo.com/506299026>
2. How do you feel about collaborating/outsourcing for transportation?
 - a. How do you feel about outsourcing your transportation to other farmers? What would it take to make you feel good/better about collaborating with other farmers?
 - b. How do you feel about outsourcing your transportation to private distribution companies? [privacy, reliability, trust...?]
 - c. How do you feel about outsourcing your transportation to other individuals?
 - d. Other ideas and thoughts?

[Show video about app possibilities] <https://vimeo.com/506300649>
3. What software/apps are you using?
 - a. Do you use routing software? Which one? Mobile?
 - b. What other software do you use on your farm? Storage, field management, sales, food safety tracking?
4. What other ideas do you have on how transportation problems could be solved?
 - a. [Present them with possible solutions/scenarios for a regional food transportation system and ask them to react.] Feasible? Doomed from the start? And why?
 - b. How prepared are we as an industry to meet the growing demand?
 - c. Other ideas?

Facilitator close: Any final thoughts? Thank you for coming. After we have analyzed the transcript from this focus group, we may need clarification on some points. If you are willing, we may contact you in the next few weeks to ask you some follow-up questions. When our analysis is complete, we will share the results with you.

Barriers to access to local produce in an early childhood setting in rural Appalachia

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Submitted February 6, 2024 / Revised April 5, June 10, July 15, and September 2, 2024 /
Accepted September 3, 2024 / Published online October 31, 2024

Citation: Miller, ‘E.’ T., Schroeder, K., Thapa, B., & Shay, E. (2025). Barriers to access to local produce in an early childhood setting in rural Appalachia. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 169–183. <https://doi.org/10.5304/jafscd.2024.141.004>

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Abstract

This case study examines young children’s access to fresh local produce in childcare settings in rural Appalachia. In-depth, semi-structured interviews with childcare center directors participating in farm to early care and education programming were conducted in the spring of 2023. Centering the perspective of childcare directors, this research explores why farm to school programming is diffi-

cult to implement. It specifically addresses the barriers preventing early childcare centers from providing access to fresh and local produce to enrolled children. Eight primary obstacles to implementing farm to early care and education programming were identified: lack of staff; too wide a variety of tasks for directors; the “extra” work that fresh produce requires; lack of knowledge about how to grow food; lack of required kitchen equipment; need for additional funding; unclear or out-of-date regulations about food safety; and a lack of parental time. Limitations of the research include the specific geographic location of the study and the long-lasting implications of the COVID-19 pandemic. Recommendations drawn from this case study include improving communication between childcare centers and regulatory agencies; creative use of alternative gardening practices; participating in a regional food hub; and improved funding.

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Author Note

The interviews for this project were conducted as part of Erali Miller’s master’s thesis research in the Department of Geography and Planning at Appalachian State University.

Funding Disclosure

Funding for this research was provided by the Cratis D. Williams Graduate School at Appalachian State University.

Keywords

local food, Appalachia, farm to early care, childcare centers, COVID-19, pandemic

Introduction

This case study provides insight into the barriers preventing young children who attend childcare centers from gaining access to fresh local produce. It centers the voices of early childcare providers as they struggle to accomplish the goal of improving access to fresh local fruits and vegetables for children in rural Appalachia. This case study demonstrates that childcare directors strive to provide fresh fruits and vegetables at their centers, but geographic, institutional, and financial obstacles hinder their attempts to do what they feel is best for the children under their care. The primary research question driving this project is: What do childcare directors believe are the barriers preventing young children in childcare centers from having access to locally sourced fruits and vegetables?

Following a literature review and discussion of the study site and the methodology, this case study identifies obstacles to participation in farm to early care programs, from interviews with childcare centers' directors. These state-supported programs connect local farms with childcare centers to encourage the development of community-based and equitable food systems. The study concludes with an examination of its limitations and recommendations for better implementation of existing programs.

Literature Review

A vast multidisciplinary literature establishes the seriousness of child food insecurity in the U.S. However, childhood food insecurity in Appalachia has been found to be three times the national average (Holben et al., 2004). One in six children in Appalachia is food insecure despite a steady national decline in food insecurity from 2010 to 2020 (Appalachian Regional Commission, 2023, p. 33). In the Appalachian counties of North Carolina, 14.2% of the population is food insecure (Appalachian Regional Commission, 2023, p. 109). Gundersen and Ziliak (2014) found that "county rates of child food insecurity are highest in the South and in rural parts of the country" (p. 3).

They also explored childcare arrangements and their effects on childhood food insecurity, finding that "low-income preschoolers attending a childcare center had lower odds of both food insecurity in general and very low food security" (p. 7) and that children with other care arrangements, such as being looked after by a relative or unrelated adult, were far more likely to experience food insecurity. Based on these findings, this case study provides a needed and more nuanced examination of the issues childcare directors face as they attempt to address food insecurity.

The geography of the region is a contributing factor to food insecurity because physical distance creates transportation challenges that can influence participation in food banks and the development of gardens (Rodriguez & Maraj Grahame, 2016). Given the realities of transportation challenges in the Appalachian region, spaces where parents and young children are already present, such as early childcare centers, provide a critical source for influencing the nutritional health of the community. It is well established in the literature that children start forming food habits at a very young age, a process that childcare centers can facilitate considerably. Wardle et al. (2003) found that "parent-led, exposure-based intervention involving daily tasting of a vegetable can improve children's acceptance of vegetables" (p. 155). Issanchou (2017) explored various methods of habit formation in children under six and found that repeated and diverse exposure to vegetables supported interest in vegetable consumption. Masento et al. (2023) found that reading young children books about eating vegetables increased their acceptance of vegetables. Given the importance of introducing fruits and vegetables at a young age, it would seem that early childhood education centers would provide an excellent venue for introducing local healthy foods.

Although this case study centers the voices of childcare directors, it is not the first to identify barriers to providing local foods in institutional settings. Perline et al. (2015) discuss the obstacles that farmers and hospitals face when trying to incorporate local foods into hospital menus, many of which are similar to what this study identifies, including high turnover rates of staff and difficulties processing raw food products into meals. The

research thus far does not directly address farm to school or farm to early care programs. Research on programs that support bringing local produce into school settings is now fairly common. Research on programs that support bringing local produce into preschool settings is less common. This gap in the literature is partially addressed by Bloom et al. (2022), who analyzed local food procurement by childcare facilities that participated in the NC Farm to Early Care and Education program led by the Center for Environmental Farming Systems. CEFS is a partnership among North Carolina State University, North Carolina Agricultural and Technical State University, and the North Carolina Department of Agriculture and Consumer Services.¹ Conducted between 2016 and 2017, Bloom et al.'s study found that childcare centers purchased low volumes of local foods at the beginning of their participation in the program which made it difficult to establishing strong relationships with local food suppliers. Childcare directors used strategies such as picking up local food, and combining demand with other centers and families to create more successful programs. This study attempts to further their work by highlighting the experiences of early care directors as they attempt to participate in farm to early care and education programming.

Foundational research by Penchansky and Thomas (1981) on how to measure access to the medical system informs how access to food systems is now commonly defined. Access is broadly defined in terms of availability, accessibility, affordability, accommodation, and acceptability (Penchansky & Thomas, 1981). A systematic review by Caspi et al. (2012) found relatively few studies that measure affordability, accommodation, and acceptability, all of which are important components of farm to early care and education food programming. Rutz et al. (2018) examined farm to early care and education programming in urban North Carolina and found inherent tensions between a “socially embedded food system” that values children’s health and early exposure to new foods and a “market-oriented world” (p. 35) that dominates the food system. Rutz et al. (2018) establish the broad context that this study builds

upon. Despite the differences between the settings of Rutz et al. (2018) and this study, both find that childcare center directors are constrained by their available resources, thus simply not able to accomplish all they would like to do. for the children under their care.

The distinction between farm to school programming and farm to early care and education programming needs greater attention, as suggested by the work of Shedd and Kelly (2023) evaluating a pilot program for sourcing local foods for early care and education sites. They identify a growing need for literature that examines the nuanced differences between the two settings. This case study addresses this call by focusing on early childcare education in an Appalachian rural North Carolina county.

North Carolina and Farm to School

As a resurgence of interest in putting local foods in cafeterias began in the late 1990s, the North Carolina Department of Agriculture and Consumer Services founded the North Carolina Farm to School program in 1997 (North Carolina Farm to School, n.d.). It was designed to benefit public school children, providing them with a variety of fresh North Carolina–grown produce in their cafeterias and to expand markets for Carolinian farmers, packagers, and processors. The first crops included apples from western North Carolina and strawberries from eastern North Carolina (North Carolina Farm to School, n.d.). The program has continued to grow, with all public schools in recent years encouraged to participate (U.S. Department of Agriculture [USDA] Farm to School Census, 2019). However, these efforts to combat food insecurity are only available to public school children. As public schools enroll children starting around age five, children can go five years without school-based meal assistance.

In the early 1990s, the North Carolina Department of Agriculture and Consumer Services partnered with several state universities to create CEFS, which carries out research and education in sustainable agriculture and local food systems (CEFS, n.d.). Its NC Farm to Early Care and Edu-

¹ <https://cefs.ncsu.edu/food-system-initiatives/nc-farm-to-early-care-and-education/>

cation program focuses on introducing local produce “through meals and snacks, taste tests, lessons, farmer visits, cooking, growing food, and/or community and parent involvement” (NC State Extension, 2023, para. 1) in North Carolina early childcare centers. The program provides resources to participating farmers and childcare centers, including workshops to help answer questions and fill in knowledge gaps (CEFS, n.d.). This program has been used by the childcare centers at the study site.

Study Site and Methods

In the summer of 2022, the first author was an intern and participant-observer with CEFS in its NC Farm to Early Care and Education program in Wilkes County, NC. The Wilkes Community Partnership for Children worked in tandem with CEFS to provide more local produce options for Wilkes County families and early childcare centers. Wilkes County, the location of this case study, is on the slope of the Blue Ridge, between the Mountain and the Piedmont regions of the state. It is considered by the Appalachian Regional Commission to be a “transitional” county, ranking in the middle between most to least distressed (Appalachian Regional Commission, 2024). Median household income in Wilkesboro, the county seat, is approximately US\$46,100 per year (U.S. Census Bureau, 2023). Wilkes County is home to many farming families and to a Tyson Foods plant that is one of the primary area employers. This is an important consideration with regard to the effect that the COVID-19 pandemic had on the community. During the pandemic, the Wilkesboro facility was forced to close temporarily, causing financial loss to poultry farmers and the plant workers (WBTV, 2020). Many of the children enrolled in the childcare centers included in this study were children of Tyson Foods workers and/or farmers.

In Wilkes County, five childcare centers participated in the 2022 NC Farm to Early Care and Education program. For this study, the first author approached the five center directors and was granted interviews with three. Relationships with these sources were developed over the summer of 2022 through the first author’s CEFS participant-observation. Semi-structured interview questions

focused on the following: (1) how the interview subjects found out about the food program; (2) how they implemented the program; and (3) how the interviewees felt about the programming. The first author conducted interviews following standard protocols (Besen-Cassino & Cassino, 2017).

After receiving IRB approval, each informant was interviewed over Zoom in March 2023; the interviews were audio and video recorded to ensure accuracy. Confidential and potentially sensitive information was removed; no one under 18 was interviewed. Every person interviewed gave consent to be interviewed and for their full names to be used. However, this case study uses anonymized names of the directors and childcare centers to ensure their privacy. The interviews lasted no longer than an hour. The interviews were transcribed by the software system Temi, and reviewed for accuracy by the first and second authors. NVivo software analyzed the transcripts. After identifying critical “stop words,” key themes from the interviews were identified. The first author created a priori codes which were guided by the research questions and the relevant literature previously discussed. They then worked inductively to rearrange and sort codes to identify key themes. The first author coded for words such as “kitchen,” “participation,” and “support.” The authors also coded the words used in specific interview questions, such as “expect” and “changes,” allowing them identification of material significant to certain themes. The first author developed a codebook that identified: (1) interviewees’ impressions of NC Farm to Early Care and Education programming, and (2) the barriers they faced implementing the programs. The first author ran a word frequency query and used the coding stripes function of the NVivo system to highlight significant themes based on the current literature; a word cloud was produced to illustrate the word frequency that emerged (Figure 1).

The word cloud highlights crucial themes with regard to the critical roles that staffing and a general lack of time to accomplish all of the tasks needed in providing support for NC Farm to Early Care and Education programming.

Figure 1. NVivo Word Frequency Cloud (2023)



Childcare Directors' Experiences with Farm to Early Care Programming

Support for Fresh Produce

The directors interviewed wanted to incorporate freshly grown produce, but this was easier for some than for others. For example, Childcare Center Number 1 (which has since closed due to a lack of staffing) was able to incorporate produce from its edible garden but still had to rely on grocery stores to create a full menu. The incorporation of garden-grown produce was highly variable. The former director explains that they support using fresh produce, but face significant challenges in having enough to use fresh produce consistently:

We could only grow so much because of space and um, we did source a few local farmers and a few area farmers markets, those types of things. But a lot of what it was was just supply and demand. We were feeding 55 people every day and having that [food] just available to us on a consistent basis was really important. (Director A)

Director A went above and beyond in her efforts to provide locally grown food to the children she served. At the center, there were two fruit-producing trees that the children could har-

vest from. There were also strawberry plants, sunflowers, and squash dotting the playground. Not all directors had the garden space or kitchen facilities required to grow, prepare, and store fruits and vegetables. Some childcare centers do not have a kitchen on site, or if they do, the kitchen may not meet the requirements to prepare meals, such as a triple-basin sink or range hood.

At Childcare Center 2, the existing kitchen met the requirements to cook on site; however, because it is

located in the basement of a multipurpose building, the center would need to install a costly ventilation system and other upgrades to meet building codes. Center 2 is able to have container gardens on their property, but an overall lack of green space means that expanding its gardening efforts would be difficult. Vertical gardening is a possible way to expand productive space, but for many childcare centers it is unreasonable as anything that could potentially fall on a child and cause harm is not allowed. Instead, it relies on Walmart and catering for the meals it serves.

Center 2 usually makes a bulk order from Walmart for pick-up each week. The director finds that Walmart supplies reliable, easy-to-prepare produce that she can use as snacks. Buying in bulk from the limited selection available from a local mobile market has proven difficult since on-site storage is limited. With what she buys, she is able to serve a two-food component snack in the mornings and afternoons. For lunch the center caters from a local restaurant, ensuring that the children have a “full hot lunch, you know, all five food components” (Director B). Making sure that the children she serves are well-nourished is important to her. Despite not being able to cook on the property, she made sure new and interesting food was served to the children. She describes how she does this:

We do serve ... cucumbers and we try some sweet peppers, things like that. But we do more things they're not used to as a taste test, just so we're making sure they actually do get some nutrients and they're not just throwing, you know, their food away. (Director B)

Some of the produce she includes in these taste tests comes from what is grown on site. They have very little green space, but they make use of that space through container gardening. Since Childcare Center 2 serves 40–45 children a day, some supplementary produce is needed that the director would hope to acquire at the local farmers market if she had enough time available in her workday. The efforts of this childcare director further demonstrate their staffs' understanding of the importance of, and their dedication to, providing access to fresh fruits and vegetables.

Some directors interviewed in this case study have chosen not to spend any time at the grocery store and instead opt for food procurement options that provide delivery. For example, Childcare Center 3 orders from Walmart and caterers (Director C). Childcare Center 3 also has a garden that it can use to provide snacks or tasting, but only when the produce is ripe and in-season. During the off-season, they have to rely entirely on what is available on store shelves. The director explained that she is waiting until later in the spring to continue gardening efforts.

The North Carolina Cooperative Extension and the Wilkes Community Partnership for Children have been instrumental in aiding local childcare centers. There are no national or state meal programs for children under four, unless they are enrolled in a limited number of Head Start programs. Both the Extension and the partnership are dedicated to strengthening their communities through programming like farm to early care and education. These agencies and contributing partners are creative and entrepreneurial in their food purchasing.

In Wilkes County, 476 children are enrolled in independent childcare centers; this number does not include religious or at-home care centers. If religious and home care centers are included, the number of children enrolled is 587. The three cen-

ters operating Head Start programs enroll 82 children who are eligible to apply for the National School Lunch and Breakfast program while the other children are not eligible (Division of Child Development and Early Education, 2023).

The former director of Childcare Center 1 stated that she was a strong advocate for NC Farm to Early Care and Education. If the doors had not closed due to staffing shortages, she would be continuing the center's participation, and she hopes to remain involved in some capacity to help ensure the program's future. For this type of programming to succeed, there have to be support networks within childcare centers among the directors and staff. Director B describes how she and her staff prepared for the NC Farm to Early Care and Education season:

We've had a great experience, you know, being a part of this initiative. Um, and I feel like we would, you know, continue our journey in this. You know, I told our staff, even if we do a little bit along the way, you know, it's better than not doing anything or exposing these children, um, to anything more. So, we're gonna make a pact to do one [garden]. (Director B)

This statement demonstrates that despite the extra effort involved and the need for additional training (everyone involved had gaps in their knowledge), they received excellent support from North Carolina Cooperative Extension to help with this program. CEFS understands that participants start with varying levels of expertise, so it provides training throughout the program. Training occurred remotely on a weekly basis and involved topics ranging from starting a garden to properly storing produce, and included information on other organizations making strides toward a more equitable food system. The former director of Childcare Center 1 demonstrates her understanding of the literature on early childhood development and comments on the main motivation for childcare centers to involve themselves with the program:

It's really important for children, not just their social emotional, but as well as their health and

well-being. We know that working outside and having your hands in the dirt is very good for their social well-being, but it also starts a healthy dietary lifespan. So, children who are introduced and learn to grow their own foods, learn to take that time, have some input, will start out and maintain a better diet throughout their lives. So that was really important to me. (Director A)

She envisioned a future where her students, who ranged from infants to kindergarteners, were able to engage with and have an understanding of the food system. Across from the children's playground there grew sunflowers, strawberries, and cucumbers. Just over the fence, blocking the view of the parking lot, were two fruit trees for the children to pick from and enjoy. The director recalls:

I wanted our students to have that, that possibility, that ability to eat strawberries warm right out of the garden, and to pick apples off the trees and tomatoes and make their own tomato sauce, make their own spaghetti sauce. Just those things that help them to see where their food comes from, that it doesn't just come from the store. And to have that input and to be able to start them on a track towards healthy eating. (Director A)

This is a long-term commitment. Peach trees take approximately three to four years before they begin to produce fruit. For three years, the children at Childcare Center 1 watched the peach tree grow in the small space between the parking lot and the center's gate, waiting for the tree to flower and fruit. When it came time to harvest, the children barely had to reach up to pick the fruit (Figure 2). Once they had enough peaches for themselves, they rinses them and had them for snacks. Children were allowed to save peaches to share with their families. The harvest experience reinforced the importance for the staff of NC Farm to Early Care and Education programming.

The childcare directors wanted to increase their students' exposure to farming and nutritious foods. When asked about her center's participation, Director C said:

Just to get the children, 'cause some children, you know, don't know nothing about farming and knowing, you know, where this stuff comes from, eating healthy because it's cheaper to eat not healthy [food]. So it was just better so the kids could get a good look at what, how it happens, what goes on, all that.

It is likely that many of the children who attend these childcare centers do not have consistent exposure to fresh produce. Director B shared this concern when asked about their participation in the program:

Well, just exposure for the children. Um, you know, a lot of them probably aren't gardening at home. Um, maybe not ... served fresh fruit and vegetables. So, um, we wanna provide as much opportunity for those things to happen here while they're with us. Um, just, and just for better health, you know, for them we

Figure 2. Peach Picking at a Childcare Center



Photo by Erali Miller.

wanted to improve what we were serving here as well.

The directors saw changes in their students as they became more familiar with gardening and trying a diverse range of seasonal fruits and vegetables; their interest in the natural world increased. Even with limited space, the children were able to experience small-scale cultivation such as container gardening (Figure 3). This gave the children the knowledge that growing even a small bit of their own food is worthwhile and possible. Discussing the observed shift in her students as a result of the program, one director said,

We've seen more interest in the children, especially when they see something they plant, produce something. They're more interested, they're more engaged. Um, a lot of 'em will even try it, you know, if they were able to, after five years, our blueberry bushes finally produced last summer and that they were so excited. ... [The blueberries are] by our sidewalk to the playground and every time they, you know, or every day they would observe the changes and they started green and we talked about waiting till they were blue. They'd get so excited to see that and pick it and we were able to serve it for snacks. (Director B)

The literature (e.g., Bloom et al., 2022) supports this observation, showing the many benefits of farm to school programs such as increasing children's willingness to try more fruits and vegetables. Farm to early care and education programming can also provide an introduction to sciences such as climatology and biology.

Despite the many benefits of this program and the

demonstrated strong support from the childcare directors interviewed, farm to early care programming faces substantial barriers to its widespread implementation. This study identified eight significant barriers to implementation: lack of staffing; too wide a variety of responsibilities for directors; the "extra" work fresh produce involves; lack of knowledge; need for kitchen equipment; funding; regulations; and lack of parental time. These constraints are examined through the eyes of childcare directors, who play a critical role in implementing these programs and whose voices are often overlooked.

Barriers to Farm to Early Care and Education Programming

Childcare directors are responsible for the meals served at their centers; therefore, it is important to understand their lived experiences in order to reduce the barriers to providing local foods to children. The work these women do is worth noticing and their voices matter. Childcare management is a demanding career that requires a broad set of skills that include everything from policy development to budgeting, maintaining sanitation, and forging

Figure 3. Playground and Garden with Trellis to Incorporate Plants into the Small Spaces

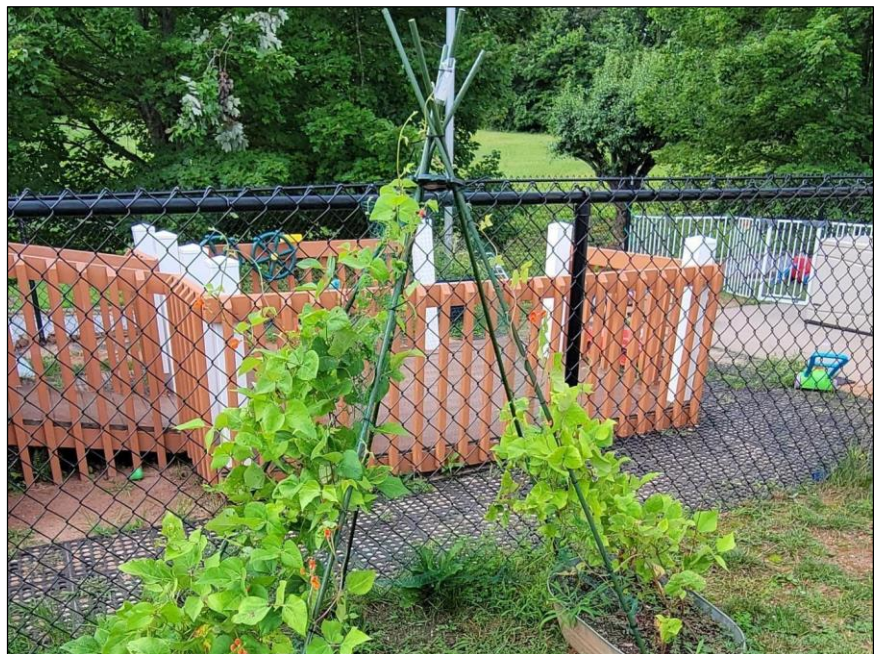


Photo by Erali Miller.

strong community relationships (NC State University [NCSU], n.d.). The first part of this case study documented how childcare directors felt about NC Farm to Early Care and Education programming. The following section discusses the barriers that childcare directors face in implementing these initiatives.

While childcare directors have many responsibilities, most will not make more than US\$50,000 per year. The number of jobs in this career track is also declining. In 2018 there were approximately 1,750 childcare director jobs in North Carolina. This number dropped in 2019 to 1,690, and to 1,540 in 2020 (NCSU, 2023). The number of childcare director jobs may be dropping, but the birth rate in North Carolina has stayed consistent throughout 2018–2020, with only a small decrease in 2020 (Division of Child Development and Early Education, 2023). The need for childcare directors has not changed; many independent childcare centers in the study site are operating at near maximum capacity (Division of Child Development and Early Education, 2023). The eight common concerns of directors that emerged in the interviews are discussed below.

Lack of Staff and Low Wages

As evident in the word cloud (Figure 1), staffing is always on the minds of childcare directors. The U.S. Bureau of Labor Statistics (2022) reported that in 2021 the median salary of preschool and childcare center directors was approximately US\$47,310; low wages clearly contribute to the shortage of childcare providers. Director A had to close one of the few childcare centers located in the study site because of a lack of staff. With constant staffing problems, it is difficult to build and maintain consistent engagement in farm to early care programming.

Wide Variety of Responsibilities and Long Hours

There is much hidden work that childcare directors do every day, making the addition of an extra task such as procuring produce from local farmers extremely challenging. Their responsibilities are altered based on daily needs or activities, such as regulatory visits, teachers calling in sick, and a prospective family requesting a tour. A director

described some of these scenarios in greater detail:

So, the primary responsibilities of the day is working with parents, ensuring that every class, um, and parents and children are greeted and met each day. Before that, making sure that the teachers have what they need, that their classrooms are set up accordingly, the teachers are prepared, um, and then making sure that the center is running functionally. So, and within state guidelines, making sure we have our supplies that we need, that we're running according to policies and procedures set by the state, ... making sure the staff has their training, um, making sure that the building is up to code and that we have all of our, um, basically our, i's dotted t's crossed. And then of course there's the business aspect of it as well, making sure that I take care of the financials, um, payroll, those types of things. (Director A)

Director C comments that the “day normally starts as early as 6:30 AM and ends as late as 5:30 PM.” These responses just scratch the surface of what a childcare director manages daily, demonstrating their dedication and their wide range of expertise. Given everything that is required to run a daycare center, it is challenging for these women to add another responsibility, such as arranging fresh food delivery, to their schedules.

The Extra Work of Fresh Produce

The three directors interviewed had differing experiences with gardening and gathering fresh produce. One was doing much more than was required for her job. She researched farm-to-table options, picked up ingredients from various sources, and served as the main cook for the center. This center provided breakfast, lunch, and afternoon snacks, Monday through Friday. The director gardened with the children and used the produce in their meals. She described sourcing ingredients for the center primarily from local grocery stores, but that they “would backfill the menu with a lot of our stuff from our garden” (Director A).

It can be challenging to find reliable and affordable local produce; directors typically need

more than one farmer to supply their centers, as few farmers grow every crop that is used in a facility. Directors also have to establish pick-up times for supplies and bulk order purchasing. It can be difficult to find time for these tasks when one's schedule is already full.

Lack of Knowledge

Directors described their knowledge base in regard to NC Farm to Early Care and Education programming. One director grew up gardening and had space available at the center for garden projects. Another director had little gardening knowledge and had very little gardening space available, but she persevered:

I don't feel like I have all the knowledge I need to, you know, do all the gardening and stuff like that. But, you know, through the trainings that ... the Cooperative Extension office has been very helpful. So I feel like we maybe only made a few baby steps last season, but this year I feel like we're more prepared. (Director B)

When met with challenges, she utilized her existing resources, stayed motivated, and looked forward to future efforts. It is worth acknowledging that their participation is not obligatory: they put in the additional work because they feel it is a benefit to the children under their care.

Kitchen Equipment

Not all childcare centers have the kitchen equipment to prepare fresh foods. State regulations are fairly clear about what is required of a center in order to prepare meals. Centers must have "adequate" countertop space, refrigeration, and cooking equipment, and follow the sanitation handbook (Division of Child Development and Early Education, 2007). For example, a center must have a separate sink for handwashing and a commercial ventilation hood if meat is cooked on the stove. The directors understood the rules for operating their facilities well and stayed in compliance with the regulations. Lacking adequate kitchen facilities, however, prevents local produce from being used in meals throughout the day. Renovation costs can be prohibitive

and sometimes renovations simply are not possible.

Only one director had a full and operating kitchen; two directors would have to go through expensive and complicated renovations to bring their kitchens up to code. As directors are acutely aware, even with an adequate kitchen, the actual preparation of meals is challenging, which could require additional staffing (Director B). Instead of installing and maintaining commercial kitchens, these directors provide easily prepared snacks such as carrot sticks or apple slices, but they all would like to do more.

Funding

The directors believe that providing local food on site is best for the children, but funding support is not readily available. Even when funding is found, as through the American Rescue Plan Act (2021), it can be difficult to prioritize spending on local food when staff are chronically undercompensated. It may make sense to use emergency funds to ensure that staff are better compensated so that centers stay open. Directors also found the funding application arduous, and extensive reports are due quarterly. Eventually, as funding ended, the centers had to decide how to phase out those extra revenues. This was a difficult task, especially after operating with a steady subsidy for over a year.

The Childcare Stabilization Grant was useful in keeping childcare centers open during the pandemic (Division of Child Development and Early Education, 2022). Its end made things difficult. A director discussed how cost is a major factor in how they currently source meals for the center:

Right now, our caterer charges [US]\$3.00 per child, per meal, or per lunch. So ... we feel like we could, you know, offset that a little bit and prepare them here a little bit cheaper. But, you know, to provide those fresh fruits and vegetables each meal, we feel it could be more expensive. Um, so we're trying to weigh, we, we know that's what we wanna do and we know that's what's best for, you know, the children is just working through all those obstacles and logistics of funding and staffing. (Director B)

NC Farm to Early Care and Education programming can be expensive, and childcare directors are aware of these additional costs. It could be more advantageous for centers to purchase from local farms, but often childcare facilities are underfunded and it is simply not an option for them. This barrier may be the most difficult to overcome.

Regulations

Another ever-present hurdle, according to the directors, are regulations. North Carolina regulates the operation of childcare services. Covering fire safety, sanitation, and more, regulations keep children safe. However, becoming familiar with regulations can be onerous. As discussed above, childcare directors are stretched thin. Sometimes they are in the infant rooms giving a teacher a break, or they are giving a tour for an interested family, or they are in the kitchen preparing lunch. They rarely have time to thoroughly evaluate regulatory documents, especially when the documents can appear unintelligible (Director B).

Another director added that the regulatory agencies check in approximately every four months. It was clear that there are many standards to be upheld, and rightfully so. Although every center in this case study was up to code, much stress is associated with meeting these standards (Director A). Childcare directors are familiar with what they need to do to stay in compliance. However, if a new kitchen were built, it would require a close examination of the current regulatory documents. Adding a kitchen to a center is an enormous task. Regulatory barriers are necessary, but they can act as a barrier when they are not easily accessible or ambiguous.

Parental Involvement

Another hurdle faced by directors is inadequate parental involvement. Childcare providers hope that parents will participate in the projects or programs that their children are engaged with during the day, but there are many barriers to the participation of parents and guardians. Sometimes, for a number of reasons, parents do not continue their children's curriculum at home. Some simply cannot afford to integrate their children's curriculum, or they may lack the time or energy. Census data

reveal that 22% of the population in Wilkes County lives in poverty, compared to 12.8% in North Carolina as a whole (U.S. Census Bureau, 2023). The purpose of the NC Farm to Early Care and Education program, in part, is to make food purchasing decisions easier and more affordable for families. As part of the CEFS program, in Wilkes County, parents can place an order to purchase a box of produce to pick up at the childcare center. Small boxes were US\$10, medium-size boxes for US\$15, and large boxes for US\$20. These boxes of fresh produce were packed with produce from nearby farms with the help of a local nonprofit.

Once the boxes were packed, they were delivered to the childcare centers. At the end of the day, when parents and guardians came to get their children, they picked up their Fresh Box. The goal was to make these boxes relatively inexpensive so that more families would be able to incorporate farm-fresh produce in their meals. Throughout the summer, the boxes were promoted through posters hung in the centers and through a raffle. While childcare directors went into the project with high hopes, there was less parent participation than expected (Director C).

The children were still exposed to fresh produce and gardening at the center, but not many families ordered produce boxes. Only three of the five centers participating in the project had families place orders. Although disappointed, the directors recognize that parent participation can be hard to elicit. One director understood that successful participation would require a team effort; by reaching out to other childcare directors, she was able to build a network to better support the project, including doing a considerable amount of her own outreach and staff training (Director A).

This director is also an avid gardener and incorporated her experience into her childcare center. For many years, she involved the families that she served in gardening at the center. She spoke about her main motivation for joining the NC Farm to Early Care and Education program:

So, I've been researching some farm-to-table options for the center before we ever opened because, um, home gardening is a big, it's a big

thing for me, and I've taught that to my daughter and my stepchildren. So, it was really important to me to have this. Plus, it's very well known that children who grow their own foods tend to eat better, and they'll try more foods. So that was a big thing for me. So, um, I did do some research. I reached out to the state, reached out to the Agricultur[e] Department as well as the Partnership for Children, and found out that there was a program when we started looking at different food options that we could join and become a part of. We did those training classes and really got the staff involved as well as the parents involved in our farm-to-table program. (Director A)

Directors indicate that parent participation can be accomplished by consistent exposure to the programming over time; it can be difficult to gather participation over one season. Parent participation can make a big difference in the outcomes of farm to early care programming.

Limitations of This Case Study

This case study documents the views only of the childcare directors who agreed to be interviewed for this project. Its recommendations may not be generalizable to other settings. Several childcare directors in the same county declined requests for interviews; how their views would have impacted this case study is unknown. Also, this rural Appalachian case could be unique in that the directors all had overall positive experiences with NC Farm to Early Care and Education programming. Food insecurity in urban Appalachia is different than in rural areas as, for example, the price of food can vary greatly between rural and urban Appalachia (Miller et al., 2022). In addition, because of this case study's rural setting, gaining physical access to farm produce through food delivery networks was a consistent challenge. In an urban setting there could be better and more varied local food delivery options. However, little research has been done comparing urban and rural childcare centers in Appalachia. A third important limitation is that these interviews were conducted in March 2023 as

the first waves of the COVID-19 pandemic were receding but COVID-19 relief funds were still available. As these funds have dried up, directors have had new challenges to face.

Recommendations

North Carolina Cooperative Extension has laid a strong foundation for providing local fruits and vegetables at childcare centers by offering training, partnership opportunities, and a vast wealth of knowledge (NC State Extension, 2023). However, regardless of setting, childcare centers operate on tight budgets, with limited space, and with strict restrictions on what they can do. These concluding remarks suggest ways to facilitate the work of directors as they struggle to provide local fresh produce to their students.

As demonstrated above, childcare directors need to make strategic purchasing decisions. Directors often depend on local grocery stores and Walmart delivery to provide meals at the lowest possible cost. The convenience of Walmart is important to consider when comparing it to farm to early care and education programs that require directors to be in contact with local farmers to source ingredients. In addition, farmers usually prefer to sell in bulk, which can be problematic for a center because produce has to be consumed relatively quickly. The method of retrieval is another difficulty; Walmart offers delivery, but not all farmers do. Sometimes staff have to drive to farms to pick up produce.

Food Hubs

One possible solution could be participation in a food hub. Currently, the option of buying directly from local farmers is more difficult than purchasing from large commercial growers. How can methods of local food procurement compete? For Wilkes County, an answer may exist in neighboring Watauga County through the High Country Food Hub, which receives support from a wide variety of agencies including NC State Extension. With the goal of making purchasing local foods easier, the food hub has developed an online marketplace for direct farm sales.² It offer up to 3,000 products

² See <https://www.ncfoodhubs.org/meet-the-nc-hubs/high-country-food-hub>

from more than 90 local businesses and farms. Orders are placed online; the organization collects and dispenses orders once a week at five different pick-up locations. Although its inventory is not comprehensive, nor does it deliver, many foods that a center needs could be ordered from its website and delivered to a reasonably convenient pick-up site.

It may not be possible to cook all meals on-site, but those centers without access to a commercial kitchen could still source their snack items through the food hub. Centers do not have to have access to a refrigerator to serve certain fruits and vegetables. Tomatoes, apples, and peaches can all be stored at room temperature prior to serving. For those centers with commercial kitchens, it could revolutionize the meals they serve.

Alternative Gardening

An additional challenge childcare directors face implementing NC Farm to Early Care and Education programming is lack of gardening space. A center's topography can limit production of fruits and vegetables, as the playground may be sloped, shady, or small. However, some directors had creative solutions to their space problem. Gates can be carefully used as trestles, and plants can live on either side of the fence. One director chose to repurpose old purses, some donated and others bought from a resale store. They were hung along the playground fence and filled with soil and sowing seeds. The children watched the purses fill with herbs and flowers. She explained that as the purses are made of fabric, they drain well, serving as hanging pots. This was but one inexpensive and ingenious solution to limited space.

Increased Communication with Regulatory Bodies

Childcare directors need better understanding of regulatory agencies. Government documents

should be current and formatted for legibility (some documents appear to be poorly scanned copies). Ease of access is also important, and; while there is a rule book for compliance and someone to assist in making sure that the rules are met, consultations should also be available for childcare centers wishing to expand their kitchens. The North Carolina Department of Health and Human Services could make appointments available for childcare directors interested in making changes. Local regulatory agencies should also follow suit. There needs to be a clear and open dialogue between regulatory bodies and those they oversee. This dialogue could prevent centers from falling short of code compliance due to changes made without all the necessary information. Make the information easily available would provide centers with an idea of where to start instead of doing the research themselves. By offering consultation meetings for centers looking to make modifications, the improvement of childcare facilities would become far more streamlined and less time-consuming.

Additional Funding

The end of COVID-19 stabilization grants have caused disruptions for many childcare providers. The state could assist in funding for centers looking to expand or upgrade. For many centers, having an operating kitchen feels like an unattainable dream as the costs are so high. If the state assisted in offsetting the costs to renovate centers, it could have remarkable benefits for the centers and for local residents.

With these suggestions, this case study amplifies the voices of childcare directors who balance heavy loads while striving to provide the best possible foods to the young children in their charge. These women providing childcare in Appalachia deserve to have their voices heard and to receive better support from state and national agencies. 

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Exploring barriers and facilitators to direct-to-retail sales channels: Farmers' perspectives on wholesaling produce to small food retailers in Charles County, Maryland

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Submitted April 26, 2024 / Revised June 25 and July 31, 2024 / Accepted August 8, 2024 /
Published online November 1, 2024

Citation: Thomas, A. E., Lewis, E. C., Poirier, L., Williamson, S., Xie, Y., Lightner, A., & Gittelsohn, J. (2025). Exploring barriers and facilitators to direct-to-retail sales channels: Farmers' perspectives on wholesaling produce to small food retailers in Charles County, Maryland. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 185–206. <https://doi.org/10.5304/jafscd.2024.141.003>

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Abstract

In 2020, a mobile application (app) was developed to connect small food retailers with local producers, recognizing the underutilization of direct-

to-retail sales channels. Before piloting the app, formative research was conducted in Charles County, Maryland, to gain an understanding of existing direct-to-retail sales channels for locally grown produce. Seven stores were surveyed to explore current local produce stocking, and four farmers participated in in-depth interviews to provide insights into their experiences with direct-to-retail marketing channels. The results indicate a

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Funding Disclosure

This research was supported by funding from the National Institutes of Health, National Heart, Lung, and Blood Institute (NIH NHLBI) under grant number R34HL145368. Additionally, support was provided by the Maryland Department of Health, Public Health Prevention Administration (MDH PHPA), through the Community Healthy Stores Initiative under grant number PHPA-1851.

limited stocking of local produce in the small food stores, some of which was self-procured to obtain adequate quantities. Farmers expressed a passion for contributing to food security in their community and a willingness to collaborate with store owners to strengthen their direct sales; however, they cited barriers such as the impact of the COVID-19 pandemic, competition with large distributors, and logistical challenges. Considering these existing barriers and facilitators, small food stores may still possess a unique potential to establish direct sale relationships with local farms. Such relationships could be effectively facilitated through the implementation of a digital strategy.

Keywords

direct-to-retail, direct marketing, mobile app, food retail, distribution networks, food access, food system, farmers, COVID-19, pandemic

Introduction

At present, the United States convenience store industry includes 152,396 stores, marking a 1.5% increase from 2023 (National Association of Convenience Stores, 2024a). Within that same year, the industry reported US\$859.8 billion in sales, with over one quarter (26.9%) of sales attributed to food (National Association of Convenience Stores, 2024b). Given many communities' reliance on small stores for food purchases and small stores' tendency to lack healthy options, the U.S. Department of Agriculture (USDA) published its *Healthy Corner Stores Guide for Communities* (USDA Food and Nutrition Service [USDA FNS], 2016) featuring case studies of successful programs and interventions to improve store offerings. However, the guide solely focuses on urban settings, failing to address that these issues exist in non-urban settings of the country as well.

Since the 1990s, the food retail industry's increased market concentration has disproportionately affected non-urban areas by reducing access to independent supermarkets and concentrating stores in larger towns. This movement has increased the distance and resources required for residents, especially in lower-income rural neighborhoods, to obtain nutritious food (Blanchard & Matthews, 2008; Paruchuri et al., 2009; Ver Ploeg

et al., 2012; Pinard et al., 2016). Consequently, residents in many rural towns rely on convenience stores as their main food sources (Liese et al., 2007; Sharkey et al., 2009). Despite being more accessible than larger supermarkets, these establishments face limitations in stocking fresh produce and tend to offer highly processed, less nutritious items. In their assessment of nutrition environments in rural stores in the Deep South, Shikany and colleagues (2018) found that healthy choices are available in a significantly higher proportion of grocery stores than convenience stores (Shikany et al., 2018). Another study in upstate New York revealed that rural residents are situated up to 68% further from fresh foods than from processed foods given the presence of nearby convenience stores (Ganter et al., 2011). Similarly, researchers studying small grocers and convenience stores in three rural North Carolina counties found that only 2% of the 55 surveyed stores stocked at least three fruits and three vegetables (D'Angelo et al., 2017).

Small stores' inability to stock fresh produce is largely attributed to gaps in the food distribution system. Due to their restricted space and refrigeration capabilities (Haboush-Deloye et al., 2023), these stores require smaller, more frequent deliveries—a demand that many suppliers are unable or unwilling to accommodate. In a study evaluating rural corner store owners' perspectives on stocking fresh foods, issues related to supply chain distribution was a primary barrier, including higher unit prices and delivery fees for smaller orders (Haynes-Maslow, 2018). Further studies examining distributor perspectives found that regional produce wholesalers tend not to view small stores as viable business opportunities due to their low order volume and irregular purchasing patterns (O'Malley et al., 2013). On the other hand, many processed food manufacturers offer incentives to small stores for promotion of their products (Ayala et al., 2017).

One potential solution to these identified barriers is to reduce the number of intermediaries (e.g., wholesalers and distributors) between small stores and producers, and instead utilize direct sales channels. There has been previous interest in the economic and health benefits of direct sales, including direct-to-consumer sales through farmers

markets (Warsaw et al., 2021), farm stands (Evans et al., 2012), and community supported agriculture operations (CSAs) (Paul, 2019). However, engagement in direct-to-retail sales among farmers has historically been low. According to the USDA's 2020 Local Food Marketing Practices Survey, only 8% of farms participated in direct sales to retailers, while 77% sold directly to consumers (USDA National Agricultural Statistics Service [USDA NASS], 2022). Researchers propose that the low engagement in direct-to-retail channels is due to the typically smaller scale of farms engaged in direct marketing, which may not produce enough to meet the demands of larger grocery stores (Plakias et al., 2020). Concurring authors have found that as retailers expand, their distribution channels tend to become more "concentrated, formalized, and vertically integrated" (Clark & Inwood, 2016, p. 16). This situation eliminates the prospects of direct-to-retail sales for small farmers and suggests that these growers are better situated to form mutually beneficial relationships with small retailers.

Given these circumstances, an intervention to establish direct-to-retail sales channels between farmers and convenience stores could benefit both parties. Farmers with smaller quantities of produce have the opportunity to gain a new market for their goods, while convenience stores could more easily procure fresh foods, thus increasing the availability of healthy food options for customers. To help facilitate these relationships, the *Baltimore Urban food Distribution* (BUD) study was funded in 2020 to design and develop the BUD mobile application (app) for improved procurement and distribution of healthier foods to small stores in Baltimore (Gittelsohn et al., 2022). The app serves as a digital interface to connect store owners with local producers and suppliers, allowing for direct purchasing and delivery of fresh produce and other healthy food and beverage items (Lewis et al., 2024). Features of the app address specific needs identified by both parties, such as collective purchasing and shared delivery to offset the aforementioned distribution challenges (Ross et al., 2018; Schwendler et al., 2017).

Given interest in adaptation of the app for non-urban regions surrounding Baltimore, this

study was expanded to Charles County, Maryland. Formative research was conducted to document small stores' (1) current stocking of local produce and (2) the extent of their involvement in direct purchasing; and (3) farmers' perspectives regarding current direct-to-retail sales.

Methods

Study Setting: Charles County, Maryland

Charles County is located two hours south of Baltimore (where the app was developed), and is an area familiar to the research team from prior research (Campbell et al., 2017). In 2022, the county had 371 farms, with 85% of them categorized as small (Garner and Yewell, 2024; USDA NASS, 2022). These farms were leaders in Maryland fruit and vegetable production, with almost one in five (17.92%) farms cultivating produce (Johns Hopkins Center for a Livable Future, 2023). The majority of Charles County residents are Black/African American, composing 53% of the population (U.S. Census, 2022). Notably, Charles County residents have a slightly higher morbidity rate than the state average, particularly in diet-related diseases such as diabetes (27.5 per 100,000) and heart disease (167.2 per 100,000) (U.S. Census, 2022). In 2019, Charles County had 112 food stores, with supermarkets accounting for 17% (19), and the rest comprising convenience stores (73) and small grocers (20) (Johns Hopkins Center for a Livable Future, 2023).

Small Food Stores

Sampling and recruitment

We used purposive sampling, defined as the non-random selection of cases within a sampling frame (Robinson, 2014), to identify small food stores in Charles County that fulfilled specific criteria. These criteria included: (1) having a store owner or manager who was willing and able to undergo training in using the BUD app and placing food orders through a smartphone or other internet-enabled device, (2) being classified as an independently owned small food store (with fewer than four aisles or two cash registers, excluding lottery registers),

and (3) being located more than 1 mile (1.6 km) away from a supermarket, defined as “large-format grocery stores with all food departments present, including produce, meats, seafood, canned goods, and packaged foods” (Johns Hopkins Center for a Livable Future, 2012, para. 10). Eligible stores were identified using a datasheet of small stores in Charles County created for a previous study (Campbell et al., 2017). A supplemental Google search provided updated information regarding store closures and changes in store ownership. Participant contact occurred through in-person recruitment. During recruitment, the research team approached stores to assess their eligibility and distributed flyers containing frequently asked questions (FAQs) about the trial. Flyers were written in English and outlined the benefits and potential risks of participation. Store owners continued communication with the research team in person and via email as they considered their willingness to participate. Of the 14 stores the research team attempted to recruit, eight agreed to participate, one of which was a farmstand and therefore excluded from the present sample.

Data collection

Store-level data were collected by the lead author, following training in observational data collection and survey administration. Two instruments were used across the seven participating stores to collect information to inform the future intervention. Both instruments were adapted from the B'more Healthy Communities for Kids (BHCK) trial (Gittelsohn et al., 2014). The Store Impact Questionnaire (SIQ) is a structured survey, consisting of 89 questions, designed to evaluate store characteristics, supplier types, and the prices of promoted foods and beverages. The SIQ was verbally read to

the store owner by the data collector and took an average of 25 minutes to complete. In addition to the SIQ, the lead author completed the Store Environmental Checklist (SEC), a structured observational tool based on the validated Nutrition Environment Measures Survey-Corner Stores (NEMS-CS) tool (Cavanaugh et al., 2013), to document the current stocking and promotion of selected foods in the participating stores. The completion time for the SEC depended on the store size and ranged from 15 to 30 minutes. Combined, these instruments took a total completion time of 45 to 60 minutes. Both tools are located in the Appendix for further reference.

Farmers

Sampling and recruitment

Farmers (see Table 1) in Charles County were also purposively sampled and contacted if they were identified as having cultivated produce that they had wholesaled to a local retailer within the past year. Four farmers were identified and contacted via a mutual connection at the Southern Maryland Agricultural Development Commission. The initial message outlined the project's scope and shared a research team member's contact information through a weekly informational email sent to farmers in their network. To complement this outreach, a Google search was conducted to identify three additional farmers operating in Charles County who met the criteria, determined by a review of their websites. Farmers identified through the web search were subsequently contacted using their listed email addresses. Six out of the seven farmers we contacted replied to our initial interview request, for a response rate of 86 percent. Of those six, one declined the invitation to

Table 1. Farm Characteristics of Farmer Participants

Farmer #	Years in operation	Scale of operation	Growing method	Main product(s)
1	>100	150 acres	Conventional	Produce
2	< 5	0.75 acre	Organic, non-certified	Produce, value-added products
3	< 25	350 acres	Pasture-raised	Livestock
4	< 25	130 acres	Organic, certified	Produce

interview and one did not respond to subsequent follow up, resulting in a total of four farmers.

Data collection

Semi-structured, in-depth interviews were conducted with four farmers by the lead author, who received graduate-level training in qualitative research methods. The interview guide was designed to capture insight into the farmers' (1) background and experience in farming, (2) preferred growing practices and produce seasonality, (3) existing direct-to-retail sales practices, and (4) efficacy for using smartphone and app-based technology. Three interviews were carried out at the respondents' farms, and one interview was conducted over the telephone. All research participants provided oral informed consent before any data collection, and interviews were recorded with the respondents' permission. Recordings were transcribed verbatim by the researcher who administered the interviews.

Data Analysis

Data analysis followed a concurrent triangulation design (Creswell & Plano Clark, 2017). This method involved separate analyses of the SIQ, SEC, and in-depth interviews, followed by subsequent comparison. Frequencies were first generated from the produce stocking data obtained from the SEC. Then, qualitative responses from the SIQ concerning stores' current wholesalers were analyzed to explore the extent to which store owners engage in local purchasing and produce stocking, as well as observational data regarding visible local food promotion. The farmer in-depth interviews were analyzed using ATLAS.ti (Version 23), employing a hybrid inductive/deductive thematic analysis approach. The process was conducted by a single coder (the lead author) and adhered to Braun and Clarke's iterative thematic analysis process. This process involves familiarization with the data, code generation, theme generation, theme review, definition and naming of themes, and identification of exemplars (Braun & Clarke, 2006). To ensure that interviews were accurately transcribed, transcripts were re-read and memoed before coding. Block

coding was applied to the transcripts, and coded segments were organized to establish subthemes within the predefined categories of barriers and facilitators. The codebook underwent analytic triangulation with another trained researcher, who aided in the review and provided comments to enhance reliability before final application to the data.

IRB Approvals and Ethics

All research activities were approved by the Institutional Review Board at the Johns Hopkins Bloomberg School of Public Health (approved April 28, 2023, IRB00024770). To ensure anonymity, both farmers and stores are de-identified throughout the paper.

Results

Stocking of Local Produce at Small Rural Retail Food Stores

Table 2 provides characteristics and produce stocking information for the sampled stores. All of the stores we surveyed had limited space for produce stocking and consisted of five or fewer aisles. Additionally, we found that only one store participated in the Special Supplemental Program for Women, Infants, and Children (WIC), and less than half participated in the Supplemental Nutrition Assistance Program (SNAP), both of which require stores to meet minimum stocking requirements for produce (USDA FNS, 2022, 2023).

Only a minority of the small food stores ($n = 2$) surveyed offered fresh vegetables, whereas a larger proportion ($n = 4$) sold fresh fruit. While only two stores offered fresh vegetables, one stocked a diverse array, including 11–20 different varieties. Most stores stocking fruit had 1–2 varieties, with bananas and limes being the commonly stocked items. When asked to list the highest-selling foods at their establishments, none of the owners listed produce among the top five items. However, many owners listed staple grocery items such as bread, eggs, and milk.

Only two store owners relied on wholesalers for produce procurement. One of them, the largest store with the most extensive variety of produce,

Table 2. Sampled Store Characteristics (N = 7)

Store #	Number of aisles	Fresh produce supplier type	Accepts WIC	Accepts SNAP	Local food promotion	Most popular food items
1	3	Supermarket	No	No	None	1. Potato chips 2. Candy 3. Dairy products 4. Bread 5. Miscellaneous groceries
2	4	None	No	Yes	None	1. Canned sausage 2. Bread 3. Potato chips 4. Soda 5. Candy
3	4	None	No	No	None	1. Bread 2. Eggs 3. Milk 4. Soda 5. Alcohol
4	4	None	No	Yes	None	1. Prepared pizzas 2. Prepared cheesesteaks 3. Milk 4. Bread 5. Eggs
5	4	Supermarket	No	No	Hand-written sign advertising local eggs	1. Potato chips 2. Snack cakes 3. Canned sausage 4. Lunch meat 5. Cheese
6	5	Regional produce distributor National food distributor	Yes	Yes	None	1. Prepared burgers 2. Bacon 3. Chicken breast 4. Sliced cheeses 5. Sliced lunch meats
7	0	National food distributor Local producer	No	No	Hand written signs advertising local blackberries, tomatoes, and corn	1. Honey 2. Meat sticks 3. Frozen steaks 4. Chicken breast 5. Eggs

used a small regional wholesaler as the main supplier of fresh produce, supplemented by a large national supplier for bananas. The remaining stores reported independently shopping at supermarkets or big-box stores (e.g., Wal-Mart, Sam's Club, and Food Lion) to acquire quantities of produce they believed could be feasibly stocked within their limited space. One store, a centennial establishment whose owner had strong ties with local producers, intermittently stocked its produce based on seasonal availability. During the observation period (summer of 2023), local blackberries, tomatoes, and corn were displayed and promoted through point-of-sale signage at that store.

Facilitators and Barriers to Wholesaling Produce Identified by Farmers

The participating farmers varied in terms of their growing methods, goods produced, operational scale, offering diverse perspectives that contributed to our formative understanding. All farmers interviewed expressed general support for the BUD app, and three out of the four commented that the technology could support their existing direct-to-retail models. Interestingly, when asked questions about their existing direct-to-retail sales, the farmers provided in-depth explanations of the macro-level forces shaping direct-to-retail marketing channels in their county, which are pre-

sented in Figure 1 as market-driven factors., They also discussed the significant care and effort required to maintain these channels, presented in the same figure as farmer-driven factors. These insights, presented in the following section under the a priori themes of barriers and facilitators to direct-to-retail sales in Charles County, provided us with a better understanding of the environment in which the BUD app will be acting. These findings confirm the usefulness of the intervention and help us identify leverage points for future use.

Facilitators to wholesaling at small food retailers

1. Participating farmers expressed that Charles County is part of a national local food movement

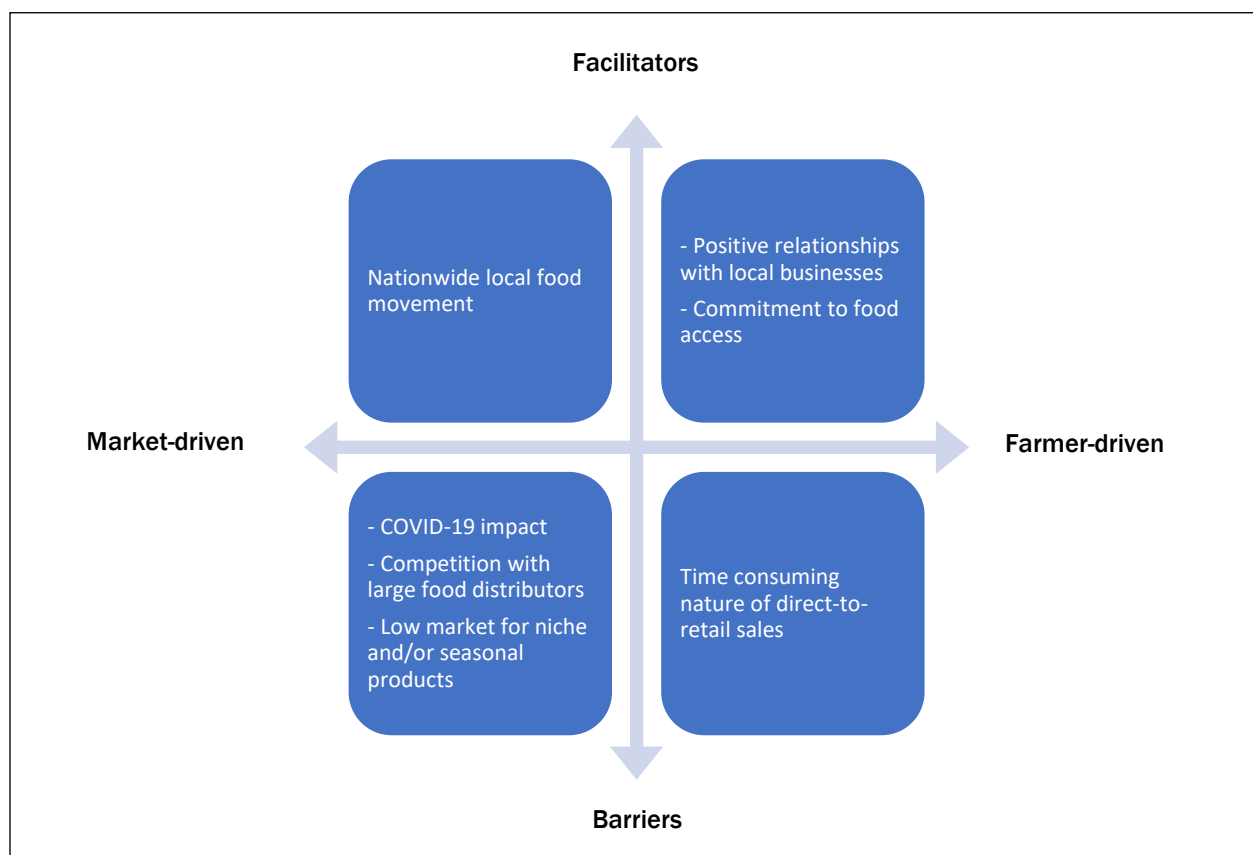
Farmers engaged in extensive discussions regarding the “local food movement”—a concerted effort by consumers to prioritize locally grown

foods in resistance to the prevailing consolidated, commodity-based food system. According to the farmers, residents of Charles County are participating in this movement and have demonstrated a higher demand for Southern Maryland–produced foods in recent years. One farmer described the lengths to which wholesale buyers will go to meet consumers’ demand for locally sourced food, stating:

It’s really the push of the local economy and this boom that has been local, and this whole local food movement that has helped guys like us, where these [distributors] are working with us, they’re giving us the time of day.
[Farmer #1]

In addition to intermediary sales, the farmers described establishing direct-to-consumer channels through avenues like farmers markets, CSA sub-

Figure 1. Farmer-Identified Barriers and Facilitators to Wholesaling Produce to Small Stores



scriptions, and on-farm sales. They highlighted the potential impact of this on building direct-to-retail sales channels, envisioning that the surge in consumer demand could manifest in their purchasing habits at nearby small food retailers. One farmer recounted a past endeavor by a convenience store to stock local foods:

Would the people in this area support direct produce? Yes. Because the owners who had [our local convenience] store prior to that, they bought local produce ... because when people were running in and they're like, 'oh yeah I could use some tomatoes,' they knew it was there and that you can stop in and get it. [Farmer #3]

2. Participating farmers have existing and positive relationships with local businesses in the area

The farmers portrayed Southern Maryland as a region rich in small businesses, a number of which already purchase directly from local farms. In describing their relationships with these businesses, the farmers suggested that the connections between farmers and local businesses in Charles County span beyond transactional exchanges and are instead rooted in civic engagement. Describing this collaborative environment, one farmer noted,

I started getting in with a lot of local business in the community. We've built so far—in the last six years—we've built this really tight-knit local, all of us local small businesses are very tight-knit and friends. And we all support each other. [Farmer #2]

Due to their existing direct-to-retail participation, the farmers were confident about maintaining and expanding these sales channels through the use of a mobile application. Reflecting on the long-term direct-to-retail relationship with one of the stores recruited to participate in the BUD trial, one farmer expressed:

With her, she buys, we do some value-added products, like we do nitrate-free beef jerky and beef sticks. ... And we've been working

with them for a very long time. And she likes to work with local people, bringing in local products. [Farmer #3]

3. Participating farmers are generally willing to work with store owners to make stocking their products easier

Several of the farmers were eager to embrace collaborative partnerships with small stores and described the many communication channels they use with local businesses, underscoring their dedication to being accessible to business owners. Alongside formal approaches like online ordering systems, farmers highlighted the significance of informal channels such as texting, which they found to be both easy and effective for maintaining communication with small businesses:

Oh ... we text. That's all we have. You know, whatever, 50 figs, and ... we have a big yield of whatever, corno di toros, would you like them? Like, Sunday morning, [we] texted him, hey, we got ... 40 pints of figs, would you like them? As simple as that, right? [Farmer #4]

Additionally, the farmers underscored their willingness to participate in efforts to address the distinct needs of small stores and businesses, acknowledging the challenges these establishments face in stocking substantial quantities of products. One farmer mentioned his cooperative relationship with a small business, wherein both parties collaborated on supply coordination. In this arrangement, the business specified the quantity of product needed, and the farmer cultivated it accordingly:

And actually, a lot of it, the ideal situation is the farmer grows on request. That's still my ideal situation. Like [one restaurant] used to, you know, you met in January, says, hey, grow us whatever, 50 corno di toro peppers, grow us 200 tomato plants. ... That would be the ideal situation. You really could grow into a known market. [Farmer #4]

The farmers also recognized that pricing could be a limiting factor for small businesses seeking to purchase local foods, and some expressed a willing-

ness to engage in negotiations to address this concern. One farmer recounted a partnership with a restaurant where he offered unsold produce from direct-to-consumer channels at a discounted price:

And I had to deal with him where, when Saturday I would just text him and say, hey, we got 50 extra bags of lettuce. Normally we would sell our lettuce for [US]\$5 a bag for a half pound. And for him I'd do half price. [Farmer #2]

4. Participating farmers have a commitment to food access and healthy eating

The farmers demonstrated support for the BUD app's overarching goal of enhancing accessibility to healthy foods in small retailers, with their endorsement rooted in shared values for health promotion and community food security. One farmer detailed how his path into farming evolved as he prioritized consuming fresher foods during his personal wellness journey, a passion he later sought to share with others:

I went from kind of eating whatever I wanted to, to eating more whole foods and more natural foods and things like that. ... Yeah, so when I changed my lifestyle, then I started growing. And then when my wife got pregnant, I was all about, like, 'we're gonna have a homestead, we're gonna grow all of our food. ...' Then I realized that we can grow a lot of food here, not just for us, but for the community too. [Farmer #2]

Another farmer spoke about his commitment to food security, saying:

And, you know, food security is something that I'm very passionate about. It's something that we are very passionate about as a family and how access is so, so important. And people, they think of access, they only think of 'well, the food's not there.' Well, it's more than that. It's the food being there. It's the ability of the consumer to get to the food, as well as for them to be able to get it home. [Farmer #1]

Taking these considerations into account, the farmers reiterated their broad endorsement of an intervention seeking to enhance consumer access to fresh produce. One farmer poignantly summarized this sentiment:

I don't care your economic means, I don't care your color, I don't care your gender identity, I just want to feed people. I want to put food in people's hands and eat it. It's all I care about. That's why I do what I do. [Farmer #1]

Barriers to wholesaling at small grocers

1. The COVID-19 pandemic had a disproportionate impact on many small grocers and businesses in Charles County

Multiple farmers highlighted the enduring challenges posed by the COVID-19 pandemic on both the supply chain and consumer demand in Charles County. One farmer recounted the significant setback of losing the majority of his customer base amid the pandemic's disruptions and expressed a persistent sense of risk aversion in future marketing efforts, emphasizing low expectations for future direct sales:

Like when COVID started, 80% of my income was restaurants. Eighty percent! Gone with no warning. And it has never recovered. It has not come back. So, it's just like it used to be every seven years you needed to reinvent, and now it seems to be every couple years, and it's not going to get easier. [Farmer #4]

Furthermore, farmers highlighted the substantial and disproportionate impact of the COVID-19 pandemic on small, family-owned retailers that had previously demonstrated a commitment to local food procurement. According to the farmers, the post-COVID retail landscape is marked by the gradual displacement of these businesses by larger retailers in urban centers. One farmer lamented:

That was a shame because there were stores and families that I've known that these businesses have been in for 150, 200 years, and ended up getting shut down during COVID.

And couldn't bounce back from it. [Farmer #3]

According to this farmer, the disproportionate impact on small businesses may have stemmed from COVID-relief policies that favored larger retailers and overlooked businesses operated entirely by families. Expressing her frustrations with the system in relation to her own business, she noted:

The whole COVID relief thing, if you didn't have, I don't have a payroll here. We're a family. I don't cut anybody a paycheck. Well, if you didn't have that, you couldn't get access to money. So, they never thought about family-owned businesses that just file a Schedule F or a Schedule C because it all gets filed at the end of the year on our taxes. ... They don't really think about family-based businesses and how things are run. [Farmer #3]

2. Participating farmers are unable to compete with the price and convenience of large food distributors

The farmers also emphasized the tendency of food retailers to choose products from large intermediaries that streamline food procurement for business owners by offering products aggregated from multiple producers and manufacturers. They explained that this tendency made it hard for them to sell to retailers directly in the past, and while they recognized their potential to complement this supply chain, they acknowledged the existing loyalties that food retailers may maintain with their current suppliers and expressed concerns about competing with well-established suppliers who have garnered brand loyalty:

And you probably know this, but like a lot of those country stores, I mean they have one supplier. Pretty much. You know, one truck comes and then it's kind of like when you go to a restaurant and say, do you have Coke products or Pepsi products? You have Coke products, then you have all their sodas. ... That's the problem you kind of run into. [Farmer #2]

Although most farmers were willing to augment the products provided by larger intermediaries, they expressed uncertainty about whether these retailers would actively seek additional food sources. One farmer recounted a conversation with a local restaurant owner who consistently ordered from a large distributor:

One of the local restaurants I was dealing with said, 'I only want to make one phone call and get my order. That's all I want to do. ... I want to make one phone call, this is what I need this week, and it gets dropped off.' So ... if they want the convenience of making one phone call, unless you have everything that they want, that one phone call is not going to be used. [Farmer #3]

Farmers also highlighted that large distributors, benefiting from economies of scale, have the capacity to provide lower prices to small food retailers, sometimes at the expense of quality.

With these competing distribution networks in mind, farmers emphasized the price point small stores are willing to pay as one of the primary obstacles to selling to these outlets. One farmer expressed hesitation to compromise on pricing while establishing relationships with new customers:

The average Maryland farmer, southern Maryland farmer, makes [US]\$7,000, you can't pay bills with that. Or you can't make a living. If the average U.S. farmer makes negative [US]\$1,400, why are you gonna squeeze the same guy over and over again? You can't get water out of a rock. It's just ... there's nothing to squeeze there. [Farmer #4]

3. Direct-to-retail sales can be time consuming for both store owners and farmers

The farmers speculated that a key reason food retailers favor the convenience provided by large distributors is the inherently time-consuming nature of the food retail industry. Drawing from a conversation with a food retailer, one farmer suggested that for direct transactions with local farms to gain traction, the intrinsic values linked to

promoting and selling local foods must outweigh the significance attributed to time efficiency by retailers:

They have the buyers out there buying from all the different people and they're condensing it into one place, and then you as a store owner or a restaurateur, you can call up and give your order: 'I need so many pounds of tomatoes, peppers, basil.' You know? ... He made it very clear he wasn't interested because he was like, time is money, I don't have the time to go do that. So that is one barrier I think, because people need to be willing to do it. [Farmer #3]

While acknowledging it as a barrier, the farmers empathized with the time-intensive demands of the food retail sector, drawing parallels to the time-consuming nature of their own profession. Many farmers recounted the early stages of their farming endeavors, highlighting the need for supplementary off-farm income sources, which, in turn, necessitated farming during nontraditional hours. Furthermore, farmers detailed the rigor of their planting schedules, emphasizing the highly systematic upkeep required for successful cultivation:

Everything is successive planting. We don't plant squash once. We plant squash about 15 times. We don't plant greens once. We plant it about 10 times. Peppers, half a dozen times. Eggplant, four times. ... We've got a system, I've got spreadsheets and documents and target dates where I want to be starting this by this day and this by this day so that I can turn the greenhouses over because space is always a concern so that the plants have to keep flowing. [Farmer #1]

Due to the time-intensive nature of farming, one farmer underscored the time-saving advantages associated with large distributors for both farmers and retailers, pointing out that there are inherent limitations to the extent a farmer can participate in direct sales to small retailers:

I can't just—so from my standpoint—I can't justify driving 10 different places to sell 10

boxes. Because your small store is only going to buy one box of this or one box of that. I mean, I know guys that work with restaurants and do all this stuff. You know, it doesn't fit our model. The amount of money we'd have to charge and the expenses with everything in between, because transportation, delivery, fuel, time. ... [Farmer #1]

4. Participating farmers grow products that are niche or seasonal in nature, which may not have a market at small stores where many people shop for staples

Appropriately named, convenience stores earn their title by stocking staple foods for American households. While certain farmers spoke about cultivating these essentials, like greens and potatoes, they also discussed growing produce for specific recipes or cuisines, recognizing that such items might not have a market in conventional convenience stores. Less conventional offerings described by farmers included intensely hot peppers like Carolina Reapers and Sichuan peppers, a variety of herbs such as Thai and Genovese basil, along with Asian persimmons, kiwis, and unique value-added products like kimchi and honey sticks. One farmer spoke of the challenges selling his products through conventional food retail channels:

Like, I do all those experiments, like will I find a market for figs, for saffron peppers, for sesame, for rice, for molasses? Will I find a market for it? But if I do the research, can I do it? At what price? I don't have those answers. So I'm sort of sticking my neck out over and over again. [Farmer #4]

The farmers also underscored the limitation of only providing stores with seasonal produce grown in Southern Maryland's climate. They voiced concerns about being unable to supply small retailers with high-demand items like oranges and bananas, which thrive in more tropical climates. Moreover, they believed that consumers, accustomed to the convenience of year-round availability of produce in large-scale markets, might express disappointment to food retailers if certain products are not

stocked during specific months. One farmer shared a conversation with a consumer at their local farmers market, emphasizing consumers' preference for consistent year-round access to produce facilitated by global trade networks:

And it makes it tough on us because everyone was like, well, why don't you have tomatoes in April? I'm like, well, because they don't grow in April. They just started two weeks ago coming out, you know? [Farmer #2]

Generally, farmers believed that to incorporate seasonal produce into small food retailers, intervention at both the individual consumer level and the retail level is warranted.

It takes more work. It takes more dedication. Yeah, and people going in need to know that they're not going to get asparagus in August. You know, they're not going to get strawberries in August, you know, so it takes a commitment from everybody to want to eat that way and run a business that way. [Farmer #3]

Discussion

This study marks the first exploration of the availability of local produce in small, non-urban food stores in Charles County, Maryland, and provides regional farmers' perspectives on the barriers and facilitators to wholesaling to those stores. We found that direct purchasing from local producers was uncommon among our sample of small food stores, which did not stock a wide variety of produce in general. Farmers in this study speculated that business challenges exacerbated by the COVID-19 pandemic, competition with large wholesalers, inability to locally wholesale out-of-season or non-native produce, and the substantial time investment required for direct-to-retail sales all contributed to the lack of direct purchasing from local producers. Nevertheless, farmers demonstrated a dedication to supplying fresh food to their community, a readiness to engage personally with suppliers, and had established relationships within a network of small businesses in Charles County, all factors that could enhance the feasibility of direct-to-retail sales to small food

retailers.

USDA data suggest that a recent surge in direct sales in the U.S. is due to increased direct sales to stores and intermediaries. However, a review of these data show that this trend does not apply to small, low-income farms, which rely more on direct-to-consumer sales (USDA Economic Research Service [USDA ERS], 2022). This could position small food retailers, such as convenience stores, as a better direct-to-retail market for these farms. When discussing the direct-to-retail sales environment in Charles County, farmers foresaw several challenges related to this approach. One of the most cited barriers affecting farmers' ability to sell directly to small food stores was pricing, and farmers speculated that most small stores source their inventory from large distributors who do not prioritize local produce, both out of convenience and aiming to minimize costs. They also expressed concerns that stores may not be able to afford a premium to cover the inputs required for producing higher-quality produce, compared to what is cultivated for large intermediary channels. Additionally, one farmer expressed concern about the financial feasibility of diverting time away from the farm to deliver relatively small quantities of produce to retailers. Prior literature confirms that large distributors are less inclined to sell local produce due to their focus on lower price points (Clark & Inwood, 2016), and that price significantly influences decisions regarding the procurement of local, organic produce in U.S. retailers (Oberholtzer et al., 2014) and fresh foods in small convenience stores (Caspi et al., 2016). However, we observed that small food stores also source their produce from supermarkets, where produce prices have been steadily increasing (USDA ERS, 2024) and are either comparable to local produce sold directly to consumers or more expensive (McGuirt et al., 2011).

Another frequently mentioned barrier to selling directly to small food stores was seasonality. Since the 1990s, the United States market has witnessed rapid growth in fresh fruit imports, which help offset seasonal shortages in domestic fruit production, granting consumers year-round access to produce while stabilizing prices (Huang, 2013). Farmers observed that, because consumers

have grown accustomed to this accessibility, they may express dissatisfaction with the produce available from retailers who source directly from them. In a 2017 survey, 78% of respondents identified seasonality as a hurdle to participating in direct-to-retail sales (Hughes et al., 2022), echoing the concerns voiced by farmers in our study who suggested that consumer education is needed to address this hurdle. This finding highlights a gap in the current development of the BUD app, which has no consumer-facing features such as education modules. This challenge presents an opportunity for stores to offer consumer education during the BUD trial regarding the advantages of seasonal eating, including sustainability (Vargas et al., 2021) and nutrient retention in produce (Wunderlich et al., 2008). Additionally, several interventions in small food stores have successfully employed taste tests as a strategy for promoting produce purchases (Curran et al., 2005; Gittelsohn, 2010). This method could be adapted using local, seasonal foods.

While many of the barriers cited by farmers were driven by market forces outside of their control, the primary facilitators of engaging in direct-to-retail sales stemmed from the individual-level characteristics of the farmers we spoke with. These characteristics include a commitment to making healthy food available in the community and a willingness to work personally with buyers. Although most farmers discussed price as a barrier, one farmer mentioned that one of the ways he had worked personally with retailers in the past was by providing a discount for produce that remained unsold through the direct-to-consumer market. This approach mirrors findings by Dunning (2016), who investigated direct-to-retail buyer/supplier dynamics in North Carolina and observed a conditional relationship between producers and buyers. In this dynamic, producers contacted retail stores with excess products and sold them for approximately half the price they would receive in a direct-to-consumer market. This finding could potentially steer the use of the BUD app in a compelling new direction, serving as a platform for local farmers to sell surplus produce to retailers at reduced prices, thus alleviating the price barrier for retailers. While farmers may earn less from this surplus produce,

they would still generate revenue, offering a preferable alternative to wasting or donating surplus (Ceryes et al., 2023).

Lastly, our findings revealed that less than half of the surveyed stores were authorized WIC or SNAP vendors. This is noteworthy given the critical role of independent grocers in mitigating barriers to adequate SNAP benefits (USDA FNS, 2021). To become SNAP authorized, retailers must offer a range of foods across four staple categories: (1) vegetables and fruits, (2) dairy products, (3) meat, poultry, or fish, and (4) breads or cereals, with at least one perishable item in two of these categories (USDA FNS, 2023). Similarly, WIC authorization requires retailers to stock specific food items that meet nutritional guidelines to support the health of low-income women, infants, and children (USDA FNS, 2022). Enhancing direct-to-retail marketing channels through interventions like the BUD trial could enable small stores to meet these criteria more effectively, and address the critical need for SNAP and WIC retailers in non-urban areas. Investigating the impact of the BUD app on facilitating WIC and SNAP authorization thus emerges as a promising direction for future research. Such research should examine not only how direct sourcing from farmers impacts stores' ability to meet SNAP and WIC authorization criteria, but also the economic impact on farmers as more independent retailers become SNAP- and WIC-authorized.

This study has several limitations. First, our sample of both stores and farmers was small due to the geographical limitation to Charles County and our inclusion criteria requiring farmers to market at least some of their produce through a direct-to-retail sales channel. However, of the 371 farms operating in Charles County in 2022, only 7% (26 farms) participated in direct sales (USDA NASS, 2022). Thus, our small sample size accurately reflects the marketing practices in Charles County and was appropriate for informing the BUD trial rather than answering a specific research question. Despite the limited sample size, the study successfully provided an understanding of direct-to-retail sales in Charles County, and offered insights for future directions in direct marketing through a mobile application. To gain a broader understand-

ing of direct-to-retail sales to small food stores throughout the United States, additional research is needed to gather insights of additional stakeholders, including store owners. Lastly, it is worth noting that all interviews, coding, and analyses were performed by a single researcher with an agrarian background, raised in a farming community with a strong emphasis on local marketing channels. While involving additional coders could have provided differing perspectives, resource constraints prohibited this approach. To enhance qualitative rigor, the researcher practiced bracketing and reflected on their positionality throughout the analysis and interpretation of data.

Conclusions

In many non-urban areas where supermarkets are scarce, small food stores are important sources of food for local consumers (Sharkey, 2009). However, these stores often struggle to offer fresh, healthy options due to distribution challenges, despite having the potential to source directly from local farmers. While direct sales between small stores and small farms are uncommon, direct-to-retail sales hold significant economic promise and have been increasingly adopted by larger farms (USDA ERS, 2022). In our formative research, which sought to understand this dynamic in preparation for an upcoming intervention, we observed

that the small stores in our sample rarely stocked local produce. Farmers cited several barriers to wholesaling to these stores, including challenges posed by the COVID-19 pandemic, limited consumer acceptance of seasonal produce, and competition from larger distributors. Nevertheless, some stores reported prior experience with direct-to-retail sales and acknowledged the potential of this marketing channel to expand fresh food access for county residents. They also highlighted the strong demand for local food in Charles County, suggesting a viable market for it in small stores. This research has deepened our understanding of both sides of the food supply chain and will guide our forthcoming digital intervention aimed at enhancing the efficiency and equity of food distribution.



Acknowledgments

The authors extend their appreciation to the farmers who graciously spared time from their busy summer harvesting schedules for interviews, as well as the small store owners who completed surveys and allowed observations in their stores. Gratitude is also extended to the researchers who provided mentorship to the lead author during the drafting of this manuscript, including Drs. Mika Matzusuki, Samantha M. Sundermeir, and Jill Clark.

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Appendix A.

Baltimore Urban food Distribution Store Impact Questionnaire (Baseline)

Section A: About Your Store

Store Classification

1. Respondent Ethnicity: _____
2. How many years have you been operating this store? _____
3. How many years have you been operating food stores in general?

4. Do you currently operate any other food stores or operations? Yes ☐ No ☐
 - a. If YES, how many other food stores? _____
5. Normal days and hours of current store:

6. What days/times **you** are usually at the store:

7. What days/times is the store **busiest**?

8. What days/times is the store **slowest**?

9. What is your store called by community members (in addition to official store name):

10. Number of cash registers: _____
11. Number of aisles: _____
12. Estimated number of customers in the last: Day _____ Week _____
13. Number of “regular customers” (i.e., regularly shop in the store at least 1+ times per week, usually more)

14. Off the top of your head, what are the top 5 foods that you sold in the last 7 days? (probe: specify – if frozen meat, what kind?)
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____

SECTION B: Storeowner Psychosocial Factors

Stocking and Sales of Promoted Foods

I am now going to ask you about stocking and sales of certain foods in your store. For each of the foods listed below, please (1) Tell me if the sales of each food increased, decreased or did not change, (2) Estimate of the number of units (i.e. cans, boxes, packages) sold in the store **in the last 7 days**, from (date) to (today's date), (3) Give the current price of that unit, (4) List places you get that particular item, and (5) List who delivers that particular item. We just need your best guess.

Food	Standard Unit	Price of Unit	In the past 30 days, have sales: 1) Increased 2) Decreased 3) Not changed	How was the unit purchased? 1) online 2) bought at wholesaler/ supermarket 3) delivered	Where was the unit purchased?	Who delivered the unit?	Number of units sold in the past 7 days.
Stage 1: Low-sugar beverages							
Flavored water	1 bottle/can						
Bottled water	1 bottle						
Stage 2: Fruits and vegetables							
Collard greens	1 piece						
Kale	1 piece						
Mustard greens	1 piece						
Green beans	1 can/pack						
Apples	1 piece						
Bananas	1 piece						
Limes	1 piece						
Oranges	1 piece						
Potatoes	1 piece/bag						
Onions	1 piece						
Peppers	1 piece/bag						
Stage 3: Low-fat whole grain							
High-fiber bread	1 pack						
Brown rice	1 box/pack						
Oatmeal	1 box						
Whole-grain pasta	1 box						
High-fiber cereal	1 box						
Other							
Low-fat milk	1 container (pint, gallon)						

Outcome Expectations: Promoted Food Sales

I am now going to read you a series of statements about how well you think certain foods would sell in your store. For example, "BAKED CHIPS WILL SELL WELL IN MY STORE." Please keep in mind that your answers will not hurt my feelings; I want to know what you *really* think will happen. Please indicate how strongly you agree or disagree with each statement by choosing one of the following responses: strongly disagree, disagree, undecided, agree or strongly agree.

Food (— will sell in my store)	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Flavored water					
Bottled water					
Collard greens					
Kale					
Mustard greens					
Green beans					
Apples					
Bananas					
Limes					
Oranges					
Potatoes					
Onions					
Peppers					
High-fiber bread					
Brown rice					
Oatmeal					
Whole-grain pasta					
High-fiber cereal					
Low-fat milk					

Self-efficacy for stocking of foods

The next set of questions asks you how sure you are that you can stock a particular food in your store. By this, I mean how sure are you that you can order food from vendors, make time to go buy the food and stock it, order the food and put it on the shelves (and make space for it). Please indicate how strongly you agree or disagree with each statement by choosing one of the following responses: strongly disagree, disagree, undecided, agree or strongly agree. [For example, "I CAN STOCK frozen vegetables IN MY STORE.]"

Food (— I can stock)	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

Flavored water					
Bottled water					
Collard greens					
Kale					
Mustard greens					
Green beans					
Apples					
Bananas					
Limes					
Oranges					
Potatoes					
Onions					
Peppers					
High-fiber bread					
Brown rice					
Oatmeal					
Whole-grain pasta					
High-fiber cereal					
Low-fat milk					

Outcome Expectations: Impact of BUD

I am now going to read you statements about what you feel will be the effect of the BUD App on overall and promoted food sales. Your answers will not hurt my feelings; I want to know what you really think will happen. Please choose: strongly disagree, disagree, undecided, agree or strongly agree.

Outcome Expectations	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Not Applicable
Group purchasing with other corner stores will increase overall sales of promoted food.						
If the prices of promoted foods are reduced, overall food sales will increase.						
If shelf labels, and handouts are distributed for promoted foods/beverages, overall food/beverage sales will increase.						
If I stock BUD promoted food items, my customer base will increase.						
Using the chat feature to coordinate group purchasing with other corner stores will reduce the cost of promoted food.						
The BUD program will give me a competitive advantage over other small food stores in the surrounding area.						

Additional Comments:

Smart Phone/WiFi Access**A) Smart Phone**

Do you have your own smart phone? Yes ☐ No ☐

Do you have an unlimited data plan on your phone? Yes ☐ No ☐

B) WiFi Access

Do you have a device for accessing WiFi other than a smart phone (iPad, tablet, laptop, etc.)? Yes ☐ No ☐

Do you have unlimited WiFi access in the store? Yes ☐ No ☐

Payment Methods (yes/no box)

Do you accept any of the following payment methods?

PayPal Yes ☐ No ☐

Venmo Yes ☐ No ☐

Cash App Yes ☐ No ☐

Zelle Yes ☐ No ☐

Facebook Pay Yes ☐ No ☐

WIC Yes ☐ No ☐

SNAP Yes ☐ No ☐

Other Yes ☐ No ☐

Time Interview Ended: ____:____ AM/PM

"Thank you, we are VERY grateful for your help!"

Equitable food value chains through collaborative action [in an inequitable landscape]: Insights from Buffalo, New York

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Submitted April 19, 2024 / Revised August 14 and October 24, 2024 / Accepted October 29, 2024 /
Published online January 21, 2025

Citation: Lipman, M. F., Griffin, D., Woyciesjes, E., Hall, G., & Raja, S. (2025). Equitable food value chains through collaborative action [in an inequitable landscape]: Insights from Buffalo, New York. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 207–226.
<https://doi.org/10.5304/jafscd.2025.141.019>

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Abstract

There is growing scholarly and practitioner interest in applying collective and place-based efforts to create equitable food systems. Drawing on community coalition action theory (CCAT), this paper explores the potential for enhancing food equity

through collaborative action across the food value chain. Through a case study of a collaborative initiative to promote equitable food systems, this paper documents the possibilities and pitfalls of collaborative, cohort-based efforts within the inequitable landscape of Buffalo, New York (NY). The paper relies on mixed-methods data that include key informant interviews, participant observations, and surveys of organizations that participated in the

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Funding and Other Disclosures

Financial support for this work includes funding from the United Way of Buffalo and Erie County and University at Buffalo Food Systems Planning and Healthy Communities Lab. The University at Buffalo Food Systems Planning and Healthy Communities Lab is a community research lab, and as such, has prior and ongoing relationships with some of the grantees of the BCFSG program.

Buffalo Community Food System Grant program. Corroborating prior research, we find that initiatives that seek to foster collective action offer unique possibilities for food equity, as well as some key limitations, especially within the context of a racialized food environment. Strengthening food systems by investing in relationships across food value chains opens new avenues for collective action. To promote food equity, new forms of collective action, including functional relationships across the value chain, must address deeper structural imbalances in the food system, such as those resulting from structural racism.

Keywords

Buffalo, New York, cohort-based, collaborative funding, collective action, collective impact theory, community coalition action theory, food equity, food systems, place-based, racial equity

Introduction

Philanthropic initiatives are increasingly promoting collaborations among community organizations working together—collective action—to ostensibly promote food equity. However, the degree to which collective actions succeed in achieving food equity remains uncertain. Part of the challenge may be that many philanthropic programs represent efforts to address hunger or food insecurity, not food inequity. Food insecurity—the chronic deprivation of affordable, nutritious, accessible, and culturally preferred foods—is one narrow manifestation of food inequity (Weiler et al., 2015). In the U.S., 17.0 million households reported being food insecure at some point during 2022, an increase from 13.7 million households in 2019 (Coleman-Jensen et al., 2020; Rabbitt et al., 2023). Across the U.S., Black and Hispanic households experience food insecurity rates 9.6 and 8.0 percentage points higher than the national average, respectively (Rabbitt et al., 2023).¹ Food insecurity varies by place: 15.3% of those living in principal U.S. cities reported experiencing food insecurity, compared to 10.5% in suburban areas in 2022 (Rabbitt et al., 2023). COVID-19 heightened such food disparities

across urbanicity levels (Mui et al., 2022). People experience food insecurity for a variety of reasons, ranging from, but not limited to, lack of financial resources, physical location in poor food environments, household circumstances, health status, and employment status. The disproportionate burden of food insecurity is one indication of food inequity.

In comparison to food security, which is an absolute measure of food access, food equity is an expansive and relational aspiration for procedural and distributive justice in the food system. Food inequity results from structural challenges in food-related systems and develops if food is unaffordable, unavailable, inaccessible, not culturally preferred, not evenly distributed, and/or not controlled by the community (Anderson, 2016; Poulsen, 2017; Raja, 2024). Food inequity remains a critical concern in many U.S. cities, where food resources are often inequitably distributed (Cook et al., 2004; Gundersen & Ziliak, 2015; Joyner et al., 2022; Judelsohn et al., 2021; Lee et al., 2012; Mui et al., 2021; Northridge & Freeman, 2011; Olson, 1999; Raja et al., 2024b).

People can be food secure and still experience food inequity (Juskaite & Haug, 2023). For example, a small-scale urban grower may be able to grow food to eat but may make limited profits due to high expenses (e.g., gentrifying land prices), and thus may be unable to meet other life expenses (e.g., healthcare). The farmer may also be excluded from public-policy decisions that impact their farming business (Raja et al., 2024a). Thus, while food secure, the farmer may not experience food equity. Food equity necessitates fairness in both the relative allocation of resources and the processes that shape the food system (Allen, 2010; Raja, n.d.; 2020; Raja et al., 2017b; 2018a; 2021; 2024b).

Measuring food equity is challenging—and assessing how collective action impacts food equity adds complexity (Mui et al., 2021). Measuring progress toward food equity requires measurement of factors that influence demand for food, such as relative poverty levels, as well as those that influence supply, such as the relative

¹ A principal city is a U.S. census designation for the largest incorporated area in a Metropolitan Statistical Area (MSA) which meets certain population and employment-based criteria (U.S. Census Bureau, 2023).

availability of grocery stores. The attention to relative levels and/or disparities that drive both demand and supply of food distinguishes measures of food equity from absolute measures, such as food security. Measuring food equity also requires documenting who has control over decision-making in the food system (Raja et al., 2017a; 2024a) and how people's intersectional identities (Crenshaw, 1989) relate to their power and agency (Raja et al., 2017a). To attain food equity, communities must address structural and systemic factors such as who earns wealth and who controls decision-making (Raja et al., 2014). Food equity requires honoring people as active agents in articulating their "food aspirations" and in designing strategies to achieve those aspirations (Raja et al., 2017a; 2021).

A growing body of philanthropy is focused on collective action. Commensurately, a growing, if small, body of literature explores and critiques the successes, challenges and impacts of collective action in improving food equity and strengthening food systems (for example, Hoey et al., 2017; Raja et al., 2008). However, existing literature offers limited insight on the possibilities and limits of collective action when undertaken by place-based coalitions of community organizations representing varied food system domains. The challenges of collective action within segregated and racialized landscapes also remain underexplored. In this paper we ask specifically how food equity might be promoted or restricted using a collaborative, intersectoral, cohort-based approach in a city with pronounced structural and racial disparities. Applying the community coalition action theory (CCAT) (Butterfoss & Kegler, 2009) to a rustbelt context, this paper contributes to the existing literature through a mixed-methods case study of the Buffalo Community Food System Grant (BCFSG) program, launched in 2017. In the subsequent sections, we describe the inequitable context of Buffalo, followed by a brief literature review of collective efforts in food systems transformation. Then, we provide a description of the research design and methods that inform this paper, as well as the findings. The paper concludes with ideas for future efforts to foster collective, equitable, and systemic food system change.

Context as Foreground

Buffalo, NY, the study area of this paper, has the potential for a robust and equitable food system. There is abundant water, fertile agricultural soils in the surrounding region, and about 8,000 vacant lots (a legacy of its post-industrial history), all of which present opportunities for food production (City of Buffalo, 2020; Metcalf & Widener, 2011; Raja et al., 2014; Raja & Chunyuan, 2016). The city is home to diverse residents, coalitions, and social movements that are engaged in food system change, including New Americans—many of whom bring agrarian expertise to their new homes (Gilbert & Williams, 2020; Judelsohn et al., 2017). Nevertheless, despite the city's many assets and strong social movements, the Buffalo food system faces challenges.

This post-industrial city is home to 276,486 people, less than half of its peak population in 1950 (U.S. Census Bureau, 2022; U.S. Department of Commerce, 1951). The 2022 median household income in Buffalo is US\$46,184, with 27.2% of the population living below the poverty line (U.S. Census Bureau, 2022). Nearly 30% of households in Buffalo rely on Supplemental Nutrition Assistance Program (SNAP) benefits, far exceeding statewide (14.6%) and national (11.5%) rates (U.S. Census Bureau, 2022). Limited economic resources hinder the ability of some to grow, procure, prepare, and eat nutritious foods (Judelsohn et al., 2017; Raj et al., 2017; 2008). A significant majority of neighborhoods in Buffalo are without a supermarket or grocery store, making it difficult for people without transportation to procure good food (Delgado et al., 2013; Raj et al., 2017; 2008; 2014). Certain groups in Buffalo are especially disadvantaged: of all households receiving SNAP in Buffalo, 41.0% have a child under the age of 18, 45.1% are Black or African American, and 48.5% include a disabled household member (U.S. Census Bureau, 2022). Buffalo is also one of the most segregated cities of its size, and decades of economic extraction negatively impact Buffalo's communities of color (Blatto, 2018; Taylor et al., 2021). Redlining by supermarkets is especially evident in neighborhoods of color. Ruptures in the food system and food equity were made glaringly clear during COVID-19 (Raja, 2020), and more recently in the

face of the May 14, 2022, massacre in one of the only supermarkets in a predominantly Black neighborhood in Buffalo (The Food Equity Scholars, U.B. Food Lab, 2022). Persistent racial segregation, economic inequities, and gentrification impact Black and brown people and their neighborhoods and constrain food equity (Coley & Adelman, 2021).

Food-related philanthropic initiatives shape and are shaped by this complex historical context. Within Buffalo, several philanthropic food initiatives have emerged locally, and others have roots from outside the city (Raja & Whittaker, 2018b). Some are led by a single organization, while others follow a mutual aid model. Some address symptoms of food inequities (e.g., distributing reduced price fresh fruits and vegetables to low-income consumers), while others attempt to address structural drivers of food inequities (e.g., establishing a neighborhood-led vacant land disposition policy to increase access to land for community gardens in communities of color). Philanthropic efforts increased after the onset of COVID-19, and then accelerated after the tragic events of May 14, 2022, when a white supremacist shot dead 10 people in one of Buffalo's few supermarkets in a Black neighborhood (The Food Equity Scholars, U.B. Food Lab, 2022). Despite the growth of philanthropic food system initiatives in Buffalo, there is a limited body of existing scholarship that teases apart the varied motivations and consequences of such work.

Collaborative and Collective Approaches toward Food Equity: A Review of the Literature

Food equity is an aspiration where people of varied incomes, identities, positionalities, resources, and power have the means and opportunities to control and leverage their desired outcomes and processes within the food system (Klassen & Murphy, 2020; Mui et al., 2021; Raja et al., 2017a; 2018a; 2021). To promote food equity, it is imperative to look upstream at the larger food system (Raja et al., 2014; 2017a). Advancing food equity requires amplifying marginalized communities' agency, control, and capabilities to use, develop, and control resources in the food system—including land and

capital—for their own well-being (Raja et al., 2017a). Equally important, food equity demands that processes shaping the food value chain—including public, private, and philanthropic investments and policies—be equitable. Recently, Cabral and Devereux (2022) present food equity as a pluralistic concept, but curiously omit references to pre-existing scholarship on food equity (Clark et al., 2017; Raja et al., 2018a; 2021).

Robust scholarship on food governance provides guidance on factors that matter for equitable food systems transformation. Some suggest that increases in food equity can be measured by increases in food access, good local jobs in the food system, community control of the food system, and diversification of decision-makers in the food system (Alkon & Mares, 2012; Allen, 2008; Allen, 2010; Anderson, 2016; Dhokarh et al., 2011; Friel & Ford, 2015; Guthman, 2011; Hinrichs & Kremer, 2002; Hinrichs & Allen, 2008; Judelsohn et al., 2021; Poulsen, 2017). Relational infrastructure is key to advancing equity in the food system (Irish et al., 2024). Food equity can also be promoted by fostering good, place-based jobs in the food system so that economic gains are retained within communities and food sector workers can earn fair wages (Allen, 2010; Dhokarh et al., 2011; Friel & Ford, 2015; Hinrichs & Allen, 2008; Judelsohn et al., 2021). Mui et al. (2021) use six criteria to evaluate food equity (as addressed in regional plans): nutritional adequacy of food, affordability of food for all people, availability of culturally preferred foods for all, social equity in the food system, spatial equity in the food system, and enhanced agency of people in the food system. These elements are more focused on eaters' experiences of the food system (as opposed to the experiences of farmers, processors, etc.).

Food inequity is a “wicked problem”—a difficult to define, dynamic, interconnected, and difficult to solve challenge—that necessitates collaborative solutions (Grochowska, 2014; Rittel & Webber, 1973). Fortunately, multiple theoretical frameworks—including some from outside the food systems domain—explain why collaborative initiatives emerge, operate, flounder, and/or succeed. For example, Butterfoss and Kegler (2012) theorize how community coalitions succeed in

making change through CCAT. The CCAT framework proposes that mutually reinforcing activities and ongoing communication between partners are critical to the success of collaborative efforts. CCAT asserts that coalescing around shared values, measurements, and goals builds trust between partners, which strengthens relationships and leads to deeper collaboration (Flood et al., 2015). CCAT scholars suggest that a backbone organization, as well as sufficient funding, are needed to facilitate the survival of the coalition (Butterfoss & Kegler, 2012; Kegler et al., 2019). Importantly, the successful application of CCAT necessitates involvement of those directly impacted, making it remarkably useful for exploring efforts to promote food equity. In recent years, scholars empirically illustrate that elements of CCAT hold true in the context of health-related coalitions (Kegler & Swan, 2011).

Other, more narrow frames for understanding collective effort also exist. For example, Kania and Kramer (2011) propose the collective impact (CI) model to guide successful collaboration. More reductive than the CCAT framework, the CI framework advocates five principles for effective collaboration: “a common agenda, shared measurement, mutually reinforcing activities, continuous communication, and [the presence of a] backbone organization” (Flood et al., 2015, p. 655). CI emphasizes “creating an approach instead of adopting an existing approach to a problem” (Flood et al., 2015, p. 657). Within CI, collaborating organizations set the scope and boundary of joint goals, engage in issue clarification, and develop a strategic action framework (Hanleybrown et al., 2012).

Scholars widely criticize the CI framework for its lack of emphasis on policy engagement, top-down goal setting, lack of community input mechanisms, and overburdening of the nonprofit sector (Ennis & Tofa, 2020; Hoey et al., 2017; Kegler et al., 2019; McAfee et al., 2015; Wolff, 2016; Wolff et al., 2016). Hoey et al. (2017) report that the lack of a policy focus was a key challenge to using CI frameworks to create equitable food system change. CI initiatives shift the burden of providing public services to the overworked (and nondemocratic) nonprofit sector, even when public-sector intervention is more appropriate (Macias, 2008;

Poppendieck, 1999; Pothukuchi & Kaufman, 1999; Ray et al., 2012). There are currently no community input mechanisms embedded explicitly in the tenets of CI. Scholars note that the success of CI frameworks may be limited unless organizations supplement CI with explicit community engagement (Hoey et al., 2017; McAfee et al., 2015; Wolff et al., 2016). The CI framework, as originally proposed, failed to consider questions of equity (for example, racial inequities), an oversight that the founders recently attempted to address by calling for attention to equity across CI principles (Kegler et al., 2019). Despite these challenges, philanthropies adopt the CI model widely (with little recognition of more nuanced, pre-existing theoretical frameworks such as CCAT). In contrast, CCAT theory, which predates the CI framework, helps explain how collective capacity is augmented by setting goals jointly with community groups and focusing on policy change (Butterfoss & Kegler, 2012; Flood et al., 2015).

We draw on these disparate literatures and on advice from community partners on how they describe equity in the food system to guide our research design, which includes a mixed-methods exploration of collective initiatives in the BCFSG program. Ultimately, we distill, translate and expand the CCAT theory into the food system domain by framing collective action toward food equity as that which (a) strengthens a community value chain; (b) builds equitable relational infrastructure; (c) increases the availability and affordability of nutritious and culturally preferred foods; (d) fosters structural change through job creation, entrepreneurship, and job training; (e) bolsters the local food system; (f) addresses structural racial disparities in the food system; and (g) catalyzes policy changes.

Long-term, systemic solutions to promote food equity necessitate collaboration (Ray et al., 2012). Although philanthropic initiatives recognize the importance of such collaboration, as evidenced by recent funding initiatives, the procedural and distributive outcomes of such programs remain understudied. The degree to which collective action leads to more equitable and stronger value chain networks in a community's food system is not well documented. This paper explores the possibilities

for equity-focused, collaborative, and cohort-based partnerships to address food equity across the value chain using a case study of Buffalo, NY.

Research Design and Methods of Data Collection and Analysis

We use a mixed-methods case study of Buffalo to examine the degree to which a funded cohort of food organizations can collectively advance food equity (Creswell & Creswell, 2017). Using an exploratory sequential research design, we began the case study with qualitative interviews of grantee representatives at baseline in 2018, followed by a quantitative survey of grantee representatives, and a spatial analysis of the food landscape in Buffalo relative to the grantees' work to gauge the spatial reach of the BCFSG program (Creswell & Creswell, 2017). We then conducted follow-up interviews with grantee representatives in 2020 to better understand the impact of the program, including its challenges. Authors were also participant observers, attending events and meetings convened by the BCFSG. The Buffalo case study was approved by the authors' institutional review board (IRB).

Qualitative Data

Two forms of qualitative data are used in this case study: participant observations and interviews with organizational representatives. Two of the five authors participated in and observed meetings and workshops organized for the cohort by the funder of the BCFSG program—United Way of Buffalo and Erie County (UWBEC)—from 2017 onwards. The lead author and one additional author also visited sites while organizations were delivering programming and observed most grantees following the completion of the BCFSG program in 2020. Participant observations provided a grounded view of the planning and execution of the BCFSG program (Creswell & Creswell, 2017).

Additionally, pre- and post-interviews with representatives of grantee organizations were used to gauge the outcomes, successes and challenges of the initiative (Creswell & Creswell, 2017). Preprogram interviews ($n = 20$) conducted at baseline (summer of 2018) focused on documenting organizational capacity, networks, the readiness of

grantee organizations to execute programming to enhance food equity, the goals for the grant program, and anticipated barriers and challenges. Follow-up interviews ($n = 10$) conducted in the fall and spring of 2020 gauged shifts in organizational readiness, the extent to which goals of the program were achieved, any challenges encountered, and the nature and impact of collaborations with other organizations in the grantee cohort. At follow-up, three organizations were nonresponsive, and ultimately, COVID-19 made it extremely difficult for some organizational representatives to participate in follow-up interviews because many organizations were involved in emergency response. Each interview took approximately 1.5 hours to complete. Baseline interviews were completed in person, while follow-up interviews were completed virtually due to COVID-19. Interviews were deidentified, transcribed, and coded for a priori themes developed from the literature. More than 100 open-ended codes such as food equity, collaborative work, program successes, and program challenges were used. Emergent themes were recorded as the coding process progressed to capture new themes present in the data (e.g., a focus on community development by organizations emerged as a theme). All interviews were coded by two individuals to ensure consistency and quality control. Any difference in coding was discussed and resolved.

Survey of Representatives of Grantee Organizations

We administered a survey at the end of the program to record grantee outputs and outcomes. Results from the qualitative interviews and participant observation at the beginning of the project informed the survey design. Because the cohort's work spanned multiple food system sectors—food production, food wholesale and retail, food service, and food policy—the authors included supplemental survey questions tailored to each organization pertaining to the food system sector they were working in. The survey instrument included questions about the number and types of people served, jobs created, and income generated by grantee organizations during the BCFSG program. Specifically, the survey asked organizations and

fundors to identify what they might value as positive outcomes of the program. Survey responses were self-reported by a designee of each grantee organization. Representatives of all 13 organizations opened the survey tool. In May 2019, to verify full and accurate responses, authors emailed the grantee representatives to confirm survey responses. Some respondents provided clarifications, adjustments, and missing data during this verification process. Still, not all questions were answered by all 13 organizations.

Spatial Data

The spatial reach of the cohort's work in Buffalo's food environment was analyzed using ArcGIS analysis. Locational (point) data showing grantees' spatial reach was geocoded to illustrate their impact on inequitable food environments. Locational data of organizations' work was obtained from the 13 organizations as well as secondary sources including City of Buffalo OpenData. All maps used the Erie County Census Tract TIGER/Line files and were joined with ACS housing and demographic estimates. All point data were geocoded using address locator and Google Maps KML files. All point- and polygon-based calculations were performed using spatial join, SQL query, and field calculator operations. The spatial reach of grantees was compared to pre-existing food disparity and opportunity maps of the city available through the University at Buffalo Food Systems Planning and Healthy Communities Lab.

Positionality

A note about authors' positionality is warranted. The five authors began work on this paper as members and affiliates of the University at Buffalo Food Systems Planning and Healthy Communities Lab, a university-based research group in the City of Buffalo, NY, which has worked on community-engaged research in Buffalo for more than 20 years. The research group and one author have observed and provided technical assistance during the formation of community-led food projects in Buffalo since 2002, including through a longstanding (over 20 year) action-research community-university project. Due to our research group's collaborative work in Buffalo, the authors previ-

ously studied some of the 13 community food organizations in the BCFSG cohort (Raja & Chunyuan, 2016; Raj et al., 2017; Raja et al., 2017b; 2024b; Raja & Whittaker, 2018b). The authors also bring diverse lived experience to this work. Two of the authors were born in Buffalo and another has family roots in Buffalo, while others have chosen to make the city home. We also have varied identities and experiences (authors include two Black women, a brown woman [immigrant], a white woman [disabled], and a white man). The authors' trajectory of research as well as their deep familiarity and lived experience in the context of Buffalo—evidenced in our groups' collective publications—helped filter the data from participant observations and interviews collected for this article.

Because the research group previously published a food system assessment of the city and region, one author was approached by UWBECE program staff prior to the launch of the BCFSG program to learn about existing food system initiatives in Buffalo. Subsequently, this author shared pre-existing reports and maps with the UWBECE team to help tailor their program to Buffalo's context. For example, the authors provided the UWBECE team with a food system assessment of the city and spatial analysis authored by the university-based research group to inform UWBECE's decisions about what geographic areas would benefit the most from equitable investment. Ultimately, our research group was contracted by UWBECE to serve as local Buffalo-based evaluators of the BCFSG program. Authors of this paper were not involved in selecting grantee organizations to participate in the BCFSG program. Neither UWBECE staff nor national funder General Mills were involved in the data collection, analysis, or development of this manuscript.

Findings: Empirical Case Study of the Buffalo Community Food Systems Grant Program

The BCFSG program is part of a larger national program funded by the General Mills Foundation to seed systemic food systems transformation. Funded cities included Buffalo, New York; Minneapolis, Minnesota; and Mississauga, Canada. The program encouraged local initiatives to tailor their

programs while learning from other funded peer cities. In Buffalo, UWBEC received a US\$1 million grant from the General Mills Foundation to lead and implement the BCFSG. UWBEC, in turn, developed a grant program to fund organizations engaged in food work in the City of Buffalo.

UWBEC staff rooted the BCFSG in the local context. Key UWBEC staff began the process of developing the BCFSG program by meeting with local, long-time food system actors, advocates, and researchers to learn about work already underway. Prior to the launch of the BCFSG program, UWBEC staff attended the People's Food Policy Summit, organized by a community coalition of food organizations, to learn about the aspirations of Buffalo community leaders. In other words, context was not only background material condition but foregrounded the design of the program. UWBEC staff reviewed prior food-related plans in Buffalo, attended community-led food workshops, and held multiple conversations with food leaders before the design and start of the BCFSG program.

After this preemptory grounding, UWBEC launched the request for proposal (RFP) process for the grant program. In their RFP responses, applicants proposed projects aligned with UWBEC's and General Mills' aims and motivations. Some organizations worked together prior to this grant and submitted proposals for intertwined projects; other organizations proposed more narrow plans. Working with a national jury, UWBEC selected 13 applicants to receive project funding over a 2-year period.² In acceptance decisions, those working in empirically identified food opportunity areas informed by authors' spatial analysis were prioritized. UWBEC staff aimed to select a diverse portfolio of awardee organizations. Grantees varied by size, scale, focus of work, and maturity. Grantees received funding and nonmonetary support, including capacity-building and training opportunities, to support the execution of their projects.

The goals of the BCFSG at funding outset were to (1) foster ongoing collaboration within the food security network in the community; (2) improve access to healthy foods such as healthier

options in neighborhood stores, new healthy food retail, and/or new healthy delivery options; (3) create food-related job opportunities, for example, through culinary or other food-related instruction leading to job readiness or job placement; (4) promote food entrepreneurship such as business incubators or community kitchens; (5) strengthen food skills such as growing, preparing and preserving healthy foods; and (6) establish food policy that supports the above efforts or similar initiatives. The goals of the BCFSG program were structured to go beyond simply alleviating hunger or food insecurity, and toward mitigating the structural drivers of food system inequity. Of the six goals, four addressed structural drivers of food inequity, including employment and income (goals 3 and 4), policy change (goal 6), and relational infrastructure (goal 1). Goals 2 and 5 did not address food inequity but addressed food access goals common to many efforts tackling food insecurity. Importantly, the premise of the BCFSG program was to converge a cohort of food systems organizations that spanned the food value chain as well as the private, public and quasipublic sectors. The BCFSG program aimed to facilitate network building and systemic transformation across the value chain through funding the collective work of the cohort.

At the program's outset, the existence of a fully shared agenda among grantees was vague. During preprogram interviews, all interviewees referred to their desire to tackle food insecurity, but the extent to which food equity was a cohort goal remained unclear over the course of the program. For example, during workshops led by UWBEC, some Black-led organizations reported an interest in fostering community wealth as a strategy for promoting food sovereignty, while other anti-hunger organizations led by white leadership expressed an interest in reducing hunger (Authors' observation, 2018).

In many ways, the BCFSG program aimed to fit the principles of CI (Kania & Kramer, 2011; 2015). Indeed, UWBEC leadership specifically mentioned CI as a guiding framework in the BCFSG program design. However, the BCFSG's funding of ongoing rather than merely innovative

² The authors and their team were not involved in the selection of organizations to fund.

programs, centering of community input and local leaders, and the inclusion of policy goals seem more aligned with tenets of CCAT than CI. The following subsections elaborate on the extent to which the BCFSG program met the following tenets of CCAT as expanded into the food system domain: (a) strengthening a community value chain; (b) building equitable relational infrastructure; (c) increasing the availability and affordability of nutritious and culturally preferred foods; (d) fostering structural change through job creation, entrepreneurship and job training; (e) bolstering the local food system; (f) addressing structural racial disparities in the food system; and (g) catalyzing policy changes.

Strengthening a Community Value Chain

The BCFSG program funded organizations in different sectors of the food value chain in Buffalo (Table 1). A few worked in multiple sectors. Of the 13 grantees, 10 worked directly on food access, seven engaged in food production, seven in food retail or food service, and at least one organization each worked on aggregation, processing, food waste, and/or food policy. Grant awardees included urban and rural growers, a cooperative food retailer, cooperative extension, an incubator for immigrant-owned food businesses, a food policy council, and a seasoned community food system organization whose work spanned the food value chain. This composition of the cohort laid the foundation for organizations to establish a collaborative network of business and entrepreneurial relationships across the value chain. For example, the rural farm incubator, which was also the youngest organization in the cohort, built business partnerships with multiple urban food preparation and vending organizations.

Building Equitable Relational Infrastructure

The local funder, UWBECC, served as the backbone

organization for the BCFSG, sharing information, coordinating meetings, and providing capacity-building resources throughout the grant term. Representatives of the grantee organizations noted that UWBECC staff were crucial in convening people across the food system. One respondent noted:

Seems like [UWBECC is] interested in being a convener and helping to build relationships, even if it's not working together right away, but building relationships and trust with each other so that we can. I think the more we work together when it makes sense, the stronger the food system will be. (Interviewee ID # 13_01, 2018)

Another respondent noted that UWBECC's flexibility and the possibility of adapting their budgets to the work at hand were significantly helpful:

Sometimes we have funders that [are] like, "This is what you put in the budget, and I don't care if it was three years ago. ... This is what you budgeted for, so this is what you're spending the money on." I think it was really helpful to be able to go to [UWBECC] and say, "... this is what's going on right now. This is where we are with the grant. This is the need I have now. Is there a way for us to maybe move this?" [United Way staff person] was great in being like, "You can modify it if you can stay within the budget to meet your current needs as long as you are meeting the overall grant outcomes." [UWBECC staff person] was incredibly helpful and flexible. We don't often get that from a lot of funders. (Interviewee ID # 05_02, 2020)

Overall, grantees reported that the supportive and flexible approach of UWBECC toward the co-

Table 1. Food Sectors of the Buffalo Community Food System Grant (BCFSG) Cohort Organizations

Cohort size	Production	Aggregation	Processing	Food retail and service	Food acquisition, preparation, cooking and eating	Food recovery, waste and management	Food policy
13	7	2	2	7	10	1	1

hort was a departure from relationships with other funders. This flexibility was especially important in navigating the onset of the COVID-19 pandemic.

By convening the grantee organizations, new relationships were forged among organizations that had not previously worked together. For example, one food service organization created a venue and market for a farm organization to sell its produce; the two organizations had no prior relationship. That said, the majority of the 13 grantee organizations had pre-existing relationships of varying strength prior to the BCFSG program. Grantees noted that the cohort-based nature of the BCFSG created opportunities for stronger relationship-building, leading to other collaborative opportunities, as illustrated in quotes below from two different organizations.

As a result of ... the United Way grant, [another grantee] and I have become friends and our organizations are specifically working together. We co-wrote a grant and got it, we just found out last week, for cold storage. ... Participating farmers in [...] can use it as a place to store stuff to distribute in the city. (Interviewee ID # 02_01, 2020)

We have formed a relationship and we're working on a project to bridge the urban and the rural farming communities. ... I'm not sure what that's going to look like, but that is new since the grant. (Interviewee ID # 04_01, 2020)

Unexpected relationships across the so-called urban-rural divide also surfaced. For example, the leader of a rural farm incubator emerged as a fierce ally for their urban counterparts, frequently advocating for resources for urban organizations in policy and philanthropic spaces.

Importantly, philanthropic initiatives like the BCFSG do not exist in a vacuum. During the grant period, seven BCFSG grantees reported networking with 72 unique organizations both within and outside of their grantee cohort. While the BCFSG was underway, new food-based community coalitions led by Black and brown organizations grew organically and in parallel to the BCFSG program.

Some, like the Seeding Resilience coalition, coalesced in response to COVID-19 and included many BCFSG cohort members. The BCFSG and Seeding Resilience mutually reinforced each other. As a result, the outcomes discussed in the paper were not caused exclusively by the implementation of the BCFSG program. Participation in multiple overlapping coalitions did create some fatigue. During interviews, some organizations reported irritation with participation in "yet another coalition."

Increasing Availability and Affordability of Nutritious and Culturally Preferred Foods

The BCFSG program aimed to increase the affordability, availability, and accessibility of nutritious and culturally preferred foods, a more traditional way to improve food security. BCFSG grantees aimed to make food affordable by participating in and offering public safety net programs. For example, over the grant period two organizations received 294 electronic benefit transfer (EBT) transactions valued at US\$2,245 and 64 Double Up Bucks or other benefit coupons valued at US\$1,051.

Organizations working with New Americans and resettled refugees facilitated the production of culturally relevant crops, as well as the sale of diverse prepared foods. One interviewee reflected on how their organization integrated crops from varied countries of origin such as East African maize and bitter melon:

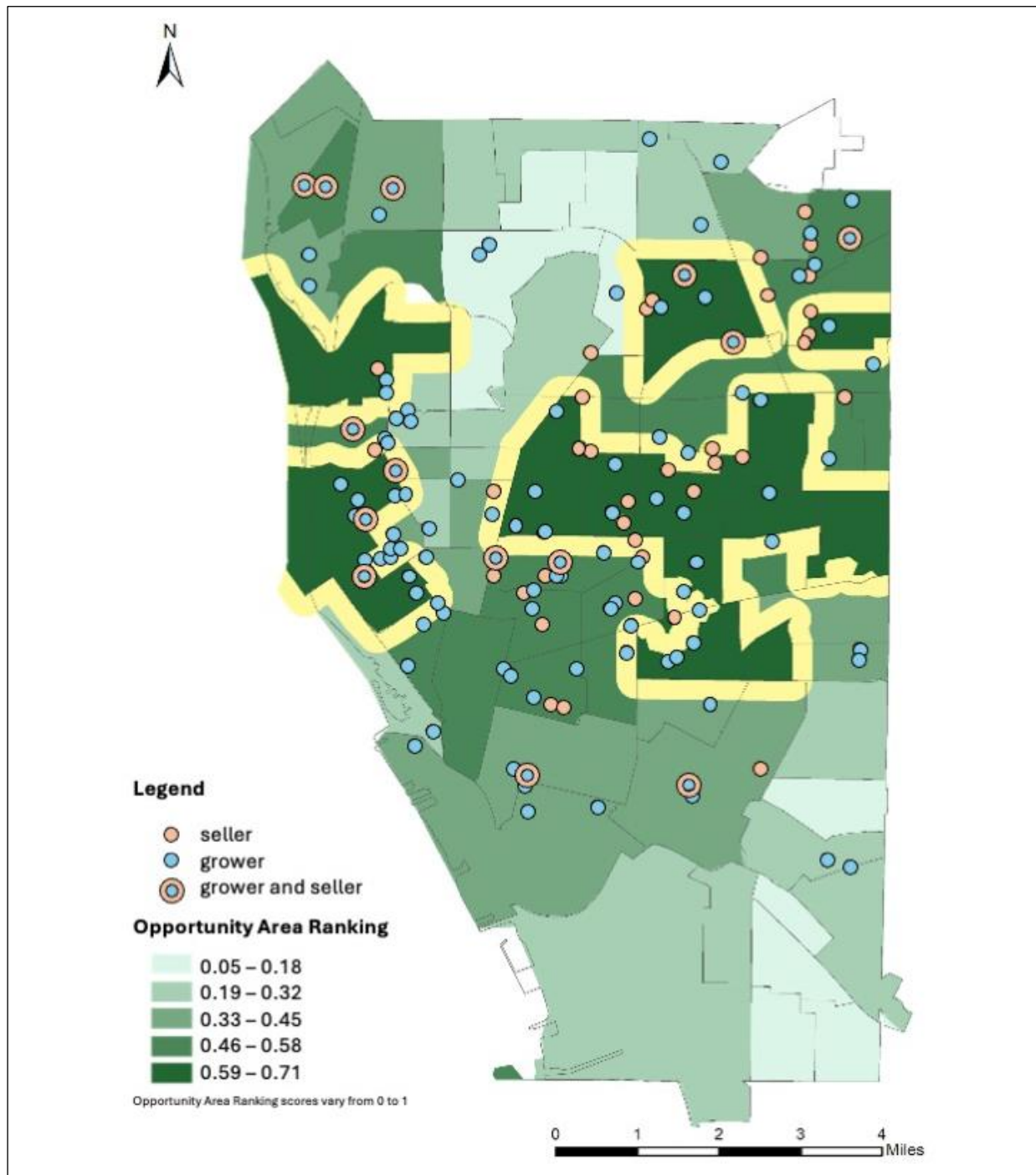
Some of the refugee populations, there are different types of vegetables that historically you're not going to see people in Buffalo think about growing but that's what [New Americans] are comfortable growing, what they want to grow, what's native to them. If it can grow here, we make sure that we get that so that they have food that is comfortable and accessible, and culturally relevant to them. (Interviewee ID # 05_02, 2018)

The BCFSG was also successful in promoting physical food access because the cohort was able to collectively reach the most marginalized neighborhoods in the city (Figure 1). This spatial reach to

address an inequitable food environment was by design. UWBEC leadership identified target areas (represented by the dark green areas bordered in yellow in Figure 1) and privileged organizations

with reach in historically marginalized neighborhoods, such as the East Side of Buffalo. Seven of the 13 funded organizations directly engaged in activities growing food in underserved opportunity

Figure 1. Location of the Buffalo Community Food System Grant (BCFSG) Cohort's Work in Opportunity Areas in Buffalo, New York



areas (Table 1 and Figure 1). For example, 59% of community gardens managed by a BCFSG grantee were in neighborhoods with limited walkable food resources (0.5 miles or 0.8 km), thereby increasing equitable food access.

Fostering Structural Change Through Job Creation, Entrepreneurship, and Job Training

The BCFSG cohort supported job creation, entrepreneurship, and job training. Across the cohort, 24 full-time equivalent jobs were created in food aggregation and wholesale, food retail, and food service. Six grantees provided job readiness and workforce development activities spanning food system sectors, including training 65 individuals in food production, 62 in food aggregation and wholesale, 92 in food retail, and 14 in food service. Trainees included adults, youth, New Americans, and formerly incarcerated individuals.

One interviewee noted how job training expanded beyond technical skills to include the soft skills necessary to secure future employment in the food system:

A lot of what we do is just basic job training, a lot of the kids who come to us, it's their first job when they come to us, so a lot of soft skills training, just being on time, what do you do when you can't show up to work, filling out a timesheet, keeping a schedule, keeping track of a schedule. (Interviewee ID # 13_01, 2018)

Another grantee shared the success of an entrepreneur who launched their food retail business over the course of the grant:

[The individual came] into the market probably two years ago. [The individual] wanted to start a regular restaurant. We went over what that would entail. And over the year, [the individual], became more knowledgeable and [a community commercial kitchen] opened. So now [the individual] is in [the community commercial kitchen] and makes [their] product, ... boxes it up, labels it, and takes it to different delis and gas stations. (Interviewee ID # 09_01, 2020)

In addition to providing pre-employment training, the BCFSG program fostered small business incubation by providing funding for commercial kitchen equipment and business development training.

Bolstering the Local Food System

One way to increase community control of the food system is to increase local capacity to grow, process, and distribute food. Seven grantees supported food production in community gardens (including market gardens), farms, and private gardens (Table 1 and Figure 1). The BCFSG program financed seed-starting equipment, equipment for new greenhouses, food production storage space, beekeeping equipment, lumber for raised beds, landscaping fabric to stifle weeds, drip irrigation, and soil amendments. This infusion of funds was crucial. One interviewee noted,

We were able to modify the remaining money we have this year to essentially act as a deposit on our lumber for next year. We have 13 new gardens coming into the network and the [US]\$5,000 we had remaining is going to probably fund half of those gardens. We'll now have six gardens that wouldn't have had raised beds or we would have to take that money from somewhere else. We were able to bring in more gardens this year and not cap it. We were able to bring on everyone that asked because we had funding. (Interviewee ID # 05_02, 2020)

During the grant period, 76 growers affiliated with BCFSG grantees started their own seeds, grantees trained 1,869 participants to grow food, and cohort members grew 14,248 pounds (6,463 kgs) of food.

The BCFSG program also supported community control of food resources through increasing demand for food grown regionally by commercial farmers. Four BCFSG grantees aggregated produce from Western NY farmers for sale or donation to customers in the City of Buffalo. BCFSG funds enabled the purchase of cold storage equipment to support the expansion of food aggregation. Grantees aggregated US\$25,200 worth of produce from regional farmers, pumping money into the local

economy. While recognizing these successes, the local food value chain can still be strengthened further. For example, one food service organization that facilitates the sale of prepared ethnic foods reported that they did not procure any produce from local farmers, signaling a missed opportunity as local farmers *do* grow the types of produce prepared by this food service organization.

Beyond supporting local food production, aggregation, and retail, public food systems education is another way to build capacity for community control of the food system. Grantees reached over 20,000 unique individuals through public education activities. Trainings incorporated topics such as saving seeds, growing food, buying healthy food, cooking safe food, and more. Increasing community knowledge of healthy food systems primes a community to gain more community control over their food system (Interviews with grant recipients; Raja et al., 2024b).

Addressing Structural Racial Disparities in the Food System

Perhaps the greatest challenge in the BCFSG program was tackling substantive racial disparities in the food system. While all 13 organizations aimed to serve Black and brown people, very few focused on eradicating the conditions that lead to racial disparities in food insecurity. Although the BCFSG supported Black- and brown-led organizations' efforts to generate jobs and income, these efforts were masked by the prevalent focus on food delivery and nutrition education across the 13 grantees.

Catalyzing Policy Changes

Departing from traditional food security initiatives, the BCFSG aimed to catalyze changes in municipal public policy to foster food equity. Specifically, the initiative funded the creation of a strategic plan for the city-county food policy council. The preparation of the plan was delayed due to challenges with the consultants, but was ultimately completed and adopted after the BCFSG program ended. The completed plan explicitly draws attention to a number of inequities in the food system (including racial inequities), and is, in fact, one of a handful of policy documents in the region that explicitly discusses inequities. The plan has since fostered ongoing

action by the county government to strengthen the food system.

Discussion

The BCFSG program launched a cohort-based, cross-sectoral model to extend the idea of CI by linking different sectors of the food system together. Despite the interest in CI among philanthropic leaders (including in Buffalo), the BCFSG model departed from the centrality on innovation in CI approaches (Flood et al., 2015; Hanleybrown et al., 2012) and moved toward a CCAT model by recognizing prior work in the city and focusing on policy. While several BCFSG grantees proposed new solutions to food inequity, others continued to implement existing initiatives with BCFSG funds. Continuing what works in a community is also innovative. Building on existing initiatives allowed organizations to scale up successful projects and develop new partnerships. The program honored and supported ongoing work, as well as created space for new ideas. This flexibility was a key strength of the BCFSG program. In many ways, BCFSG illustrates that philanthropic organizations should look to CCAT, not CI, frameworks as a strategy for addressing the complexity of community-rooted food projects.

Strengths of the BCFSG resulting from implementing a CCAT model included building relationships across an intersectoral food system cohort, leveraging ongoing work, and operationalizing a flexible funding model. Convening relationships was a key strength of the BCFSG program and led several grantees to seek future collaborative funding with one another and engage in joint programming. One of the powerful components of the BCFSG program was that it was intersectoral—it included growers as well as retailers. Seeding and fostering intersectoral relationships could be the most long-term systemic impact of the BCFSG program on Buffalo's food system.

A key factor for success of the BCFSG program was the outstanding staff support from UWBECE, the backbone organization. Having a backbone organization is a key recommendation in both CCAT and CI literature (Butterfoss & Kegler, 2012; Flood et al., 2015; Kegler et al., 2019). UWBECE funded items that are typically difficult to

include in grants (e.g., salary support and vehicular purchases). Grant applications often necessitate submitting and following a strict budget despite changing community needs. In the case of the BCFSG cohort, grantees faced numerous unexpected situations ranging from vandalism on property, to failed contractual arrangements with consultants, to a global pandemic. Through all these unexpected challenges, UWBECE staff were flexible, an approach greatly appreciated by the participants. Unfortunately, at UWBECE, there was staff transition, and the key staff overseeing the food portfolio is no longer with the organization. Such transitions in backbone staff can undermine the mature phases of collective action efforts.

Despite these successes, there were challenges for the cohort. The short-term funding of the BCFSG program, the burden of data collection, sparse staff capacity for continued communication, and an emphasis on separate work plans for each organization posed challenges for the cohort.

All but one grantee/interviewee noted that the limited financial sustainability of initiatives launched through the BCFSG program was a challenge. More specifically, organizations expressed concern over their ability to continue programming while remaining dependent on grant funding. These challenges are not unique to the BCFSG. Although some grantees already secured additional funding to sustain their projects beyond the BCFSG program, respondents from other organizations raised doubts about financial sustainability past the two-year funding cycle of the BCFSG.

As Hoey et al. (2017) find, shared data collection, a key tenet of CCAT work, is often not possible until organizations build capacity. Larger BCFSG grantees were better equipped and better resourced to collect data compared to smaller organizations. While all organizations shaped the metrics that guided the data collection, not all organizations were able to contribute equally to data reporting. These disparities in the organizational capacity of food-related organizations are also tied to larger racial and economic disparities in the City of Buffalo (The Food Equity Scholars, U.B. Food Lab, 2022). Such differences in organizational capacity led to inequities in who could substantially contribute to the program evaluation.

Equitable, cohort-based, and collaborative programming must recognize historic, place-based structural disparities, and level the organizational playing field by funding technical assistance support for smaller organizations, including for data collection.

A key pillar of CCAT is continued communication among all partners. One challenge that grantees reported was having insufficient time to develop deep collaborative partnerships. This challenge was especially salient for organizations with fewer staff. As relationship-building takes time, organizations with fewer staff members often had to juggle attending cohort workshops with meeting other, frequently time-sensitive, organizational needs. In fact, the downside of the capacity-building workshops and gatherings was that it took time away from substantive work. Organizations with more staff were able to distribute staff time more broadly, meeting organizational demands while also freeing up time to attend workshops, trainings, and meetings with other grantees.

Among some grantees, self-perceptions shifted due to collaborations across grantees. For example, some organizations were engaged with food work prior to the grant, but did not see themselves as part of the food system or as contributing to food equity until engaging in programming with their BCFSG cohort. While some grantees initiated collaborations, the entire cohort of grantees did not communicate collectively unless initiated by the funder or the evaluator. One of the most successful ways that a few members of the BCFSG cohort continued to communicate beyond the duration of the grant was by establishing new intersectoral partnerships (e.g., buying, selling, and/or donating goods and/or services across the food value chain).

Although some grantees chose to work together and were self-motivated to do so, there was little incentive built into the grant for cross-organizational collaboration. A key lesson learned is that collaborative grants could be more effective if they funded organizations to work together on programming through shared initiatives. While some collaborative work happened organically, and several partners applied for future grants together as a product of having developed stronger partnerships through the BCFSG, such partnership-build-

ing was not directly funded by the grant, and not all grantees worked collaboratively with other cohort partners.

Certainly, some elements of CCAT (Butterfoss & Kegler, 2009, 2012) and CI (Kania & Kramer, 2011) frameworks hold true for the BCFSG program. However, such principles were insufficient in assuring a focus on food equity within funded initiatives, rather than a focus on food security. For example, rebalancing powered relationships in the food system was not the dominant grant outcome. Butterfoss and Kegler (2009; 2012) recommend that affected people be centered in designing and executing coalition work, but adherence to this tenet was uneven across grantee organizations. That said, some grantees were led by community residents deeply impacted by food inequity and were better able to respond to community needs because they were integrated into the neighborhood. For example, two grantee organizations mobilized quickly to deliver produce to shut-in elder residents in Black neighborhoods at the onset of COVID-19. These organizations were primed to do so as they were part of the community, embedded in its fabric, and aware of their own needs.

There are some limitations of this research which are important to note. As discussed above, this research was ongoing at the onset of COVID-19. As organizations within the BCFSG cohort shifted to respond to emergency needs augmented by the pandemic, staff had less time available to participate in data collection. This was especially true for organizations with a small number of staff. Therefore, the first key limitation to this work is that there is an imbalance of data collected across organizations within the cohort. Our findings might inflate the experiences of organizations that participated in more data collection activities. The authors combatted this limitation by triangulating findings across data sources. The second key limitation, which can also be perceived as a strength, is that the authors had preexisting relationships with many of the organizations in the cohort. The authors reduced the impact of our own biases by engaging in strategies that included conducting intercoder reliability assessments during thematic coding, analyzing quantitative data alongside qualitative data, and engaging in discussions of critical

reflexivity with other co-authors. While reducing the impact of our own biases was an important aspect of bracketing for this research, being a part of the food equity community in Buffalo also strengthened this work. Having prior knowledge of and relationships with organizations in the cohort increased trust between research participants and the authors. By living and working in Buffalo, the authors of this work more deeply understood the historic and contextual settings of this research, and such knowledge was critical foregrounding for research activities.

Conclusion

Fostering food equity through collaborative, intersectoral initiatives is anything but easy. Designing collective initiatives, launching them, and monitoring their successes are complex endeavors. The experience of the BCFSG program offers some insights into the possibilities of advancing food equity through collective initiatives. Collaborating across partners, honoring ongoing and preceding food system work, and providing flexible funding were key nurturing factors of the BCFSG cohort-based model. Such recognition of prior collaborations is rare and represents a departure from traditional philanthropic work. Collectively, gains of the BCFSG were apparent in increasing the availability and affordability of nutritious and culturally relevant foods. Still, more fundamental questions of addressing equity, especially racial equity, remained a challenge during the BCFSG program.

Multiple crises bring attention to the bottlenecks, inefficiencies, and inequities within Buffalo's food system. Following the onset of COVID-19, on May 14, 2022, a white supremacist massacred 10 people in one of the only food stores in a predominantly Black neighborhood in Buffalo. The massacre drew attention to racial disparities long present in the Buffalo food retail environment. During COVID-19 and after the massacre, local organizations mobilized relatively rapidly, in large part due to the presence of local knowledge and prior working relationships, including many of those funded by the BCFSG. Growers donated extra food, gardeners planted extra beds, local aggregators stored food, bicycle couriers delivered food, all within days or weeks of each crisis (Authors' observations,

2020; Raja, 2020). Local networks are, in fact, key to rapid and equitable response and recovery (The Food Equity Scholars, U.B. Food Lab, 2022; Raja, 2020). Building and sustaining the capacity of localized and resilient networks to respond to multiple crises will be an important strategy for the future of community food systems. But this will not be enough. Dismantling systemic racism within the food system is crucial. Crises like the massacre at a grocery store in Buffalo's majority Black community suggest that discussions about food equity must address deeper issues of power imbalances and systemic disparities.

An important insight from the BCFSG program is that the already overburdened nonprofit sector cannot restructure the food system or combat systemic racism alone. Food equity needs to be on the public policy agenda. Recent national analyses suggest that while food is starting to be incorporated into the public agenda, equity remains an elusive goal (Mui et al., 2021). Community organizations—especially those engaged in collective efforts such as the BCFSG program—have the potential to engage with the public sector to scale up their collective impacts. This is, of course, difficult. Food policy implementation takes considerable time, while grant programs are short-lived.

Moving forward, those interested in collaborative approaches to food systems transformations could consider catalyzing interorganizational and intersectoral cooperation. Long-term funding for collaboration across the food value chain that encourages cooperation, not competition, is necessary to foster long-term change, allow relationships and collaborations to evolve, and build trust between partners. For example, philanthropic organizations committed to systemic change could consider inviting joint, cooperative, intersectoral

proposals—from a coalition of new farmers and a coalition of retailers, for example—to foster complementary projects. Developing grant programs that are by design community-based and intersectoral across the food value chain is more likely to accelerate equitable systemic transformation compared with traditional philanthropic models. Within such efforts, prioritizing racial equity is crucial, a fact that is glaringly apparent in the national consciousness following Mr. Floyd's murder (The Civil Eats Editors, 2020), and more locally, the massacre by a white supremacist in Buffalo on May 14, 2022 (The Food Equity Scholars, U.B. Food Lab, 2022). Overall, cohort-based collaborative funding that supports the development of a food value chain is a promising approach to addressing food inequity—but only when such cohorts disrupt racial, economic, and existing power structures in the food system.



Acknowledgments

The authors are deeply grateful for the community food champions we have the joy to link arms with in this work. Thank you for your deep commitment to make Buffalo, New York, a better place for all. It is not easy, but because we stand together, we have the power to create real change. The work presented in this paper is also indebted to Joe Roccisano. Thank you, Joe, for listening, adapting, and learning alongside us. There are many University at Buffalo Food Systems Planning and Healthy Communities Lab members and alumni who supported this work by developing visuals, taking notes, reading drafts, making suggestions, and providing the space within which this work could be conceived and put down on paper. Thank you.

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U.S. farmers market attendance and experiences: Descriptive results from a national survey

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Submitted April 15, 2024 / Revised September 2 and October 23, 2024 / Accepted October 24, 2024 /
Published online January 21, 2025

Citation: Witzling, L., Shaw, B. R., & Wolnik, D. (2025). U.S. farmers market attendance and experiences: Descriptive results from a national survey. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 227–249. <https://doi.org/10.5304/jafscd.2025.141.017>

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Abstract

To provide farmers market leaders and researchers with new insights about farmers market attendees, given shifting consumer preferences and demographics, we conducted a nearly nationally representative survey in the United States. Among the 5,141 respondents, 38.51% reported attending

farmers markets infrequently (i.e., five or fewer times per year), and 41.78% reported attending with more regularity (i.e., six or greater times per year). In combination, this equated to 80.30% of the entire sample having at least some experience with farmers markets (i.e., attending once per year or more). Of note, farmers markets were defined as

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Author Note

There are references in this article to the Farmers Market Coalition (FMC), a national nonprofit dedicated to working with farmers market operators to strengthen farmers markets across the United States. The authors are either affiliated with or work closely with FMC.

Funding Disclosure

This work was supported by the U.S. Department of Agriculture National Institute of Food and Agriculture (USDA NIFA, award no. 2023-68006-38984).

Acknowledgments

The authors wish to thank the project partners who provided feedback on the survey used in this study in addition to the staff at the National Opinion Research Center.

places to buy local food directly from more than one vendor. Top motivations for attending included getting fresh food, supporting local farmers, getting high-quality food, and doing something fun, suggesting that promoting farmers markets with those themes should resonate with audiences. The top challenge to attendance was forgetting about farmers markets, indicating that campaigns or strategies to remind individuals about markets could be beneficial. Additionally, the majority of attendees reported that they ate healthier because of farmers markets and that they did nonconsumer activities at farmers markets, such as socializing and learning, underscoring that farmers markets can be a shared community experience that goes beyond consumption. We recommend that future work build on our results to further investigate how to expand the customer base for farmers markets and help people access the many benefits they provide.

Keywords

farmers market, consumer, communication, electronic benefits transfer (EBT), food access, local food systems, marketing, national survey, scrip, Supplemental Nutrition Assistance Program (SNAP)

Introduction

For many people in the U.S., farmers markets play a role in how they experience and access food. There are over 8,700 farmers markets in the U.S., where some 40,000 farmers sell their products (U.S. Department of Agriculture [USDA] National Agricultural Statistics Service, 2016; USDA Economic Research Service, 2022). Although growth in the number of farmers markets in the U.S. has slowed in recent years, long-term growth has been dramatic; in 1970, there were only an estimated 340 farmers markets in the country (Brown, 2002). To put the scope of farmers markets in perspective: in the U.S., there are more farmers markets than the 5,206 Walmart and Sam's Club stores (Walmart, 2024).

The growth in farmers markets has benefited communities as farmers markets may offer fresh

food in locations lacking retail options (Larsen & Gililand, 2009; Sage et al., 2013). Moreover, thousands of farmers markets are sites for redeeming benefits from food assistance programs such as the Supplemental Nutrition Assistance Program (SNAP), with \$33 million¹ in SNAP benefits redeemed at farmers markets in 2020 (USDA Food and Nutrition Service, 2021). Many states classified farmers markets as essential services during the COVID-19 pandemic (Farmers Market Coalition [FMC], 2020), highlighting that farmers markets are critical for food access.

Farmers markets offer communities other kinds of benefits, too. Farmers markets can be a place for meaningful social interactions (Alkon & McCullen, 2011; Aucoin & Fry, 2015; Carson et al., 2016; Morales, 2021) and for civic engagement (Witzling & Shaw, 2022), as well as to access resources and information (Dollahite et al., 2005; Morales, 2021; Witzling & Shaw, 2022) and to celebrate cultures (Alkon, 2007; Meyers, 2015). Economically, farmers markets can benefit communities as they support the circulation of money locally (Sadler et al., 2013). Relatedly, they provide financial benefits to the small and medium-sized farms, and other businesses, that vend there. Vendors may receive higher profit margins at farmers markets compared to other marketing channels (Warsaw et al., 2021), and selling food locally through direct-to-consumer marketing channels, which include farmers markets, is associated with higher rates of business survival (Lowe et al., 2015).

Given the benefits farmers markets provide, there is a need to provide farmers market managers, vendors, community leaders, and food systems educators with new insights about market attendees. Such insights can help ensure that farmers markets remain relevant at a time when consumer preferences and demographics are shifting. Marketing research has identified online food shopping as a growing trend (Verdon, 2022), which potentially challenges farmers markets. Additionally, millennials are now the largest living generation, and research has found that they rely more on prepared food and snacks than other generations do (Kuhns & Saksena, 2017), which could present

¹ All currency in this article is in US\$.

further challenges to farmers markets. This generation may become more interested in cooking; research finds that as household sizes grow, more time is spent preparing food (Mancino & Newman, 2007).

With these consumer shifts in mind, a greater understanding of expectations and trends of farmers market attendance at the national level is needed. Much research about farmers markets attendance has been based on local studies, with some exceptions (e.g., Bir et al., 2019; Chen & House, 2022; Zepeda, 2009). To build on this prior work, our study focused on understanding farmers market attendance with a comprehensive set of questions related to farmers market shopping in addition to questions about other activities that take place at markets. We included novel survey questions to query understudied aspects of farmers market attendance, such as interest among attendees in the ability to preorder market products online, purchase meal kits, or pay with digital apps. We also included novel questions related to a broad range of activities that may take place at farmers markets, such as receiving a health service, making a new friend, or voting. We intend for this work to encourage new directions in farmers market research and to support research at local and regional levels, as our analysis provides a source of national-level benchmarks.

Levels of Farmers Market Attendance

National U.S. estimates of market attendance vary widely. Zepeda (2009) found among a national sample, 78.5% had access to farmers markets. Of those with access, 58.1% shopped at farmers markets at least once per month, which equates to 45.6% of the sample shopping at farmers markets at least once per month. One more recent study suggested higher levels of attendance. Bir et al. (2019) found that 63% of individuals surveyed using a national sample reported having previously purchased food from a farmers market, roadside stand, or U-pick operation. In contrast, Rossi (2024) found that across three national surveys, an average of 30% of respondents reported shopping at a farmers markets in the previous month. A research firm found only 12% of individuals from a national U.S. sample reported doing their “grocery

shopping” at a farmers market (Schmidt, 2016). The estimates may vary due to changing behavior over time or because farmers market attendance was measured differently in each study. Respondent sensitivity to question wording may also impact estimates (i.e., attending a farmers market vs. grocery shopping there).

Regional data provides another source of estimates. In one study, researchers surveyed individuals at food stores in San Luis Obispo County in California (Wolf et al., 2005). They found that 42% of those surveyed reported buying produce at a farmers market in the past month (Wolf et al., 2005), a figure similar to the Zepeda (2009) finding. Results suggestive of greater participation, more similar to the Bir et al. (2019) finding, were found in other regional studies. Jilcott Pitts et al. (2014) used representative samples of primary food shoppers in both North Carolina and Kentucky. In North Carolina, 49.2% of the sample had made a purchase at a farmers markets or through community supported agriculture more than “Never,” and in Kentucky, the corresponding figure was 74.2%. Results from a Michigan study and a Florida study landed between those estimates. In Michigan, 61% of respondents from a random telephone survey of residents reported that they had visited a farmers market in the past year (Conner et al., 2010). Similarly, in Florida, a survey of randomly sampled households found that 61.7% of those surveyed reported that they had purchased food from a farmers market, roadside stand, or U-pick operation in 2012, the year the survey took place (Shi & Hodges, 2016).

Seasonality may be an important component to understanding attendance as well, as some markets are available year-round whereas others are only seasonally available. Relatedly, some places may have markets year-round but with a reduced product selection during off-peak seasons, which may impact attendance. Given the range of estimates and the potential sensitivity to question wording, it remains unclear how many people in the United States attend farmers markets with regularity, leading to the first of our five research questions:

RQ1: How often, and in which seasons, do individuals attend farmers markets?

Farmers Market Shopping Behaviors and Preferences

Another primary objective of this study was to understand farmers market shopping behaviors. Recent work collected during the COVID-19 pandemic found typical spending per farmers market trip ranged from \$15 to \$28 (Rossi, 2022). Comparing these figures to data collected in more typical circumstances could be insightful, though the Rossi (2022) estimates do align with pre-pandemic regional work (Jilcott Pitts et al., 2014; Zepeda & Carroll, 2018). Regarding products purchased, Zepeda and Carroll (2018) reported most customers bought vegetables (81%), with many purchasing bakery items (59%), cheese (41%), and fruit (37%).

Less is known about relative interest in preferences for newer payment options, such as digital payment apps, at farmers markets. Research not specific to farmers markets finds that digital payment options such as Venmo and PayPal are popular with younger demographics, as 57% of individuals ages 18 to 49 reported using Venmo and 63% reported using PayPal (Anderson, 2022). Similarly, it is unclear whether farmers market attendees may have preferences for preordering farmers market products online to pick up on market day or to have them delivered. Nevertheless, research finds there is interest among consumers in shopping for food online. Greater proportions of consumers used online options to purchase food across numerous marketing channels in 2023 compared to 2022, though the proportion of consumers using online options to purchase food via direct-to-consumer channels (which includes farmers markets) remained steady at 6% in both years (Gill & Thilmany, 2024).

Similarly, less is known regarding interest in purchasing meal kits at farmers markets. Although meal kits may not be available at all farmers markets, understanding consumer interest in them could offer valuable insight to vendors considering whether to develop meal kit products. A survey of U.S. consumers by a market research firm found that 49% of adult consumers ages 18–34 reported meal kits were part of their routines, with the most interest from households with three or more people (Goldschmidt, 2022). Meal kits could be espe-

cially attractive to individuals seeking to learn more about cooking, given that commercial meal kits contain recipes that are easy to follow, though the kits can be more expensive compared to the cost of purchasing the same ingredients at a supermarket (McKay, 2023). Additionally, research has found that meal kits have the potential to increase cooking skills and self-efficacy in cooking (Horning et al., 2021), which may be important to younger consumers or others seeking to increase their skills and expand their culinary repertoire. As noted previously, interest in cooking may increase as household sizes grow (Mancino & Newman, 2007). With a goal of learning more about national trends and other understudied aspects of shopping at farmers markets, our second research question was:

RQ2: What are typical shopping behaviors and preferences at farmers markets among attendees?

Activities and Impacts

We also sought to investigate what people do at farmers markets beyond shopping and the impacts of farmers market attendance. In a survey of market attendees, Crompton et al. (2012) found that attendees reported eating more fruits and vegetables as a result of visiting a market. Research has also found a connection between attendance and an increase in nutritional knowledge (Dannefer, 2015). Furthermore, farmers markets are events that provide opportunities for social connections and civic engagement (Warsaw et al., 2021). As farmers market leaders in Wisconsin reported partnerships between farmers markets and numerous types of civic and social organizations, researchers concluded that farmers markets likely facilitate connections between residents and their communities (Wilson et al., 2018; Witzling & Shaw, 2022). With civic, educational, health, and social activities and impacts in mind, our third research question was:

RQ3: What activities do attendees report doing at markets beyond shopping, and what impacts from attendance do they perceive?

Motivations For and Challenges to Attending Farmers Markets

A comprehensive look at motivations for and challenges to attending farmers markets was offered by Byker et al. (2012), who reviewed 22 articles focused on farmers market consumer studies. Byker et al. (2012) found the primary motivations for attending farmers markets included obtaining fresh, high-quality, organic, and/or tasty food. Other reasons included to support local agriculture, obtain food perceived to be safer, or attend a social event. Although that study is over 10 years old, these results have been corroborated by more recent regional work (e.g., Zepeda & Carroll, 2018).

The relative importance of benefits likely varies at a local level. In one of the studies included in the Byker et al. (2012) review, Baker et al. (2009) asked attendees of two markets in Vermont to rank the importance of various reasons to attend markets. The results found that at both markets, obtaining local food was ranked first, followed by obtaining fresh food, and then supporting local agriculture. However, convenience was ranked in fourth place over social benefits at one market, whereas at the other, social benefits were ranked in fourth place over convenience. “Social benefits” were described as the market being “a good place to see friends and family, a good place to meet people, a good place to take visitors.”

Regarding challenges to attending farmers markets, Byker et al. (2012) described issues related to convenience, such as market hours and location, in addition to cultural barriers or feeling unwelcome, and product prices. Similarly, Zepeda and Carroll (2018) found that survey participants reported challenges related to price, payment options, and convenience, in addition to crowds, lack of product variety, and lack of space to store items at home. A systematic review by Maró et al. (2023) reported price as a primary obstacle. With the goal of understanding why people do (and do not) attend farmers markets at a national level, we posed the next research question:

RQ4: What motivations for and challenges to attending farmers markets do attendees perceive?

Differences in Background Characteristics of Farmers Market Attendees and Non-Attendees

Studies examining farmers market attendees in specific locations in the U.S. have noted that farmers market attendees are more likely to be women (Byker et al., 2012; Maró et al., 2023; Rice, 2015), more educated and/or affluent (Byker et al., 2012; Garner & Ayala, 2019; Maró et al., 2023; Rice, 2015; Zepeda & Carroll, 2018), white (Garner & Ayala, 2019; Maró et al., 2023; Rice, 2015; Zepeda & Carroll, 2018), and over 40 (Maró et al., 2023; Zepeda & Carroll, 2018). For example, a survey conducted in 1997 of farmers market shoppers in New Jersey found that 83% of attendees were women. In terms of age, that study found attendees trended older, with only 12% under the age of 35 (Govindasamy et al., 1998). Similarly, in a study of two Alabama farmers markets, only 12% of attendees were under the age of 35 at one market and 13% at the other (Brooker et al., 1993). In contrast, Bir et al. (2019) found that age and gender were not statistically significant explanatory variables for shopping at farmers markets.

Nevertheless, understanding more about the role of demographics is crucial as this information could help farmers market leaders enact strategies to attract a greater diversity of attendees, serve the needs of attendees better, and increase access to farmers markets. Lifestyle factors are also associated with market attendance (Witzling & Shaw, 2019), in particular enjoyment of cooking (Byker et al., 2012), which may be another key background characteristic of attendees. Therefore, for RQ5 we considered:

RQ5: How do the background characteristics of farmers market attendees and non-attendees differ?

Methods

To investigate these research questions, a survey was developed in the spring of 2023 by the study team. The team represented a partnership between the University of Wisconsin–Madison and FMC. Survey questions drew from previous studies (e.g., Brunso et al. 2021; Byker et al. 2012; Elepu & Mazzocco, 2010; Garner & Ayala 2019; Mesić et al.

2021; Jilcott Pitts et al. 2014; Witzling & Shaw, 2019, 2022; Zepeda & Carroll, 2018), and additional novel questions were added. Ten professionals affiliated with farmers market associations or who otherwise worked in the field of food systems provided feedback on the draft survey. The draft survey was piloted by the survey administrator, the National Opinion Research Center (NORC). NORC is an independent research organization affiliated with the University of Chicago. NORC staff provided additional feedback and translated the final survey into Spanish to provide a Spanish language option (3% of all respondents used the Spanish language option). The study protocol, which included a consent process, received Institutional Review Board (IRB) approval from the University of Wisconsin–Madison (IRB No. 2023-0759-CP00) in addition to undergoing an IRB review via NORC.

To ensure participants began the survey with a similar understanding of farmers markets, the survey included a definition of farmers markets “as places where you can buy food directly from more than one market vendor and where all or most of the items are locally grown, raised, or made.” This definition was written in consultation with the group of farmers market and food systems professionals who provided feedback on the survey. The survey questions with response options are available in the Appendix (Table A1). Because all participants had been part of NORC’s AmeriSpeak Panel, they had already provided information related to demographics and their backgrounds. Therefore, data related to age, education, gender, household income, household size, political ideology, and race and ethnicity were available for analysis, but questions related to those items were not included on the survey instrument.

The survey instrument included items related to community type (rural, suburban, urban), weekly food shopping budget, and food assistance program participation, as data related to those items was not available from NORC. The food assistance items inquired about participation in the following programs: SNAP; the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC); the Commodity Supplemental Food Program (CSFP); and The Emergency Food

Assistance Program (TEFAP). SNAP is the largest food assistance program accepted at farmers markets. SNAP funds are held on a participant’s electronic benefits transfer card and must be processed, most commonly via scrip (e.g., paper coupons, tokens, or mobile wallet accounts) issued through a central terminal managed by a farmers market organization (Way & Edmonds, 2023). However, our survey included variables related to the additional programs as there are private funds available to particular markets, or funds available in certain states, through which coupons may be issued to qualifying individuals based on participation in those programs (e.g., based on WIC participant status). The survey also contained additional questions that were not used in this analysis.

NORC administered the survey between August 2 and August 11, 2023. NORC selected recipients from their national probability-based AmeriSpeak Panel to achieve a sample that was close to demographically representative of the U.S. population. This involved oversampling some demographic categories to achieve alignment with national targets, in particular to reach younger participants, less affluent participants, and people across racial and ethnic backgrounds. NORC achieves industry-leading response rates through intensive nonresponse follow-up methods with panelists and has a retention rate of panelists of approximately 85% (NORC, 2022). High panelist retention is an indicator of better-quality data, as low panelist retention may be a reflection of the trend for paid panelists to quickly move through surveys and quit panels, rather than provide accurate responses.

The survey was available to participants online or by phone with an interviewer. An incentive equivalent to \$3 was offered to panelists. We aimed to collect a large sample (5,000 completed surveys) given the low-end estimates of how many individuals attend farmers markets in the U.S. to ensure that enough data would be collected among attendees. This target was reached with 5,141 respondents in the final sample, including 4,996 who participated online and 145 by phone. Not included in the total were 179 participants whose responses were flagged by NORC staff due to data quality concerns such as skipping questions. With

24,455 individuals initially invited to take the survey, the survey completion rate was 21%.

NORC provided descriptive data (see Table A2 in the Appendix) that shows how the survey sample compared to NORC's key U.S. demographic benchmarks. Some but not all of these benchmarks were reached. Those in the youngest age categories, those with less education, and respondents who selected "Other" for race and ethnicity appear to be proportionally underrepresented. A closer examination of race and ethnicity data revealed that Asian respondents were underrepresented, and this is a limitation of this study. However, the sample is still more demographically representative of the U.S. than is typical in survey research given NORC's unique AmeriSpeak Panel and the scope of the data collection.

Analysis

For some questions, a "Don't know" option was available, and these responses were subsequently coded as missing data. We excluded missing data from the reported proportions as it was minimal for any single item given NORC's quality control measures. In tables displaying percentages, we arranged the items starting with the item that had the highest percentage in the top scale category. We used chi-square tests for independence (with a Bonferroni correction applied) for comparisons to address RQ5. Data were analyzed in SPSS (IBM SPSS Statistics Version 29.0.2.0).

For our analysis, we needed to designate which respondents among the entire sample were farmers market attendees. We designated respondents as attendees if they affirmed their attendance across three questions. The survey first asked about general attendance when markets were seasonally available with response choices of "Never," "Rarely," "Sometimes," "Frequently," and "Very frequently." Respondents who indicated they "Never" went to farmers markets and people who did not respond were removed from consideration as farmers market attendees. The survey next asked about attendance using a time-specific, but broad, scale. The response choices were "Never," "Just a few times each year," "About once a month," "About once every other week," and "About once a week." Respondents who stated they generally attend the

markets more than "Never" on this item remained in consideration as attendees. The third question asked specifically how many times per year respondents attended. To be categorized as attendees, respondents needed to select more than zero times to be included in our analysis as attendees.

For our comparison of attendees to non-attendees (RQ5), we categorized respondents who selected "Never" to that first general question about attendance as non-attendees. With the survey logic we used, those respondents were not presented with the other two questions about attendance. Some respondents were not categorized as attendees or non-attendees, and therefore not part of the RQ5 analysis, either due to their inconsistent responses on the three attendance items or because they skipped some or all of these questions. For example, individuals who responded in the affirmative to the first general question about attendance (i.e., more than "Never"), but then responded otherwise or skipped the other attendance questions, were not classified as attendees or non-attendees.

Some of the analysis examined responses from individuals who participated in a food assistance program. Respondents were classified as food assistance program participants if they indicated that they participated in at least one of the programs listed (SNAP, WIC, CSFP, or TEFAP).

Results

RQ1 explored how often and in which seasons individuals attend farmers markets. Of the nearly nationally representative sample, 1,980 respondents (38.51%) reported attending infrequently, five or fewer times per year. We found that 2,148 respondents (41.78%) attended farmers markets with more regularity, at six or more times per year. Note all of these respondents also selected more than "Never" on the two more general attendance questions to check for consistency in responses. Taken together, 80.30% of the sample (4,128 respondents) were classified as attendees. In contrast, there were 662 respondents (12.88% of the sample) that reported never attending farmers markets and were classified as non-attendees, and another 351 (6.83%) that had inconsistent responses regarding attendance or were missing

data and were not classified as attendees or non-attendees.

When considering just the 4,128 respondents we classified as attendees, we found that among them, the most common frequency for attending farmers markets with one of the more general frequency questions was “Just a few times per year,” which was selected by nearly half of the attendees (48.01%), followed by about once a month (25.46%), about once every other week (17.08%), and about once a week (9.45%). Among attendees, the proportions for the number of visits per year were as follows: one to five times per year (47.97%), six to 10 times (20.86%), 11–15 times (11.19%), and 16–20 times (6.06%). The remainder of the attendees (13.93%) selected choices greater than 20 times per year.

Among those classified as attendees, we found that summer was the most common season for attendance, at least once per month (70.57%), followed by fall (44.84%), spring (40.67%), and winter (9.81%). Taken together, these assessments show that though attending farmers markets more occasionally is typical, there is a wide range in how often individuals attend, and in what seasons, as seasonal attendance appears to vary widely.

For RQ2, related to typical shopping behaviors and preferences at farmers markets, attendees most commonly described the market they typically attend as along a main street (40.11%), followed by a market in a neighborhood (18.47%), a market that attracts tourists and has a festival atmosphere (17.11%), a market outside or inside of a building like a library or a hospital (14.77%), and a market

in a location without buildings or development (9.54%).

Nearly all attendees reported commonly purchasing fruits and vegetables (92.13%). Over a quarter of attendees also reported commonly purchasing packaged items (38.59%), bakery items (38.20%), and eggs (25.22%). Under a quarter of attendees reported commonly purchasing garden plants (22.80%), arts and crafts (18.14%), dairy products (16.96%), cut flowers (16.96%), beverages (16.23%), meals to eat at the market (15.50%), meat (12.31%), meal kits (2.81%), and other items (2.52%).

We also asked about interest in nontraditional or convenience-focused options that may not be available at many markets (Table 1), finding 23.02% of attendees were either “Quite” or “Very” interested in buying prepared meals at farmers markets. By comparison, 20.46% of attendees were either “Quite” or “Very” interested in buying a meal kit, whereas only 16.63% were either “Quite” or “Very” interested in preordering products online for pickup at the market, and only 15.63% expressed similar levels of interest in preordering products for home delivery.

We found that most attendees typically patronized between two and five vendors (72.88%). There were 10.04% that selected one vendor, 11.40% that selected between six and 10 vendors, and 4.33% that selected more than 10 vendors. Few reported patronizing no vendors (1.36%).

Few attendees (4.69%) spent less than \$10 on a typical trip. More commonly, they reported spend-

Table 1. Interest in Convenience-Focused Options at Farmers Markets

Option	N	Not at all interested (%)	Slightly interested (%)	Somewhat interested (%)	Quite interested (%)	Very interested (%)
Buying prepared meals	4,101	22.43	24.02	30.53	15.53	7.49
Buying a meal kit	4,096	31.30	22.24	26.00	13.09	7.37
Preordering farmers market products online for home delivery	4,089	48.35	17.02	19.00	8.83	6.80
Preordering farmers market products online to pick up at the market	4,094	41.38	19.52	22.47	10.89	5.74

Note: The proportions displayed reflect only the responses from farmers market attendees.

ing between \$10 and \$25 (31.81%), or more than \$25 but less than \$50 (39.76%). About 20% reported spending more than this typically, with 15.13% selecting more than \$50 but less than \$75, 5.72% selecting more than \$75 but less than \$100, and 2.89% spending more than \$100 per trip.

We also examined interest in payment types (Table 2). There were greater proportions of attendees who were “Very” interested in using cash (28.40%) or a credit card (20.37%), as opposed to other options such as paying with gift cards or through digital apps such as Venmo or PayPal. We further examined interest in food assistance payment options just among the subset of attendees who also participate in food assistance programs (Table 3) and saw strong interest among them in using SNAP or WIC at farmers markets.

RQ3 considered activities done at farmers markets and the perceived impacts of farmers market attendance. Nearly half of attendees reported spending time with family and friends at a farmers

market (47.65%), with many also learning new things about food (40.50%). Over a quarter met a new person (29.41%) or learned new things about the community (25.41%). Nearly a quarter learned about growing food (24.52%). Less frequently, attendees reported that they learned about cooking (14.34%), made a connection with a new organization (13.76%), made a friend (12.35%), took a photo and posted it to social media (10.73%), got ideas about new business opportunities (8.96%), received information about voting (4.36%), received a health service such as a blood pressure check (3.13%), or registered to vote (1.72%). Only 18.77% of attendees reported doing none of the listed activities.

We also investigated whether attendees had done several things as a result of their past trips to farmers markets (Table 4). More than three quarters of attendees reported eating healthier at levels of “Somewhat” or higher because of farmers markets. Many attendees also reported economic bene-

Table 2. Interest in Payment Options at Farmers Markets

Option	N	Not at all interested (%)	Slightly interested (%)	Somewhat interested (%)	Quite interested (%)	Very interested (%)
Cash	4,095	6.25	11.70	27.28	26.37	28.40
Credit card	4,105	21.73	13.69	23.78	20.44	20.37
Paying digitally with apps like Venmo or PayPal	4,086	47.04	13.61	17.52	12.51	9.32
Gift cards or certificates	4,075	46.50	16.69	19.34	10.63	6.85

Note: The proportions displayed reflect only the responses from farmers market attendees.

Table 3. Interest in Food Assistance Payment Options at Farmers Markets

Option	N	Not at all interested (%)	Slightly interested (%)	Somewhat interested (%)	Quite interested (%)	Very interested (%)
Using SNAP or WIC	793	16.27	11.85	21.31	20.05	30.52
Using matching incentive dollars offered to those using SNAP at the farmers market	789	20.03	12.55	23.57	17.49	26.36
Using coupons issued by the farmers market or a state agency	786	17.94	13.10	28.63	19.08	21.25

Note: SNAP = Supplemental Nutrition Assistance Program, WIC = the Special Supplemental Nutrition Program for Women, Infants, and Children. The proportions displayed reflect only the responses from farmers market attendees who also participate in food assistance programs.

fits such as saving money or community economic benefits such as patronizing nearby stores or restaurants on market day or looking for locally grown products in stores. Many attendees also connected with others in the community and community

organizations at least “Somewhat.”

For RQ4, regarding the motivations for and challenges to attending farmers markets, we found that the top motivations (Table 5) were to buy fresh food, support local farmers, get high-quality

Table 4. Perceptions of Farmers Market Impacts

Perception	N	Not at all (%)	Very little (%)	Somewhat (%)	Quite a bit (%)	A great deal (%)
Have eaten healthier	4,112	8.78	16.15	45.89	20.89	8.29
Looked at locally grown products at the grocery store based on experience at farmers markets	4,093	13.58	19.79	41.90	19.08	5.64
Saved money by shopping at the farmers market	4,091	21.12	30.41	33.02	10.36	5.08
Connected with others in the community	4,108	25.15	26.75	32.04	11.73	4.33
Gotten information from organizations in the community	4,105	27.87	26.92	29.72	11.62	3.87
Shopped or visited nearby retail stores on market day	4,087	21.16	29.88	35.28	10.74	2.94
Have eaten at a nearby restaurant on market day	4,080	28.75	28.92	30.86	8.87	2.60

Note: The proportions displayed reflect only the responses from farmers market attendees.

Table 5. Motivations for Attending Farmers Markets

Motivation	N	Not at all (%)	Very little (%)	Somewhat (%)	Quite a bit (%)	A great deal (%)
To buy fresh food	4,112	1.95	4.38	21.26	34.87	37.55
To support local farmers	4,117	3.04	6.22	27.88	31.67	31.19
To get high-quality food	4,102	3.24	5.39	26.55	35.96	28.86
To do something fun	4,094	3.98	8.06	34.78	31.39	21.79
To eat healthier	4,100	5.88	10.93	35.17	27.15	20.88
To find products that are hard to find elsewhere	4,099	10.17	18.10	34.72	21.59	15.42
To buy environmentally sustainable food	4,090	15.45	14.40	36.87	22.18	11.10
To reduce your use of food packaging	4,083	23.34	18.44	31.79	16.63	9.80
To save money	4,086	26.55	25.40	28.76	10.99	8.30
To talk to people who grow or make your food	4,091	21.41	22.12	33.12	15.57	7.77
To feel like you're part of the community	4,093	20.67	19.11	35.99	16.57	7.67
To learn new things about food	4,089	23.70	22.94	32.80	13.65	6.92
To shop in a way that feels traditional	4,097	24.73	21.63	35.34	12.06	6.25

Note: The proportions displayed reflect only the responses from farmers market attendees.

food, or do something fun. We separately examined motivations that would only be relevant to individuals who also participate in food assistance programs (Table 6). Over 25% of those attendees reported the ability to use SNAP at a farmers market as a motivation for attendance either “Quite a bit” or “A great deal.” Among the 19 challenges to attending more often (Table 7), the top challenges were forgetting about farmers markets, high prices, and crowds.

To examine RQ5, we considered whether background characteristics differed among farmers market attendees compared to non-attendees using chi-square tests for independence with a Bonferroni correction applied. Results indicated that farmers market attendees and non-attendees did not differ relative to community type, education, food assistance program participation, political ideology, or weekly food budget. We did find significant differences regarding a number of other variables. Being female was associated with being a farmers market attendee ($\chi^2 [1, N = 4733] = 12.18, p = .008$). Among attendees, 52.29% were female, whereas only 44.92% of non-attendees were female. Note for this particular comparison, we only compared respondents that specified their gender as male or female due to low numbers of individuals who selected other options for gender.

Two of the race and ethnicity variables were significant. There were greater proportions of white respondents among attendees ($\chi^2 [1, N = 4790] = 15.15, p = .002$). Among attendees, 65.65% were white, whereas 57.85% of non-attendees were white. There was a reduced proportion of Black respondents among attendees ($\chi^2 [1, N = 4790] = 11.23, p = .013$). Among attendees, 10.93% were

Black, whereas among non-attendees, 15.41% were Black. There were no significant differences in the other race and ethnicity categories.

With age ($\chi^2 [4, N = 4790] = 44.65, p < .001$), there were smaller proportions of the younger age categories among attendees. Among attendees, 8.41% were Gen Z (ages 18 to 26) and 29.34% were millennial (ages 27 to 42), compared to non-attendees, where 9.67% were Gen Z and 38.67% were millennial (Table 8). For descriptive purposes, we also report on the distribution of ages for the attendees: The first quarter were ages 18 to 34, the second quarter were ages 35 to 51, the third quarter were ages 52 to 64, and the fourth quarter were above age 65.

Regarding the frequency of cooking or preparing fresh food ($\chi^2 [4, N = 4772] = 152.02, p = <.001$), greater proportions of attendees reported cooking more frequently compared to non-attendees (Table 9). Among attendees, 26.33% reported that they cooked about once a day, compared to only 20.52% of non-attendees. Regarding household income ($\chi^2 [3, N = 4790] = 29.34, p = <.001$), there were greater proportions of attendees in the highest income category relative to non-attendees (Table 10). Specifically, 27.52% of attendees had annual household incomes of \$100,000 or more, compared to 22.96% of non-attendees. At the other end of the scale, only 21.17% of attendees had household incomes less than \$30,000 annually, compared to 28.10% of non-attendees. Regarding household size ($\chi^2 [5, N = 4790] = 22.33, p = .007$), among attendees, there was a smaller proportion of single-person households (18.92%) compared to non-attendees (25.98%), as shown in Table 11.

Table 6. Motivations for Attending Farmers Markets Related To Food Assistance Programs

Motivation	N	Not at all (%)	Very little (%)	Somewhat (%)	Quite a bit (%)	A great deal (%)
To use SNAP	801	32.83	12.61	26.22	12.98	15.36
To use the matching incentive dollars offered to those using SNAP at the farmers market	796	38.44	13.69	23.74	11.31	12.81
To use coupons issued to you for local food	799	40.68	12.39	25.53	10.89	10.51

Note: SNAP = Supplemental Nutrition Assistance Program. The proportions displayed reflect only the responses from farmers market attendees who also participate in food assistance programs.

Discussion

We found that a substantial number of people in our national sample—80.30%—had some exposure to farmers markets, attending at least once per year. This highlights how farmers markets are a shared, though occasional, cultural experience for many individuals (RQ1). This finding potentially contrasts with prior national work that characterized farmers market attendance as reaching a smaller proportion of individuals. For example, Rossi (2024) found only 30% of respondents had

shopped at farmers markets in the last month, and a research firm found only 12% of individuals from a national U.S. sample reported doing their “grocery shopping” at a farmers market (Schmidt, 2016).

However, our findings are also generally consistent, although still somewhat higher, with other studies that used more inclusive measurements of attendance. For example, Jilcott Pitts et al. (2014) found that 74.2% of their Kentucky sample had made a purchase at a farmers market or CSA. In

Table 7. Challenges to Attending Farmers Markets More Often

Challenge	N	Not at all (%)	Very little (%)	Somewhat (%)	Quite a bit (%)	A great deal (%)
You forget about farmers markets.	4,079	23.68	16.99	33.24	18.07	8.02
The prices are too high.	4,079	25.79	23.63	30.94	12.50	7.13
There are crowds.	4,071	28.45	23.43	28.15	13.22	6.76
The location isn't convenient.	4,096	35.55	16.82	30.64	11.04	5.96
The parking isn't convenient.	4,086	39.35	18.06	26.11	10.67	5.80
You don't know where or when the farmers markets are.	4,092	41.84	19.04	23.80	9.70	5.62
The hours at the farmers market aren't convenient.	4,083	41.61	18.52	26.11	8.79	4.97
The day of the farmers market isn't convenient.	4,078	43.31	19.05	25.06	8.09	4.49
There aren't convenient public transportation options.	4,081	67.46	10.66	12.25	5.54	4.09
You prefer to shop in stores.	4,068	47.17	16.72	24.31	8.53	3.27
It takes too much time to shop.	4,086	41.36	24.38	23.50	8.05	2.72
You don't feel welcome at the farmers market.	4,100	77.15	9.51	8.10	3.12	2.12
The payment options aren't convenient.	4,067	60.54	17.56	15.93	3.93	2.04
The products at farmers markets are not what you want.	4,077	42.88	28.26	22.57	4.39	1.91
Few people at the farmers market speak your language.	4,085	80.44	7.08	7.83	2.94	1.71
You don't see people like you at the farmers market.	4,089	75.96	9.54	9.20	3.72	1.59
You don't trust that the food is local.	4,054	70.25	14.18	10.95	3.03	1.58
The farmers market is lacking accommodations for physical accessibility	4,070	77.81	8.82	9.09	2.70	1.57
There aren't vendors from the same background as you.	4,077	78.64	8.83	8.19	2.80	1.55

Note: The proportions displayed reflect only the responses from farmers market attendees.

Michigan and Florida studies, approximately 60% of respondents had visited or made a purchase at a farmers market in the last year (Conner et al., 2010; Shi & Hodges, 2016). Similarly Bir et al. (2019) found that, nationally, 63% of individuals reported previously having purchased food from a farmers market, roadside stand, or U-pick operation. It may be that our large sample, with a focus on collecting representational data, helped uncover the commonality of farmers market attendance. It may also be that our measurements for attendance were more inclusive, as we were able to quantify levels of both infrequent and frequent attendance with our survey instrument. In fact, we found infrequent attendance was common, with nearly half (48.01%) of attendees reporting that they go to farmers markets just one to five times per year. This finding is consistent with a systematic review by Maró et al. (2023), which found that many attendees visit

farmers markets just a few times per year. The fact that many people attend only a few times per year suggests that rather than focus on new customer acquisition, which can be resource intensive, farmers market managers might focus on increasing the frequency of attendance and dollars spent per visit among individuals who already attend their markets.

Regarding more frequent attendance, we found that 41.78% of our entire sample attended farmers markets six or more times per year. This aligns with the Zepeda (2009) finding that among a national sample, 45.6% of individuals shopped at farmers markets at least once per month. Similarly, Wolf et al. (2005) found that 42% of individuals surveyed in their California sample had made a purchase at farmers markets in the previous month.

Regarding shopping behaviors and preferences at farmers markets (RQ2), we identified the most

Table 8. Ages of Attendees and Non-Attendees

Attendance category	N	Gen Z = 18 to 26 (%)	Millennial = 27 to 42 (%)	Gen X = 43 to 58 (%)	Baby Boomer = 59 to 77 (%)	Silent Generation = 78 and over (%)
Attendees	4,128	8.41	29.34	22.75	34.86	4.65
Non-attendees	662	9.67	38.67	24.77	22.51	4.38

Table 9. Frequency of Cooking or Preparing Fresh Food Among Attendees and Non-Attendees

Attendance category	N	Cook less than monthly (%)	Cook a few times a month (%)	Cook a few times a week (%)	Cook about once a day (%)	Cook more than once a day (%)
Attendees	4,114	3.60	13.08	36.02	26.33	20.98
Non-attendees	658	13.68	18.85	32.98	20.52	13.98

Table 10. Income Among Attendees and Non-Attendees

Attendance category	N	Less than US\$30,000 (%)	US\$30,000 to under US\$60,000 (%)	US\$60,000 to under US\$100,000 (%)	Over US\$100,000 (%)
Attendees	4,128	21.17	25.02	26.28	27.52
Non-attendees	662	28.10	29.00	19.94	22.96

Table 11. Household Size Among Attendees and Non-Attendees

Attendance category	N	1 person (self) (%)	2 people (%)	3 people (%)	4 people (%)	5 people (%)	6 or more people (%)
Attendees	4,128	18.92	37.04	15.75	12.82	7.83	7.66
Non-attendees	662	25.98	30.63	14.80	13.29	7.25	8.31

“typical” farmers market experience as an individual attending a market along a city’s main street, purchasing fruits and vegetables, patronizing two to five vendors, and spending more than \$25 but less than \$50. The most common spend per trip reported in our study was on the high end, but still in the ballpark, of the Rossi (2022) finding of \$15 to \$28 spent per trip. It may be that the Rossi (2022) average was less because that survey was administered when farmers markets were substantially impacted by COVID-19 protocols.

We also note the variety in the farmers market shopping experience in terms of the number of vendors patronized. Although patronizing two to five vendors was most commonly reported, we found that 10.04% of the sample only shopped with one vendor; these individuals may always shop with a specific vendor or seek a particular product. On the other hand, 15.73% of responding attendees shopped with six or more vendors; these individuals may seek a more diverse array of interactions with vendors, buy a broader selection of products, or buy more of their groceries at farmers markets.

Regarding products most commonly purchased, only 15.50% of attendees reported commonly purchasing meals to eat at markets, and 2.81% reported commonly purchasing meal kits. These types of items may not be available to purchase at many farmers markets, so the fact that these items were not commonly purchased does not necessarily mean they would not be purchased if available. In fact, the data pointed toward interest in buying prepared meals to eat at the market and buying meal kits. For younger attendees desiring to learn more about cooking, offering farmers market meal kits could be a promising strategy to attract or retain them.

We also saw a lack of interest in online ordering, suggesting that even though online shopping is a consumer trend, it may not apply to farmers markets. Such an option could run counter to the experiential benefits of attendance such as socializing, engaging with community organizations, or learning at farmers markets. With the other payment questions, the preference for cash was noteworthy, as it contrasts the Zepeda and Carroll (2018) finding that nearly half of

attendees at a large summer market indicated that they would have spent more had vendors accepted credit cards. This warrants more investigation, and it may be the case that preferences at individual markets vary substantially. However, our results do suggest that markets should continue to focus on cash and be prepared to do so (i.e., to have ample change) given that we found that cash was a preferred payment method. Accepting credit cards and using machines to accept app payments can be expensive for individual vendors and may not necessarily be worth adopting at this time if many customers prefer cash.

Regarding activities done at farmers markets and perceived impacts of farmers markets (RQ3), we found that most attendees did at least one activity not directly related to shopping while at farmers markets. This finding highlights how farmers markets can be viewed in terms other than a consumer experience. Attendees commonly reported that they socialized and learned new things at farmers markets. Over 10% had made a friend at a farmers market, an important statistic given recent reports of isolation among Americans (Office of the Surgeon General, 2023). We found that less common activities at farmers markets included receiving health services or receiving information about voting. Such opportunities may not be available at many farmers markets, but there may be potential for expansion when applicable. Given our finding that a broad cross-section of individuals attend markets, markets appear to be promising spaces for sharing resources and services. Further, we found that because of farmers markets, attendees reported eating healthier and connecting with community organizations. Our results also suggest that attendees may benefit communities economically as they spend money at nearby businesses.

With motivations for and challenges to attending farmers markets (RQ4), we found that top motivations to attend were to buy fresh food, to support local farmers, to get high-quality food, and to do something fun. These motivations largely align with previous research and would likely be wise to emphasize in promoting farmers markets. Regarding challenges, the top challenge was forgetting about farmers markets. This is not a challenge that has been widely investigated before, and it

highlights that promoting markets in a way to make attending them a more habitual practice could be beneficial. Some strategies for managers include ensuring that farmers market days are listed in community event calendars, running campaigns focused on encouraging individuals to add the farmers market day to their personal calendars, posting regular reminders on social media about the farmers market before and on the market day, or encouraging social media users to receive reminders about attending the market. For example, this is an option available through Facebook Events. Additionally, recruiting attendees to help remind others about the farmers market by posting on social media could be a worthwhile strategy. Although only a modest proportion of attendees (10.73%) reported that they had posted a photo from the farmers market to social media, there could be potential for attendees and market managers to promote farmers markets collaboratively.

Another highly rated challenge was perceived higher prices at farmers markets, which aligns with previous research. Relatedly, we found that using SNAP and WIC at farmers markets was of strong interest to current food assistance program participants. These findings underscore the need to continue work that allows markets to accept benefits from SNAP or other food assistance programs, as such programs are key to making markets more accessible to those with lower incomes. Also key are efforts to make farmers markets more convenient for food assistance program participants, such as varying times and locations of operation, encouraging more products eligible to be purchased with food assistance program dollars, and examining potential deterrents in the area in which the market is sited. A related recommendation is to ensure that the greatest number of vendors are able to accept payment via food assistance programs by continuing systems that place the responsibility for issuance at the market level—rather than relying on individual vendors to accept SNAP, which can be cumbersome and cost prohibitive for individual vendors given the current available technology. The practice of accepting SNAP at a central market terminal is currently far more common (Way & Edmonds, 2023).

RQ5 considered the background characteristics

of farmers market attendees versus non-attendees. We found some patterns similar to those prior studies have identified, as we had significant results for variables such as age, gender, household income, and some race and ethnicity categories. However, the data did not support that farmers market attendees are overwhelmingly white, middle-aged women who are highly educated and affluent. These results suggest a shift from findings in earlier studies. Govindasamy et al. (1998) and Brooker et al. (1993) found only 12–13% of attendees were under the age of 35, but in our study, 25% of attendees were ages 34 or younger. We also found a substantial portion of attendees were male and that attendees came from a variety of racial and ethnic backgrounds and had incomes across the spectrum. Past efforts to expand the reach of farmers markets may have resulted in progress toward encouraging attendance at markets among a broad cross-section of society. Nevertheless, more work remains to be done to make farmers markets inclusive (Freedman et al., 2016; Russomanno & Jabson Tree, 2021). We suggest that farmers markets collaborate with community members to understand ways to promote interest in and access to farmers markets at a local level. In particular, we see an opportunity to expand attendance and include more Gen Z and millennial individuals, given their relatively lower representation among attendees (though we found their presence was still stronger than in former studies). We also note the importance of ongoing efforts to implement antiracist strategies at farmers markets. As an example, to respond to such needs, the FMC funded a working group of Black food systems experts who developed the Anti-Racist Farmers Market Toolkit (Jalal et al., 2022).

As a limitation to this work, we note that while we defined farmers markets broadly, our definition would not include mobile markets (e.g., Mobile Market Coalition, 2024). Our survey was also limited to a U.S. sample, and these results may not be applicable to farmers markets attendees in other countries. Another limitation is that although our sample appeared to be generally representative, the 21% response rate suggests the possibility that people with certain characteristics may have been more likely to fill out the survey, and as previously men-

tioned, Asian respondents were proportionally less represented in the data. An additional limitation is that the survey administrator did not provide a race/ethnicity category or sample benchmarks for Indigenous or Native American individuals. While our national dataset enabled us to identify broad trends related to race and ethnicity, we acknowledge the significance of studies that take place at a local level. These studies help amplify the experience of or initiatives involving individuals who have traditionally been underrepresented at farmers markets or in related literature (e.g., Alkon & Vang, 2016; Meyers, 2015; Martin & Vold, 2018).

We further recommend that future research about participation at farmers markets consider some of the novel variables we used in our questionnaire, such as the challenge of forgetting about farmers markets, and focus on activities at farmers markets other than shopping. As we found responses were sensitive to wording in questions about attendance, we also encourage future researchers to use multiple measures for such items and to develop questions with scales that are sensitive enough to capture the participation of individuals who attend farmers markets but do so infrequently. As described in our results, we were not able to classify 6.83% of the sample as “attendees” or “non-attendees” because these respondents had inconsistent responses regarding attendance or were missing data. For example, some of the respondents who could not be classified selected a response option greater than “Never” to the question, “Which of the following describes how often you attend farmers markets when they are seasonally available to you?” (i.e., they selected “Rarely,”

“Sometimes,” “Frequently,” or “Very frequently”). However, these individuals subsequently selected “0” to the question, “How many times would you estimate that you go to a farmers market in a year?” It may be that some respondents interpreted the question asking generally about attendance differently than the question asking about a specific number of visits. Future work might also compare the performance of variables asking attendees to specify attendance at markets within a specific past time period (e.g., in the last year, in the last season, in the last month) to our more general approach to better understand potential sensitivities to question wording.

Relatedly, we see an opportunity for future regional work to compare findings to highlight regional differences, which may be particularly relevant to data regarding seasonality and attendance, differences based on market type, and more consideration of how motivations for and challenges to market attendance may differ based on demographics.

Most strongly, we recommend that future work continue to investigate how farmer markets are integrated into society and can support community-building. One finding that stands out most strongly in our study is that farmers markets attract extensive and diverse participation, indicating that farmers markets are a shared community experience. As a physical place for a broad cross-section of individuals to gather, at a time when such civic opportunities appear to be otherwise in decline, the potential of farmers markets to foster community-building should be further explored and supported.

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Appendix

Table A1. Survey Questions and Response Options for Each Research Question (RQ) (all currency in US\$)

RQ1: How often, and in which seasons, do individuals attend farmers markets?

Which of the following describes how often you attend farmers markets when they are seasonally available to you?

- Response options: Never, Rarely, Sometimes, Frequently, Very frequently

How often do you generally attend the farmers market when it is seasonally available to you?

- Response options: Never, Just a few times each year, About once a month, About once every other week, About once a week.

How many times would you estimate that you go to a farmers market in a year?

- Response options: 0, 1–5, 6–10, 11–15, 16–20, 21–25, 26–30, 31–35, 36–40, 41–45, 46–50, 51–55

Which seasons do you attend farmers markets at least once a month? Select all that apply.

- Response options: Winter, Spring, Summer, Fall
-

RQ2: What are typical shopping behaviors and preferences at farmers markets among attendees?

All farmers markets are a little different, but for the farmers market you go to most frequently, which of the following is the description that best fits where it takes place?

- Response options: Outside or inside of a building like a library or hospital, In a neighborhood, Along a town or city's main street, Somewhere in an area that attracts tourists and has a festival atmosphere, In a location without buildings or development

Which products do you commonly purchase at the farmers market? Select all that apply.

- Response options: Fruits and vegetables; Meat; Bakery; Dairy, including cheese; Eggs; Packaged products like jams, syrups, and sauces; Beverages to drink at the farmers market like coffee or smoothies; Meals to eat at the farmers market, like hot food in takeout containers or on paper plates; Cut flowers; Plants for your garden or yard; Arts and craft products like soap, candles, or jewelry; Meal kits to prepare at home; Other

How interested are you in these features of farmers markets?

- Items in the question matrix: Buying prepared meals or snacks to eat at the farmers market, Buying a meal kit at the farmers market to take home and make, Pre-ordering farmers market products online and picking them up at the market, Pre-ordering farmers market products online and having them home delivered
- Response options: Not at all interested, Slightly interested, Somewhat interested, Quite interested, Very interested

How many vendors do you shop with on an average trip to the farmers market?

- Response options: 0, 1, Between 2 and 5, Between 6 and 10, More than 10

How much do you spend on an average trip to the farmers market?

- Response options: Less than \$10, Between \$10 and \$25, More than \$25, less than \$50, More than \$50, less than \$75, More than \$75, less than \$100, More than \$100

Farmers markets offer different kinds of payment options. How interested are you in the following payment options at farmers markets?

- Items in the question matrix: Using a credit card, Using cash, Using gift cards or certificates, Paying digitally with apps like Venmo or PayPal, Using food assistance benefits such as SNAP or WIC, Using matching incentive dollars offered to those using SNAP at the farmers market, Using coupons issued by the farmers market or a state agency.
 - Response options: Not at all interested, Slightly interested, Somewhat interested, Quite interested, Very interested
-

(continued)

*Table A1 continued***RQ3: What activities do attendees report doing at markets beyond shopping, and what impacts from attendance do they perceive?**

Because of past trips to farmers markets, have you done the following things?

- Items in the question matrix: See Table 4
- Response options: Not at all, Very Little, Somewhat, Quite a bit, A great deal

At the farmers market, have you ever done the following? Select all that apply.

- Response options: Learned about cooking, Learned about growing food, Learned new things about food, Gotten ideas about new business opportunities, Learned new things about the community, Made a connection with a new organization, Spent time with friends or family, Met a new person, Made a friend, Gotten information about voting, Registered to vote, Received a health service such as a blood pressure check, Taken a photo and posted it to social media, None of these activities

RQ4: What motivations for and challenges to attending farmers markets do attendees perceive?

Are these reasons you shop at a farmers market?

- Items in the question matrix: See Tables 5 and 6
- Response options: Not at all, Very Little, Somewhat, Quite a bit, A great deal

Are the following reasons you don't shop at farmers markets more often?

- Items in the question matrix: See Table 7
- Response options: Not at all, Very Little, Somewhat, Quite a bit, A great deal

RQ5: How do the background characteristics of farmers market attendees and non-attendees differ?

The following demographic and background characteristic items were either included on the survey instrument or provided by NORC:

- Age: Reported in years and categorized as Gen Z = 18 to 26; Millennial = 27 to 42; Gen X = 43 to 58; Baby Boomer = 59 to 77; Silent Generation = 78 and over
- Community type: Urban, Suburban, or Rural
- Cook or prepare fresh food: Less than monthly, A few times a month, A few times a week, About once a day, More than once a day
- Education: Less than high school, High school graduate, Some college or associate's degree, Bachelor's degree, Post-graduate or professional degree
- Food assistance program participant status: Collapsed into categories of participant or nonparticipant
- Gender: Male, Female, Transgender, Other
- Household income (annual): Collapsed into categories of less than \$30,000; \$30,000 to under \$60,000; \$60,000 to under \$100,000; Over \$100,000
- Household size: 1 person (self), 2 people, 3 people, 4 people, 5 people, 6 or more people
- Political ideology: Very liberal, Somewhat liberal, Moderate, Somewhat conservative, Very conservative
- Race and ethnicity: Asian, Black, Hispanic/Latino, Multiracial, Other, White. Note that individuals who identified as Hispanic/Latino in addition to another category were coded as Hispanic/Latino per NORC's procedures.
- Weekly food shopping budget: Less than \$100, \$100 to \$200, \$201 to \$300, \$301 to \$400, Over \$400

Table A2. Comparison of the Survey Sample to U.S. Benchmarks for Key Demographics, as Supplied by the National Opinion Research Center (NORC)

Demographic category	N	Survey sample (%)	Benchmark for U.S. (%)
Age			
18–34	319	6.2	11.7
25–29	380	7.4	8.4
30–39	1,044	20.3	17.5
40–49	807	15.7	15.9
50–59	751	14.6	15.9
60–64	597	11.6	8.2
65 Plus	1,249	24.3	22.4
Education			
Less than high school	288	5.6	9.0
High school equivalent	946	18.4	29.0
Some college/associate degree	2,010	39.1	26.4
More than college	1,892	36.8	35.6
Gender			
Male	2,504	48.7	48.8
Female	2,637	51.3	51.2
Race			
White	3,301	64.2	61.4
Black	601	11.7	12.1
Hispanic/Latino	884	17.2	17.4
All other	355	6.9	9.0

Farmers market food safety: A comprehensive review of training needs in the U.S.

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Submitted April 17, 2024 / Revised June 27 and August 15, 2024 / Accepted August 15, 2024 /
Published online October 30, 2024

Citation: Topalcengiz, Z., Sirsat, S. A., Acuff, J. C., & Gibson, K. E. (2025). Farmers market food safety: A comprehensive review of training needs in the U.S.. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 251–269. <https://doi.org/10.5304/jafscd.2024.141.005>

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Abstract

Farmers markets offer an apparently easy way for small-scale or hobbyist food producers to sell fresh produce, meat, and poultry from their farms or dis-

tribute value-added products, but they may be unaware of the foodborne illness risks associated with both fresh produce and derivative products, as well as of their local food safety requirements. Food guidance and rules vary from state to state and market to market, making it difficult for individuals to navigate the various regulatory levels.

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Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could appear to have influenced the work reported in this paper.

Funding Disclosure

This project was supported by Agriculture and Food Research Initiative Competitive Grant No. 2022-70020-37593 from the USDA National Institute of Food and Agriculture.

Even if a local food producer is exempt from these rules due to their amount of sales, they will still benefit greatly from resources and educational tools that increase awareness and knowledge of food safety best practices. This review discusses current knowledge of and guidelines for food safety in farmers markets based on peer-reviewed and grey literature as well as published guidelines and recommendations. We examine facilities and supplies, regulatory measures, education and training, and Good Farmers Market Practices as preventive measures to enhance food safety in farmers markets, which are critical to local and regional food systems. Overall, we identified various barriers to implementing farmers market food safety standards and practices in this scoping review; removing these barriers will require the participation of local regulatory authorities, market managers, vendors, and consumers.

Keywords

pathogen, cross-contamination, vendor, manager, value-added, fresh produce, cottage food, local food system, farmers markets, regulations, food safety, education and training, facilities, Good Farmers' Market Practices

Introduction

According to a 2021 U.S. Department of Agriculture (USDA) Economic Research Service (ERS) report, over the previous decade local food sales increased nationwide through a variety of market channels (Martinez & Park, 2021). Despite no uniform USDA definition of the term “local” (Rossano, 2022), local food markets contribute substantially to the economic growth of communities. Rossi et al. (2017) reported that local food sales generate greater regional sales, employment, and gross domestic product when compared to the same dollar value of conventional food sales. According to the National Farmers Market Directory (NFMD), there are a little over 10,000 U.S. farmers markets, more than triple the number recorded in 2000 (2,024). Local food producers most often sell their products at direct-to-consumer venues, including farmers markets, on-farm stores, community supported agriculture (CSA) programs, and pick-your-own operations (Martinez & Park,

2021). The income generated in local and regional food systems provides significant support for many farmers, especially new and beginning farmers and small-scale farmers (Martinez & Park, 2021). In addition, the growth of farmers markets in the past several years helped to fill gaps in the supply chain during the COVID-19 pandemic, with some farmers markets showing their highest sales in 2020, along with helping to renew public interest in local food options (Goldy et al., 2020). Moreover, Thilmany et al. (2021) reported that local and regional food systems responded to the COVID-19 pandemic in more nimble ways compared to the national food supply chain.

Public interest in local food products, such as cottage foods (i.e., homemade goods) and home processing, has risen notably in the last several years (Goldy et al., 2020). Coupled with supply chain disruptions and a shortage of canning supplies, this interest led entrepreneurs to explore alternative home food processing methods during the COVID-19 pandemic, including ones that may not ensure food safety (Niles et al., 2021). Furthermore, in 2021 numerous states passed various forms of food freedom acts that amended cottage food laws to cottage food make selling cottage foods easier for local food producers and farmers market vendors (Farquhar, 2020). Many small-scale growers and food processors who sell directly to retailers are exploring ways to manufacture value-added products that could increase the market value of their raw commodities and yield higher profits. For instance, dairy products such as cheese and yogurt may yield greater profits than the milk itself (Alvarez et al., 2018). Canned low-acid or fermented vegetables can utilize fresh produce gleaned as “seconds,” preventing food waste and providing an additional source of income during off seasons. Prepared foods can also increase the income viability of local food producers, though there can be a several year lag without increased income (Clark, 2020).

These value-added foods may present opportunities for economic growth, but key knowledge about risks and best practices is required for safe production of the food. Increased interest in, access to, and ability for producing and selling cottage foods without a proportional increase in dis-

semination of food safety knowledge and best practices could result in unintended consequences. In the last three decades in North America, several confirmed outbreaks in farmers markets have occurred due to contaminated cheese, meat, fruit, and vegetables (Wisconsin Department of Health Services [WDHS], 2022; Young et al., 2017). In retail settings such as farmers markets, foodborne illness risk factors may include food from unsafe sources, inadequate cooking, improper holding or time/temperature controls, contaminated equipment or protection, and poor personal hygiene (National Retail Food Team, 2010). Recommendations for Good Retail Practices for food service and retail establishments are available to facilitate control of basic operational and sanitation conditions under the U.S. Food and Drug Administration (U.S. FDA) Food Code (U.S. FDA, 2022a) which may apply to direct-to-consumer venues depending on products sold. Furthermore, cottage food laws (e.g., food freedom acts) are in place in all states, with various requirements, recommendations, certifications, permits, and guidelines. A comprehensive list of these laws is available at the National Agricultural Law Center.¹

Nevertheless, lack of handwashing, incorrect glove use, and temperature control issues related to holding foods have been widely reported across farmers market food safety studies (McIntyre, Karden et al., 2014; Miller, 2020; Young et al., 2020). Young et al. (2017) performed a systematic review comparing food safety-related issues and practices for products sold in farmers markets, indicating a small but significant number of problems with unsafe practices and contamination, including two deaths as consequences. Conversely, in the present review, peer-reviewed and grey literature, in addition to guidelines and recommendations by university cooperative extension service and local governments relevant to food safety in farmers markets, were examined to evaluate knowledge gaps in understanding food safety risks related to local food products. Based on the literature review, preventive measures categorized on four main areas (facilities, regulatory, education, best practices) are identified and discussed as strat-

egies to enhance food safety in farmers markets.

Food Safety Risks of Products Sold in Farmers Markets

The types of products sold in farmers markets varies depending on location, weather conditions, seasonality, demographics, consumption habits, consumer preferences, socio-economic parameters, and individual market rules. In some cases, vendor ingredient preferences and their creativity shape the value-added goods offered with little or no consideration for food safety (Richard et al., 2023). The risks of foodborne illnesses linked to each product type depend on several factors spanning vendor-to-consumer practices and individual farmers market rules and guidelines. Food categories and products sold in farmers markets in 2019 are presented in Table 1, based on a national survey of farmers market managers by the USDA National Agricultural Statistics Service (USDA NASS, 2020). Foods with elevated risks, in the milk and dairy (44.3%) and seafood, meat, poultry, and eggs (84.5%) categories, require time and temperature control for safety. Crops in the category of fruits and vegetables (99.6%) commonly consumed raw are also sold by vendors in all farmers markets. The food products and categories in Table 1 were then overlaid with data showing if a food has been linked to confirmed or suspected foodborne outbreaks during 1998–2021 in the U.S. Centers for Disease Control and Prevention (CDC) National Outbreak Reporting System (NORS) (CDC, 2023).

When stored and handled properly, products requiring a kill step to eliminate or reduce harmful microorganisms before consumption (e.g., cooking raw meat to appropriate internal temperature) should not necessarily be of concern as a source of cross-contamination at the point of sale. However, outbreaks of *Salmonella* and *Trichinella* have been associated with pork products and wild boar meat sold in farmers markets in Canada and the U.S., respectively. (Kennedy et al., 2009; National Microbiology Laboratory & Centre for Food-borne Environmental and Zoonotic Infectious Diseases, 2006). Similarly, the risk of foodborne illness is reduced in cottage food products after cooking,

¹ <https://nationalaglawcenter.org/state-compilations/cottagefood/>

acidification, pickling (Pérez-Díaz et al., 2015), canning (Nichols, 2016), and addition of salt and sugar (Sehrawat et al., 2021) when prepared with basic hygiene rules and best practices (Etzel et al., 2015).

However, homemade beverages and ready-to-eat (RTE) food can be at higher risk for foodborne illness transmission due to contaminated ingredients or non-hygienic preparation practices. For exam-

Table 1. Food Categories and Products Sold in Farmers Markets in 2019 Along with the Number of Confirmed or Suspected Outbreaks (1998 to 2021) Linked to Those Types of Food Products in General

Category	Product	Confirmed/ suspected foodborne outbreaks	Searched terms for food vehicle	Sold in farmers market (%)
Milk and dairy				44.2
	Cheese	501	Cheese	92.0 ^a
	Yogurt	14	Yogurt	29.3 ^a
	Milk	415	Milk	34.6 ^a
	Butter	43	Butter	30.6 ^a
Bread and baking goods				90.9
	Baked goods	92/129	Bread/Baked	99.8 ^a
	Grains/flour	211/7	Grains/Flour	17.6 ^a
Fruit and vegetables				99.6
	Fresh fruit	515	Fruit	95.3 ^a
	Fresh vegetables	625	Vegetable	99.3 ^a
	Fresh and dried herbs	89	Herb	79.6 ^a
Seafood, meat, poultry, and eggs				84.5
	Fish and seafood	2,262/93	Fish/Seafood	28.0 ^a
	Red meat	345 /227	Meat/Steak	70.2 ^a
	Poultry	2,473/707/16/1	Chicken/Turkey/ Duck/Goose	52.5 ^a
	Eggs	656	Egg	93.9 ^a
Condiments and sauce				94.1
	Honey	26	Honey	93.2 ^a
	Canned fruits and preserves	14	Canned	87.8 ^a
	Maple syrup	0	Maple/Syrup	38.8 ^a
Beverages				60.4
	Alcoholic beverages	12	Alcohol	28.2 ^a
	Coffee and tea	10/31	Coffee/Tea	73.6 ^a
	Other non-alcoholic	0	-	73.8 ^a
Other foods				77.9
	Tofu and/or meat and dairy substitutes	6	Tofu	7.7
	Nuts	51	Nuts (doughnuts excluded)	40.9 ^a
	Mushrooms	85	Mushroom	49.0 ^a
	Wild harvested and foraged	0	-	17.6 ^a
	Prepared foods	2,441	Food Prepared	70.0 ^a
	Seed of edible plants	0	-	18.7 ^a
	Fermented and pickled foods	5/9	Fermented/Pickle	58.8 ^a

^a Product breakout percent is for respondents reporting sales within the product category.

Data sources: Data are based on a report detailing the results of the National Farmers Market Managers survey published by the Agricultural Statistics Board of the U.S. Department of Agriculture National Agricultural Statistics Service (USDA NASS, 2020), and the number of confirmed or suspected local and multistate foodborne outbreaks between 1998 and 2021 listed in the National Outbreak Reporting System (NORS) at the U.S. Centers for Disease Control and Prevention (CDC, 2023).

ple, confirmed outbreaks of *Escherichia coli* O157:H7 and *Salmonella* associated with a guacamole product and apple cider, respectively, sold in farmers markets have been reported (Sun et al., 2010). Artisan cheeses made from raw milk, plus inadequate aging, can also harbor foodborne pathogens such as *E. coli* O157:H7, *Salmonella*, and *Listeria monocytogenes*, and these have been linked to foodborne outbreaks in North America (Ellis et al., 1998; Honish et al., 2005; McIntyre et al., 2015). It has been determined that these outbreaks occurred due to poor handling practices and the use of ingredients from unsafe sources.

Fresh fruits and vegetables generally consumed raw, and products prepared with these commodities, along with foods with time and temperature control for safety (TCS) sold at farmers markets, are considered some of the more high-risk products due to the lack of any pathogen kill step. In 2019, fresh fruit and vegetables were sold at 99% of farmers markets and generated the primary revenue (20–36%) for U.S. vendors (USDA NASS, 2020). While contamination of fruits and vegetables may occur during production, harvesting, and post-harvest handling (Harris et al., 2003; Topalcengiz et al., 2024), pathogen populations still cannot be adequately reduced to undetectable levels on fresh produce with home washing methods like running tap water, soaking in tap water, or using vegetable washing solutions such as 5% vinegar solution or 13% lemon solution (Kilonzo-Nthenge et al., 2006; Uhlig et al., 2017). Contaminated cantaloupe, strawberries, blackberries, and tomatoes—all frequently eaten raw—from farmers markets have caused outbreaks due to contamination with *E. coli* O157:H7, *Salmonella*, and Hepatitis A virus (CDC, 2020; Douglass et al., 2016; Laidler et al., 2013; Smathers, 2012). Shelled peas purchased in farmers markets in Wisconsin and Alaska have also been implicated as outbreak sources of outbreaks of *Campylobacter jejuni* and *Salmonella*, respectively (Gardner et al., 2011; WDHHS, 2022). These outbreaks demonstrate that the food safety concerns stated are valid for a variety of food products sold in farmers markets. To some extent, consumers are compelled to accept a potentially higher risk of foodborne illness when they purchase homemade products, fresh produce eaten

raw, and raw milk or associated products, regardless of retail venue.

Fate of Pathogens in Farmers Markets

As stated, five primary risk factors for the transmission of foodborne illness have been identified for foodservice, restaurants, and retail settings (Retail Food Program Steering Committee, 2000): unsafe food sources, inadequate cooking, improper holding or time/temperature control, contaminated equipment/protection, and poor personal hygiene. These factors also apply to settings in farmers markets. Pathogens may be introduced to products sold in farmers markets at any stage and can survive for prolonged periods of time, long enough for foodborne pathogens to persist and cause foodborne illnesses (Harrison, 2017; Young et al., 2017). Products having a kill step such as cooking before consumption may not cause foodborne illnesses when properly cooked. However, pathogens in meat, seafood, and poultry can be sources of cross-contamination of RTE food or produce consumed raw at farmers markets due to the use of contaminated equipment or food-contact surfaces or inadvertent cross-contamination between products (e.g., leakage of raw animal protein products onto fresh produce).

Because fruits, vegetables, and leafy greens are frequently consumed raw, they require extra attention, as they may introduce pathogens originating at the farm to the market or become contaminated during transportation, display, preparation, or storage at the farmers market. Possible routes of contamination during the production and harvest of fresh produce include agricultural water, biological soil amendments of animal origin (BSAAO), domesticated and wild animals, workers, and equipment and buildings (USFDA, 2015). When contaminated in the field, produce pathogens can persist until consumption or become a source of contamination at the farmers market. For example, the use of raw manure without waiting between application and harvest and the use of a water source with no microbiological testing are common among the small to medium-sized farms that are often vendors at farmers markets (Harrison et al., 2013). Produce can also become contaminated during the preparation of minimally processed food at

the farmers markets from utensils, aprons, other products for sale, lack of hygiene practices, food-contact surfaces, or customers touching the items in different booths (Acosta et al., 2021; Li et al., 2017).

A greater risk of pathogen presence and higher microbial loads have been reported in farmers markets for various food items compared to conventional retail counterparts (Roth et al., 2018; Scheinberg et al., 2013; Soendjojo, 2012). For instance, Roth et al. (2018) reported that total coliform concentration in leafy greens and spinach were approximately 2.1 and 3.4 times higher at farmers markets than at retail supermarket counterparts. Whole, raw chickens ($N = 100$) sold in farmers markets in Pennsylvania were 90% and 28% positive for *Campylobacter* and *Salmonella* spp., respectively, compared to 8% and 52% in conventionally processed, nonorganic chicken, respectively (Scheinberg et al., 2013). Vendors' limited food safety knowledge regarding TCS foods (e.g., fresh-cut fruits, sprouts, ready-to-eat salads, eggs, milk products, and raw, cooked, or partially cooked meat, poultry, and seafood) combined with the lack of cooling, refrigeration, and freezing available at farmers markets may compound the risk of food-borne illnesses (Harrison et al., 2013; Scheinberg et al., 2018; Teng et al., 2004). Thus, the fate of pathogens in farmers markets depends on several factors, including lack of food safety knowledge of both vendors and market managers, limited or no refrigeration, and uncontrolled parameters such as consumer behaviors (e.g., running additional errands before taking products home for proper storage), weather conditions such as heat, and food from unsafe sources.

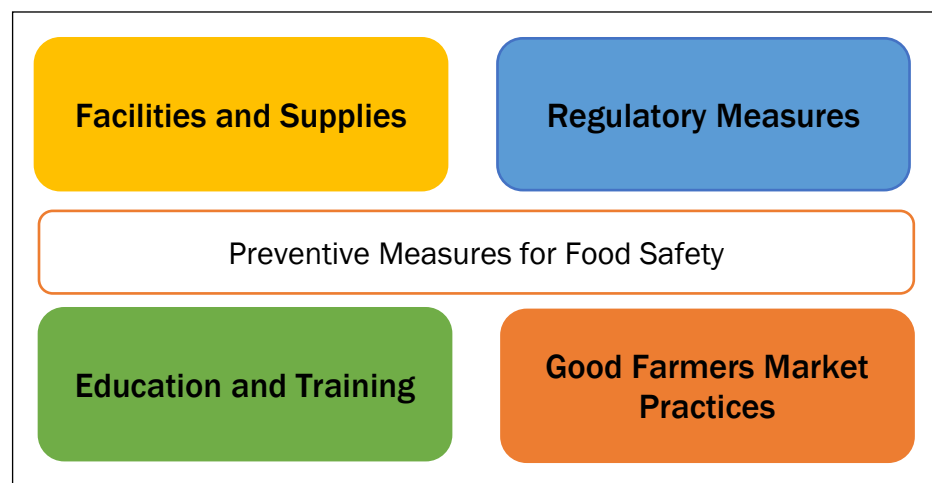
Literature Search Criteria

The most recent literature review of farmers markets studies was published in 2017

by Young et al. However, that scoping review did not specifically focus on food safety at farmers markets, and additional studies have been published in the past five years that should be considered. In the present study, we performed a realist review of the farmers market food safety literature to identify contextual elements that promote or impede the act of receiving and implementing knowledge during knowledge dissemination. To identify these elements, a variety of data sources were used in addition to empirical studies, including grey literature (e.g., reports, white papers), commentaries, and theoretical papers (Jagosh, 2019). This realist review approach to identify context-mechanism interactions to inform food safety training has not been widely used (Yeargin et al., 2021), yet it holds the potential to address the current research-practice gap—between knowledge reception and actually putting knowledge into practice—in food safety training interventions. In this review, we focused specifically on preventive measures to enhance food safety in farmers markets in the four areas: (a) facilities and supplies, (b) regulatory measures, (c) education and training, and (d) Good Farmers Market Practices (Figure 1).

In addition, we conducted a search for farmers market food safety resources to determine the quantity and topic areas of resources available through university cooperative extension and state health and agriculture departments. All resources

Figure 1. Areas for Preventative Food Safety Measures in Farmers Markets



were collected that resulted from a Google search for “[State] Cooperative Extension Farmers Market Food Safety” and compiled in a spreadsheet with the following information: state, type of resource (video, factsheet, webpage, legislation, etc.), key word(s), topics covered, author(s), date published, and link.

Results and Discussion

Preventive Measures to Enhance Food Safety in Farmers Markets

Minimizing food safety hazards in farmers markets is more challenging than in retail food settings as the temporary market settings, operated by managers and vendors on a part-time basis, are hard to control (Boys & Fraser, 2019; Mack & Tong, 2015). Preventive approaches with all parties collaborating may reduce the risk of foodborne illnesses. Facilities and supplies, regulatory measures, education and training, and development of Good Farmers’ Market Practices (Chapman & Sain, 2017) have been identified as the four main areas of preventive measures to enhance food safety in farmers markets (Figure 1).

Facilities and supplies

Properly designed and well-maintained facilities with enough supplies for both customers and vendors are essential to reduce contamination risk at farmers markets. To support this need, facility and design recommendations and guidelines to enhance food safety practices have been published by governmental agencies (CDC, 2014), nonprofit organizations, and university researchers and cooperative extension services (Boyer & Yang, 2017). Despite current knowledge and efforts, sufficient facilities and supplies at farmers markets are often inadequate and remains a food safety risk (Harrison, 2017). Handwashing facilities and supplies, proper storage of TCS foods, and appropriate food-contact surfaces and materials represent the main food safety concerns. The presence of companion animals can also be a food safety concern and is generally not recommended by food safety professionals (Boyer & Yang, 2017).

Adequate handwashing and using gloves properly are essential during the preparation and

handling of food to avoid transferring pathogens to the final product. As reported by Behnke et al. (2012), access to handwashing stations affects the handwashing frequency of farmers market vendors and customers. However, little to no access to well-maintained handwashing facilities and insufficient supplies have been observed in farmers markets, possibly affecting vendors’ ability to practice handwashing in most circumstances (Behnke et al., 2012; Harrison et al., 2013; McIntyre, Karden et al., 2014; Smathers, 2012; Worsfold et al., 2004). Handwashing facilities should be convenient, unobstructed, and within a manageable and easily accessible distance (e.g., some recommend within 25 feet/7.6 meters) from vendor booths or tables. These handwashing stations should also include adequate supplies such as potable water, catch basins for wastewater, liquid soap, paper towels, and trash cans.

Proper and effective storage of TCS foods requires refrigeration to control the growth of pathogens. TCS foods should be held below 5°C (41°F) and above 57.2°C (135°F) for cold and hot storage, respectively (Chapman & Sain, 2017; USDA, 2019). However, the display and storage of TCS products such as eggs and processed fruits and vegetables without refrigeration has been observed in farmers markets, especially during months with warmer ambient temperatures (Harrison, 2017; Li et al., 2017; McIntyre, Herr et al., 2014; McIntyre et al., 2015; Scheinberg et al., 2018; Teng et al., 2004). For example, only 60% of vendors selling TCS foods were observed to be in compliance with the food temperature control requirement at Canadian farmers markets (McIntyre, Herr et al., 2014). Other studies suggest that the use of thermometers to verify temperature control is not always followed (Teng et al., 2004). In the U.S., only 12.7% of vendors selling TCS food at Pennsylvania farmers markets were observed (i.e., under direct concealed observation) with a thermometer on site or in the cold storage unit at the farmers markets (Scheinberg et al., 2018). These types of circumstances may occur due to both a lack of knowledge or training by both managers and vendors (Mohammad et al., 2020), and a lack of onsite storage facilities and cooling units. To address the lack of cold storage at farm-

ers markets, Scheinberg et al. (2018) reported that some vendors selling temperature-sensitive foods used portable coolers with ice (16.9%) and without ice (9.9%). However, these cold storage solutions can still be susceptible to temperature fluctuations.

The transfer and survival of pathogens between food-contact surfaces and produce have been demonstrated at farmers markets. Surface types include reusable and single-use gloves (Brar & Danyluk, 2013), clean and dirty cloths (Beiza et al., 2021; Sreedharan et al., 2014), new, used, and dirty corrugated fiberboard boxes (cartons) (Topalcengiz et al., 2023), plastic (Zhu et al., 2020), and stainless steel (Xie et al., 2023). The cleanliness of surfaces in contact with food at farmers markets has been widely reported as deficient. Specifically, signs of dirt and lack of cleanliness ranged 10.8%–81% across multiple studies for vendors observed handling foods such as poultry, cheese, and produce (Scheinberg et al., 2018; Teng et al., 2004; Vandeputte et al., 2014). The considerable percentage gap among observed unclean food-contact surface materials can be explained by the subjective nature of the observation, type of data collection, type of food handled, and the time during a given farmers market operating hours that the observation was made, which may result in more or less frequent business transactions.

The use of easy-to-clean surfaces is another important factor to reduce risk of foodborne disease transmission. For example, using plastic containers is suggested rather than those made of porous materials, primarily because porous materials such as pressed cardboard, molded pulp fiber, and wood have slower reduction of pathogens including *E. coli* O157:H7, *Salmonella*, and *L. monocytogenes* at refrigerated and room temperature (Beiza et al., 2021; Li et al., 2017). Thus, the use of cleanable materials is recommended and often required by farmers market managers and local authorities (Boyer & Yang 2017; Harrison, 2017).

Regulatory measures

Regulations pertaining to farmers markets food safety practices are not established at the federal

level and thus are not enforced by governmental agencies such as the U.S. FDA or USDA Food Safety Inspection Service (FSIS). Regulations and rules for the sale of food products at farmers markets are established at the state level by departments of health and/or farmers market associations, and often differ across states and even between counties within a state (Smathers, 2012). Regarding value-added food sales at farmers markets, 19 states have enacted their own cottage food or food freedom legislations, legislation summaries, or additional resources for regulatory compliance on easily accessible sites such as university cooperative extension services and state government webpages. Other states may have regulations and related published resources, but they could not be found with the search criteria used. Individuals looking for them would have to tailor their search to find legal guidance in states where these resources are not easily accessible.

Some states also require retail food licenses in order to operate food facilities at farmers markets. Responsible state health or agriculture departments may issue permits and licenses to market vendors as a regulatory tool (Hoffman et al., 2007). Although intact, unprocessed fruits and vegetables and similar products are not regulated, state-level departments generally have regulatory authority over processed food items sold in farmers markets. In contrast, foods covered by cottage food laws may or may not require registration, licensing, and permitting, and may be inspected by responsible state departments with little or no regulatory oversight in general (see compilation by The National Agricultural Law Center²).

The model policy known commonly as the “Food Freedom Act” was finalized in 2018 and recognizes the right of individuals to produce and consume homemade foods with no unnecessary and competitive regulations.³ The term food freedom act may have various names and versions for similar legislative purposes by state governments. The act led to updates of cottage food rules where the sale of cottage food had previously been illegal, such as in the state of New Jersey. Depending on

² <https://nationalaglawcenter.org/state-compilations/cottagefood/>

³ <https://alec.org/model-policy/food-freedom-act/>

state law, cottage food products may or may not be limited to a prescribed list and may or may not allow for direct or indirect sales to end consumers. Limits on annual revenue and labeling requirements vary in each state's cottage food law. In some states, cottage foods are classified based on type of foods, direct sale, certifications, degree of risk, and producing location, e.g., at home or on farm. Common elements of state cottage food laws include types of food products allowed, limits on where these food products can be sold, required registration, licenses, inspections, and/or permits, limits on total sales, and required labeling. These state food laws have been compiled for comparison by the Harvard Law School Food Law and Policy Clinic⁴ and are also available at the National Agricultural Law Center as noted above.

Improvement of food safety at farmers markets is supported with direct and indirect local and national funding sources. Local governments grant state-specific farmers market and local food promotion programs, in addition to technical, consulting, licensing, certification, and educational and training services. USDA grants available to enhance food safety in farmers market include the Local Food Promotion Program,⁵ Organic Agriculture Research and Extension Initiative,⁶ and Beginning Farmer and Rancher Development Program.⁷ All other possible grants, loans and funding support are listed under various services.⁸

Education and training

Food safety training programs and certification are among the backbones of the effort to prevent foodborne illnesses. Effective training programs are essential for both protection of public health and the survival of food companies. From nationwide companies with bulk production to vendors selling locally grown and processed foods, food safety knowledge delivery requires the cooperation of all parts of a food business, including employees, managers, and trainers. The extent and content

of the food safety knowledge provided is typically based on type of products, processes, knowledge level, and the responsibilities of the trainee.

Food safety knowledge and awareness in farmers markets continue to lag based on published studies in different locations. Harrison et al. (2013) reported that risky on-farm practices could lead to pathogen contamination of produce sold in farmers markets across three southeastern states. This survey-based study indicated that a lack of compliance with applying soil amendments as well the use of untested surface water sources for agricultural and cleaning purposes (Harrison et al., 2013). However, these reported on-farm practices occurred prior to the enactment of the Produce Safety Final Rule (USFDA, 2015). Another survey-based study in Arkansas and Texas found that only about 37% of vendors and farmers market managers received formal food safety training, and only half of market managers provided food safety educational materials to vendors (Mohammad et al., 2020). In Rhode Island farmers markets, 81% of vendors were observed to have unsanitary conditions, such as visible dirt on clothes and nails and improper hygiene practices including handling money or touching the body and then produce with no hand washing in between (Vandeputte et al., 2014). Another direct observational study at 18 farmers markets in Indiana revealed that proper food safety practices were rarely followed by vendors, with handwashing regulation compliance observed only twice in 417 transactions (Bhenke et al., 2012).

More positive observations, however, have been reported as well regarding food safety knowledge and awareness at markets. In Pennsylvania, both direct and concealed observations and a state sanitarian survey showed low percentages of unclean clothing and unclean stalls at farmers markets, despite some important gaps in vendor food safety behavior, such as insufficient hand washing and cross-contamination (Scheinberg et al., 2018).

⁴ https://chlpj.org/wp-content/uploads/2013/12/FLPC_Cottage-Foods-Report_August-2018.pdf

⁵ <https://www.ams.usda.gov/services/grants/lfpp>

⁶ <https://www.nifa.usda.gov/grants/funding-opportunities/organic-agriculture-research-extension-initiative>

⁷ <https://www.nifa.usda.gov/grants/funding-opportunities/beginning-farmer-rancher-development-program>

⁸ <https://www.ams.usda.gov/services/local-regional/food-sector/grants>

Chen et al. (2022) reported that 82% of small-scale produce growers in Indiana selling in farmers markets declared themselves knowledgeable about food safety. In California, over two-thirds of surveyed farmers market managers claimed that food safety standards (which are under their responsibility on-site) are in place (88.2%) and in compliance with local and environmental health department regulations (Pires et al., 2020). Nevertheless, food safety knowledge and awareness are highly variable in U.S. farmers markets despite educational efforts and regulatory requirements and guidance documents.

Resources for educational materials

Many educational materials and training resources from governmental agencies and university cooperative extension services are available to fill food safety knowledge gaps, reduce the risk of food-borne illnesses at farmers markets. Written recommendations, guidelines, and training resources have been developed and published in many states through cooperative extension services or health departments, with varying depth and detail (CDC, 2014). Visual, auditory, and interactive educational materials to enhance food safety are also available for managers, food vendors, and growers, including general and product-specific information about safe handling practices, avoiding cross-contamination, temperature monitoring, hot holding, cleaning and sanitation, personal hygiene, washing stations, proper cooking, storage, and labeling. All vendors and market managers are expected to comply substantially with relevant rules and regulations by customers and regulatory authorities. To improve product the safety, some state and local governments require certification of vendors and permits to sell at the farmers markets (see Education and Training, above).

Rules and safety guidelines with similar handling and storage recommendations have been published in each state by university cooperative extension service, state programs and divisions, or farmers market coalitions for market managers and vendors. The guidelines may include food safety knowledge and best practices for different types of foods. The same guidelines used in multiple states may also be recommended by different extension

services or state government websites. We found resources from 47 of the 50 states, with topics varying little. While this may seem repetitive, most university cooperative extension programs aim to gain trust from local communities as a source of reliable information. Therefore, many programs will repost other state's resources or paraphrase the same concepts using their own branding.

Using the methods that were used for this review to search for these materials, 197 unique resources were identified online: 100 were fact-sheets, webpages, or presentations generated by university cooperative extensions; 51 were from state government webpages; and the remaining 46 were from interest entities, such as state farmers market associations or personal blogs. The most common topics were hygiene and handwashing; sanitation; permit and other regulatory requirements; holding and storage temperatures; and guidance on included or excluded foods based on potential hazards. Other materials provided information about production (farm, slaughter, transportation, GAPs), processing (acidifying, dehydration, cooking, canning, handling), and selling (labeling, sampling, temperature control). Additionally, six resources provided through cooperative extension specifically provided self-evaluation checklists and toolkits.

Training programs

Delivering knowledge and establishing proper food safety practices to farmers market vendors, managers, and growers is not an easy task. For example, 78% of Indiana small-scale produce growers agree that food safety is one of the top parameters in a value-added business, but time limitation and the large amount of necessary expertise are identified as the two main barriers for growers to learn more about food safety (Chen et al., 2022). Chen et al. also reported that growers tend to receive more educational materials about increasing sales and communicating with regulators and inspectors compared to food safety information.

Significantly related to food safety knowledge and attitudes are the ways educators adapt and disseminate food safety information to local food producers selling direct-to-consumers. Jan et al. (2021) investigated the impact of visual-based, minimal-

text educational tools on the food safety knowledge and attitude of farmers market vendors. There was a positive difference in knowledge between vendors who saw the visual learning tools and those who did not, indicating that the vendors are receptive to training but need to be provided with the right tools to learn effectively. Previous studies (Plakias et al., 2020; Schmit et al., 2020) and anecdotal evidence (e.g., conversations with growers) have shown that food safety training programs are more effective when presented as part of a comprehensive approach to enhancing the success of producers. For example, Schmit et al. (2020) demonstrated that it is important to engage growers by showing a direct link between investing in food safety practices and enhanced sales growth.

Although educational and training resources are available, farmers market managers may not have access to farmers market-specific training that can be disseminated to their vendors. For example, in some cases food safety training may be provided through state cooperative extension service; however, Pollard et al. (2016) showed that within the same state some market vendors go through training while others do not. This is further complicated by the reality that each state and perhaps each city and county may have different sets of guidelines. There are several American National Standards Institute (ANSI)-certified commercial options for handler and manager food safety training programs and certifications; Mohammad et al. (2020) showed that only about 37% of farmers market vendors pursued these types of training programs. However, these programs are based on the U.S. FDA Food Code and contain task-specific information for foodservice and retail operation employees and managers, which are not contextually applicable to farmers markets and other direct-to-consumer venues.

Good Farmers Market Practices

The food supply chain can consist of multiple nodes, including growers, processors, packagers, manufacturers, distributors, and retail markets through to consumer purchase. Food safety practices are often designed for each node of the chain under various food safety management systems, depending on specific risk factors. Some systems

include Good Agricultural Practices (GAPs) (Center for Food Safety and Applied Nutrition, 1998) in the field, Good Manufacturing Practices (GMPs) (U.S. FDA, 2020), and Hazard Analysis and Critical Control Points (HACCP) principles with the support of Sanitation Standard Operating Procedures (SSOPs) for processing and manufacturing food (U.S. FDA, 2022b). Even product-specific food safety practices such as Tomato-GAPs (TGAPs) (Florida Administrative Code & Florida Administrative Register, 2016), California Leafy Green Marketing Agreement (2023), and juice HACCP standards (U.S. FDA, 2004) have been developed requiring compliance of growers and processors with local or nationwide alliances and authorities. Good Hygienic Practices and Good Retail Practices (GRPs) have also been defined for foodservice and retail establishments by the U.S. FDA (Retail Food Program Steering Committee, 2000; USFDA, 2022a).

For vendors selling in farmers markets, food safety decision trees, self-assessment forms, and best practices have been defined and developed by university extension specialists and local authorities. In general, the defined best practices are built on the previously described five risk factors likely to cause foodborne illness transmission in retail settings (Retail Food Program Steering Committee, 2000). The Good Farmers Market Practices (GFMPs) developed by North Carolina State University Cooperative Extension (NCSUCE) (Chapman & Sain, 2017; NCSUCE, 2023) is a curriculum that covers food safety practices under three areas: food safety principles, personal health and hygiene, and food sampling (NCSUCE, 2023). Food safety principles focus on basic definitions and knowledge about types of hazards, five factors contributing to foodborne illnesses, high-risk populations, and key parameters for pathogen growth. Personnel health and hygiene covers proper handwashing and gloves use, restrooms, facilities, and required supplies. Finally, the food sampling section mentions different food safety considerations during preparation, thawing, storage, and transportation, which include cross-contamination, use of food-grade containers, and use of thermometers.

Multiple food safety management systems may be required in farmers markets to ensure product

safety depending on the types of products. There are challenges for both vendors and market managers. For example, produce that is frequently consumed raw represents the majority of products sold and displayed at the vendor booths. It does not seem to be affordable and realistic for small-scale growers to invest in food safety knowledge and apply GAPs on farms with tight budgets. Another issue is the allowable list of cottage foods, which varies state to state. In most states, non-TCS foods are unrestricted or do not require inspection and permits by responsible authorities. However, the large variety of ingredients, potential lack of food safety knowledge, and careless individual behavior can limit establishing good practices in home kitchens. Insufficient infrastructure and settings, lack of facilities and supplies, and the absence of refrigeration and electricity are observed limitations for food safety in farmers markets. Although GFMPs are intended to be in place, all these aforementioned factors cannot be reliably in place in most farmers markets.

Conclusions and Future Research Needs

Local and regional food systems provide substantial income for many farmers and food entrepreneurs. In 2015, local food producers sold US\$8.7 billion of edible farm products directly to consumers, retailers, institutions, and local distributors (Martinez & Park, 2021), equal to 2.2% of agricultural sales in 2017. Approximately 35% of local foods are sold through direct-to-consumer market channels, including farmers markets, and 69% of local food farms (114,801 out of 167,009) sell directly to consumers (Martinez & Park, 2021). Overall, local and regional food systems provide significant support for many farmers, especially new and beginning farmers and small-scale farmers, which in turn contributes to the sustainability of U.S. agriculture.

Microbiological safety of products sold at farmers markets is generally not the primary concern of consumers, many of whom believe that foods sold at farmers markets are inherently safer than those sold in supermarket retail stores (Crandall et al., 2011; Worsfold et al., 2004; Yu et al., 2017). Freshness and taste have been rated as an important to extremely important reason for

shopping at farmers markets by more than 93% of consumers (Khouryieh et al., 2019; Shen et al., 2022). Despite consumer beliefs, habits and preferences, outbreaks linked to products sold in farmers markets are an indicate significant food safety issues, as discussed in the section Food Safety Risks of Products Sold in Farmers Markets, above.

State regulators and educators confirm the lack of food safety knowledge, awareness, capital, and training in small and very small food businesses selling risky products in farmers markets (Harrison et al., 2016). Numerous observational studies have been published on the food safety practices of local food producers and vendors at farmers market venues as reviewed by Young et al. (2017). One practice that was consistently low across 14 studies was “adequate hand washing when required.” While this may be in part due to deficient knowledge about and attitudes towards food safety practices, often the resources for handwashing were not available, particularly in smaller, outdoor markets. Another key area of concern for farmers markets is the lack of proper refrigeration of potentially hazardous foods and the absence of thermometers for monitoring temperatures. Again, both inadequate knowledge and access to necessary resources may be preventing the implementation of key food safety practices related to temperature control. To enhance market food safety, preventive measures should be considered under the four main areas of facilities and supplies, regulatory measures, education and training, and GFMPs (Figure 1).

Aside from infrastructure barriers, the biggest challenge is the effective delivery of knowledge produced by university extension specialists and local authorities to vendors and managers to improve food safety awareness and behaviors. Transformative and engaging food safety training seems to be critical to increasing the food safety knowledge of local food producers, eliciting behavior change, and preventing food safety issues within direct-to-consumer venues. Educational games and interactive modules have the potential to create meaningful learning experiences for a wide range of subjects and ages (Hsiao et al., 2020; Trujillo et al., 2016; Ulery et al., 2020). For example, open-access online food safety education con-

tent to improve safe food-handling skills in the kitchen (e.g., Ninja Kitchen) and interactive modules for growing microgreens, developed through collaborative education and training projects, represent some active and user-friendly computer-based or mobile-responsive resources.⁹ Research overwhelmingly indicates that interactive multimedia learning tools can help audiences understand concepts better than traditional education practices, and they are powerful mechanisms to elicit behavioral change (Dede, 2009; Gee, 2003). Multimedia learning theory suggests that people learn better when words and images are used together, the multimodal approach (Clark & Lyons, 2011). This is an opportunity to engage via educational games with local food producers about acquiring the resources needed to implement best safety practices.

Technology can be adapted to farmers markets to improve food safety in addition to the alternative training methods discussed previously. Many vendors are small-scale farmers who grow, handle, and sell their commodities at farmers markets with tight budgets. Dhillon and Moncur (2023) concluded that small-scale farmers may benefit from a combination of smart sensors, automation, solutions from the internet of things (IoT), smartphone applications for decision making, and traceability for both productivity and food safety as a part of value-added food production. For example, low-cost smartphone-based infrared cameras are practical, easy to use, and cost-effective for monitoring the temperature of produce and assessing cooling and storage efficiency (Yang et al., 2022). Further research and practical applications in the use of technology to address the identified gaps in food safety knowledge and practices at farmers markets

should be prioritized. These efforts could focus on supply chain transparency and food traceability via the implementation of already available low-cost technologies such as GPS receivers, radio frequency identification (RFID), and QR code methods (Dhillon & Moncur, 2023).

The establishment of nationally accepted preventive food safety measures in farmers markets could play a crucial role in reducing the risk of foodborne illness transmission, in addition to producing economic impacts through conceptual strategies and practical interventions. First, scientific and data-driven evidence is needed to reduce the risk of contamination in market facilities and supplies. Prevention and early intervention methods that reduce risk of contamination from farm to fork should be studied and specifically designed for vendors growing high-risk food commodities (Table 1). Second, vendor-oriented and encouraging regulatory measures are important as an inclusive approach for all stakeholders to take responsibilities for food safety in the farmers markets. For example, state cottage food laws could be easily updated with nationwide cottage food laws targeting high-risk food categories while also considering each vendor's level of experience, which could be based on training received or the scale of their business based on the total revenue (i.e., local food sales). By considering these characteristics, a more customized or tiered approach to compliance and training could be developed. Third, providing accessible educational materials and training to vendors, managers, and customers through a variety of delivery forms is essential, as discussed above. Fourth, implementation of GFMPs should be encouraged in all states for overall success in food safety.



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Garden access and barriers for low-income community members

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Submitted July 31, 2023 / Revised September 15 and November 28, 2023, and
March 25, July 25, and September 6, 2024 / Accepted September 9, 2024 /
Published online November 15, 2024

Citation: Duerst, C. K., Williams, R., Lopez, J., & LaVergne, D. (2025).
Garden access and barriers for low-income community members. *Journal
of Agriculture, Food Systems, and Community Development*, 14(1), 271–284.
<https://doi.org/10.5304/jafscd.2024.141.008>

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Abstract

Gardening can be an important source of fresh food for impoverished households, yet people experiencing food insecurity in the United States often lack access to any form of garden. Although research on community gardening is plentiful,

research on other forms of gardening, such as residential and container gardening, especially among rural populations, is scarce. This project investigates the garden-related experiences of food pantry customers in rural northern Minnesota, in the Bemidji area. We address gardening in its many forms, including residential, container, community, and other types of gardening. We focus on the specific barriers to garden access, and propose several solutions to these barriers, as suggested by study participants.

Over one-third of food pantry customers during the study period responded to a questionnaire administered in the waiting room of the food pantry ($n = 205$, $N = 562$). Although 91% of respondents stated that they wanted to garden, and 85%

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Disclosure Statement

The authors declare they have no conflicts of interest.

Author note

The first author's graduate thesis is the basis for this article (Duerst, 2022).

had gardened in the past, only 31% were active gardeners. This equates to 60% of questionnaire respondents who wanted to garden but were currently not gardening, and is 22% of the total customers to the food pantry during our study period. Although it may be easy to assume that these individuals simply do not want to garden, our study found many specific reasons that prevented these otherwise motivated individuals from gardening. Participants offered suggestions to relieve these barriers, some of which are in the control of local policymakers. Our findings showcase the motivation, knowledge, and experience of rural, low-income individuals and encourage policymakers to take this into consideration when trying to promote gardening.

Keywords

access, barrier, food pantry, food production, garden, household, low-income, residential, rural, questionnaire

Introduction and Literature Review

More fresh fruits and vegetables are consumed by people who have access to a garden (Taylor & Lovell, 2014). Despite this, many people experiencing food insecurity do not have garden access (Darby et al., 2020). “Gardening has been proven to have great potential in improving social and ecological well-being for people and the food system in general” (Darby et al., 2020, p. 56), and yet there is a deficit of information regarding the barriers to any kind of gardening, especially among low-income populations. This study seeks to understand the factors that prevent people from gardening.

Known Benefits of Gardening

The benefits of gardening have been well researched and documented (Draper & Freedman, 2010). Gardening improves the health of individuals and communities by influencing social, spiritual, mental, and physical wellbeing. These positive outcomes are compounded by increased access to fresh vegetables.

Community gardeners in southern East Toronto enjoyed access to fresh produce, exercise, and an enhanced sense of community—especially across

linguistic and cultural barriers (Wakefield et al., 2007). Gardeners viewed community gardens as a place to communicate with people from other cultures, to appreciate social diversity, and to come together over the shared experience of food (Wakefield et al., 2007). Other studies agree that gardening contributes to social unity; this is especially well researched in the context of community gardening (Firth et al., 2011; Teig et al., 2009; Ullevig et al., 2021).

Mental health benefits of gardening are also documented. Horticultural therapy supports overall mental health (Diehl & Brown, 2016). Horticultural therapy with Alzheimer’s patients can slow cognitive deterioration versus the control group, lessen apathy, slow the loss of attention span and recent memory, create a sense of pride in caring for something living, and increase sociability (D’Andrea et al., 2007–2008). A study among women at a shelter for unhoused families found that horticultural therapy increased their levels of self-efficacy (Pierce & Seals, 2006).

Research by North American Indigenous people was particularly relevant to our study, due to the high Native American population in Bemidji, Minnesota (Lawrence, 2010). Gardening and caring for plants has significant ceremonial and cultural implications for Indigenous people and their food security (Baskin et al., 2009; Cidro et al., 2015; Power, 2008). Access to traditional food production methods such as gardening has “symbolic and spiritual value, and is central to personal identity and the maintenance of culture. ... Food security is integral to cultural health and survival” (Power, 2008, p. 96). Our study sought to identify the barriers that reduce access to gardening in the Bemidji region.

Gardeners additionally enjoy the benefits of increased access to nutritious food, physical activity, a sense of responsibility, pride in caring for something alive, the ability to learn something new, added aesthetic beauty and ecological health, improved self-efficacy and community-efficacy, a connection to growth, the ability to help each other out, increased social capital, social connections across language and culture barriers, and improved community cohesion and unity (Firth et al., 2011; Wakefield et al., 2007; Wang & Glicksman, 2013).

Gardening brings diverse people together despite cultural, political, and class differences, and helps them to find common ground as they discuss broader community issues.

Correlation of Low Gardening Rates to Poverty

Research has indicated a correlation between poverty and the lack of a garden in any form. A study in rural Pennsylvania found that higher-income households were more likely to garden (a 69% gardening rate) than lower-income populations (a 46% gardening rate; Darby et al., 2020). Although not compared with higher income households, a survey of 484 low-income households in Toronto found that only 2% participated in community gardens (Kirkpatrick & Tarasuk, 2009). A study that mapped community food production in Madison, Wisconsin, found a disparity surrounding the placement of resources for community food production (Smith et al., 2013). Although there were historic community gardens in low-income areas, home gardens and newer community gardens were focused in neighborhoods with above-average household income (Smith et al., 2013). This could indicate that poverty itself is the most prominent barrier to gardening for food security.

Holistic Garden Research

Although community gardening has been thoroughly studied (Draper & Freedman, 2010), less information is available on residential or any other kind of gardening, especially in the global north (Darby et al., 2020; Taylor & Lovell, 2014). Specifically, very little data is available on the barriers faced by low-income individuals who want to garden (Darby et al., 2020). Community gardening is distinct from other forms of gardening, and home food gardens have especially “been overlooked, understudied, and unsupported by government agencies, non-governmental organizations, and academics” (Taylor & Lovell, 2014, p. 285). In 2021, Vávra et al. noted that rural home gardens have been overlooked and understudied. Again in 2022, Pham et al. point out that “residential food gardens are the dominant form of UA [urban agriculture] in North American cities. ... Residential food gardens produce three times more food than community gardens do. ... Despite its predominance, residen-

tial food production has received less attention in the literature than these other forms of UA” (p. 1). In addition, it is possible that low-income households participate more readily in residential gardening as opposed to community gardening (Pham et al., 2022). Home gardens and gardening as a holistic topic should receive more attention, since community gardening is not only well studied, but possibly also less effective.

Community garden research has touched on access and barriers, but this cannot be extrapolated to apply to all other forms of gardening. The issue of space is especially difficult to extrapolate since community gardens can simply fill to capacity, while the reasons a household may have no space for a garden are more numerous and complex. Participation rates in community gardening alone cannot be assumed to represent residential gardening or other forms of gardening. When planning initiatives designed to boost gardening rates among an entire demographic group or locale, it should be understood that the barriers to gardening as a whole are completely different from the barriers involved in community gardening specifically. Community gardening is a very targeted form of a multifaceted and diverse activity.

Access to Gardening

Nonprofit organizations, Indigenous food sovereignty efforts, and even city boards have been working to increase access to gardening in its many forms (4-Directions Development, 2022; Bergstrand, 2014; Montgomery, 2018), yet few studies provide holistic data to inform their projects and policymaking, or to reveal the factors preventing motivated individuals from gardening. With several exceptions, the currently available data on household gardening among low-income populations generally consist of small focus groups, geospatial analyses, and broad surveys of multiple food-related topics that include gardening as one component of the research.

In rural New York state, a survey including 28 households living below 185% of the poverty level found that lack of time, skills, tools, and interest were major barriers to gardening, and that limited land access and poor soil were also challenging factors (Webber & Dollahite, 2008). In the urban

environment of southern East Toronto, a series of focus groups and interviews showed that low-income, minority community gardeners face issues related to land access, including misunderstanding or resistance by policymakers, soil contamination, and a lack of awareness from the rest of the community (Wakefield et al., 2007). Also in East Toronto, a survey of 371 low-income families found that many who did not participate in community gardens faced barriers of time, lack of interest, lack of knowledge about available resources, or no access to community gardens—such as that all the plots were taken (Loopstra & Tarasuk, 2013). Although time was cited as a primary barrier, the authors indicate that the short answers requested by the instrument may have limited feedback, and that participants may have cited other, more nuanced reasons during interviews or focus groups which “could have resulted in different quantitative balance of reasons for not participating” (Loopstra & Tarasuk, 2013, p. 58).

More recently, in rural western Pennsylvania, a survey of 124 households—85 of which were classified as low-income—showed that the main barriers facing the study population were space and time to garden (Darby et al., 2020). This study noted that “the scarcity of literature regarding the barriers to household gardening is remarkable” (Darby et al., 2020, p. 56) and concluded that “more qualitative, place-based studies like this are needed to understand how to better support gardening practice in diverse settings” (Darby et al., 2020, p. 65).

A place-based study in Hobart, Australia, in 2022, targeted barriers to urban residential gardening with 301 participants of varied incomes. The researchers noted a global dearth of research in this area (Goodfellow & Prahalad, 2022) and found that

Key factors to growing more food include control over property, available land, and gardening experience and know-how. Our findings highlight the need for policy, programs, and resources, especially at the level of local governments, that can contribute to an increase in the amount of local, home grown food in cities. (p. 1).

When academic research is connected to hands-on work in community food systems, it is best to seek direct input from the affected community members—including non-academics—and especially when addressing disparities (Pendergrast et al., 2019; Taylor & Lovell, 2014). Rural policymakers should have access to data showing accurate reasons for lower gardening rates among lower-income rural households. Research should be done with a holistic approach to gardening including residential, container, and anything else that study participants consider to be gardening. Our project seeks feedback directly from the community and aims to inform policymakers of the challenges faced by their constituents. We include a larger sample size of low-income, rural individuals ($N = 205$) than most previous studies, specifically targeting the barriers they face.

Previous Research at the Study Location

Bemidji, Minnesota (MN), had a population of 14,574 as of 2020 (U.S. Census Bureau, 2020). Located centrally between three major American Indian Reservations, the Bemidji area is a hotbed of tribal food sovereignty projects and other food security efforts. Bemidji is also a critical shopping hub in the northern Minnesota region, regularly drawing residents from rural areas from up to an hour away for their weekly grocery shopping trips (Lawrence, 2010).

The Bemidji Community Food Shelf (BCFS) hosted this study. BCFS is the only food pantry in Bemidji, and shared 550,000 pounds (249,000 kg) of food to 6,200 households in 2021 (BCFS, 2022). This site was chosen because of its aggressive initiatives to broaden community access to gardening and fresh produce. This food pantry operates a 4-acre (1.6 hectare) farm project, which in 2021 produced and distributed 21,500 pounds (9,750 kg) of produce (BCFS, 2022). Access to this food pantry is income-based, and therefore food pantry customers are representative of low-income Bemidji area residents.

Prior to our study, other researchers had already performed studies at this food pantry (Cairns, 2019; Montgomery, 2018). Our research drew insights from their structure, results, and findings. The studies explored customers’ experi-

ences with gardening, fresh produce, and the BCFS farm project. This included a set of focus groups (Montgomery, 2018), and a set of questionnaires (Cairns, 2019). These studies helped to inform our questionnaire, logistical setup, and expectations for our research.

The Montgomery, 2018, study was intended to explore BCFS customers' thoughts and knowledge about fresh produce, gardening, and the Food Shelf Farm project. Ten individuals participated in two focus groups. According to the report, six Native Americans, three white Americans, and one Black American participated. Other circumstances were noted that shed light on the diversity of the individual BCFS customers and their circumstances:

One (1) was an elder, two (2) represented small families of three or less and seven (7) represented larger families. Eight (8) were Bemidji residents, while two (2) lived in smaller communities or rural settings. Although it was not a variable that was targeted, two (2) had major mobility issues. (Montgomery, 2018, p. 6)

These participants expressed that they had previous garden exposure, interest, and knowledge, but lacked access to space, tools, seeds, and other supplies, and desired education in specific topics such as container gardening. Space seemed to be the most frequently mentioned barrier, with several participants living in rented housing or apartment buildings (Montgomery, 2018). This study had a very small sample size of just 10, so our study built on their findings while including a much larger sample of BCFS customers.

A set of questionnaires was administered at BCFS in 2018 ($n = 215$) and 2019 ($n = 200$) to evaluate customer produce usage (Cairns, 2019). The questionnaires were readily accessible to BCFS food pantry customers and reached a broader audience than the focus groups, consequently garnering a larger sample size of individuals who would be affected by policy changes. Cairns' study helped to guide the logistical setup of our study, specifically that questionnaires were offered at a particular counter in the waiting room of the food pantry, and that they were offered during the wait time

between the pantry's entrance interview and shopping. Cairns' study also helped to set our expectations for an approximate number of participants in a questionnaire-based research project at this location, demonstrating that a sample size of around 200 individuals was realistic and repeatable.

Research Methods

The questionnaire-based study took place in Bemidji, Minnesota, USA at the local food pantry. The Texas A&M University-Commerce Institutional Review Board granted approval for this study on September 20, 2021.

Data Collection

The researcher distributed and gathered 205 questionnaires from food pantry customers at the BCFS from September 22, 2021, through October 22, 2021. The researcher was available in the waiting room of the food pantry during open hours, 10:00 AM until 3:00 PM, each day that data were collected. The food pantry's standard protocol is that customers are interviewed and approved by food shelf staff and then seated to await access to the food pantry shopping area. Their average expected wait time is approximately 15 minutes, but this varies from no wait time at all up to 30 or more minutes, depending on the day's traffic. It is during this wait time that the researcher solicited food pantry customers for the study from a station in the waiting room.

The questionnaire was administered to any interested adult BCFS customer. Setup was designed to not be disruptive to normal food pantry operations. There was no incentive offered for participation. If an individual expressed interest in participating, they were provided with a consent form, a paper questionnaire, a clipboard and a pen. Two participants expressed a desire for help completing the questionnaire, so assistance was given in the manner requested.

For the confidentiality of participants, no names were recorded, and no audio or visual recording took place. The consent form was separate from the questionnaire and was placed in a different pile, which was occasionally shuffled to ensure anonymity. All clipboards and pens were sanitized between uses. The researcher wore a

mask in accordance with food pantry policy.

During the data collection period, customers were allowed two visits to the food pantry each month. This is different from BCFS' typical policy of only once per month and made it more challenging to prevent duplicates than had been originally anticipated. The policy was changed only weeks before data collection began. To counter this, the researcher asked customers whether they had already participated, before offering the questionnaire. Approximately 200 participants were anticipated, due to other researchers' previous studies in the same location (Cairns, 2019).

The total number of customers each day is always recorded by BCFS, and this information was provided to the researcher. The total number of questionnaires collected each day was recorded, and each questionnaire was dated. These data recorded the ratio between the population N and the sample n .

Data Analysis

The questionnaire contained multiple-choice questions as well as open-ended questions. In one particular set of multiple-choice questions, participants were expected to select the option that best matched their experiences. Instead, participants circled as many options as they felt might apply to them, summarized in Table 1 below. This, and other multiple-choice nominal data, were coded and analyzed through descriptive statistical analysis. Open-ended questions were usually answered with

only a few words. Many of these were identical phrases or phrases with very similar meaning. As such, the answers to these questions were categorized by the researcher into consistent groupings, and then analyzed by descriptive statistics. In summary, multiple-choice results were statistically compiled, answers to open-ended questions were manually analyzed for reoccurring themes, and descriptive statistics were applied to all. Non-answers were not frequent and therefore generally ignored. Numbers presented in the results are typically based on the total number of questionnaires collected, unless stated otherwise.

Results

A total of 205 questionnaires were collected. During that same time, no more than 562 unique customers visited the food pantry during active data collection. Our sample represents 36.5% of the total customers to the food pantry during the study period. Most respondents (62%) were between 31 and 64 years of age, but 20% were 18–30, and 17% were 65 or older. The BCFS has income guidelines based on 300% of the federal poverty level. All study participants are assumed to be below 300% of the federal poverty level as screened by the food pantry. Due to the sensitive environment of the study location, racial demographics were not collected. Tribal leadership is encouraged to make their own analysis of the study location and the researcher, to assess the relevance of this study for their needs.

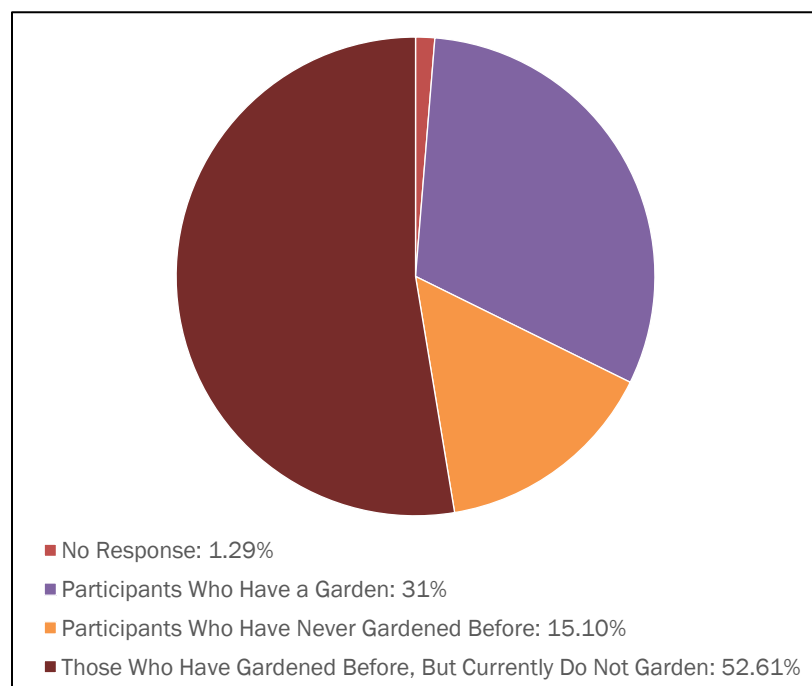
Table 1. Level of Gardening Experience as Self-Reported by Food Pantry Customers (No Garden = NG)

Response	<i>f</i>	% <i>f</i>	NG	% NG
I have never gardened before	29	15.10	28	96.55
I gardened as a child/youth	48	25.00	45	93.75
I gardened as a child/youth & I sometimes help a relative or neighbor in their garden	11	5.73	10	90.91
I gardened as a child/youth & I have gardened as a hobby	11	5.73	6	54.55
I gardened as a child/youth & I sometimes help a relative or neighbor in their garden & I have gardened as a hobby	3	1.56	2	66.67
I sometimes help a relative or neighbor in their garden	14	7.29	12	85.71
I sometimes help a relative or neighbor in their garden & I have gardened as a hobby	3	1.56	2	66.67
I have gardened as a hobby	22	11.46	9	40.91
I garden all the time, whenever I have the opportunity	51	26.56	16	31.37
All respondents	192	100.00	130	67.71

Approximately 90% of participants stated that they would plant food if they had access to a garden. In response to the question “What would you plant in your garden?” 184 of the 205 respondents circled “Food,” 102 circled “Flowers,” and 50 circled “Cultural Plants.” “Other” responses included medicinal plants, berries, native species, succulents, herbs, and rocks. (Rocks are a joke among gardeners and farmers in northern Minnesota, since the winter frost brings up a new “crop” of rocks to pick every spring. This joking response demonstrates familiarity with the challenges of gardening in this region.)

It is worth noting that the non-gardening rate among study participants was 67.71% even though only 15.10% had never gardened before and 93% circled “Yes” in response to the prompt “In a perfect world, would you want a garden?” This indicates that over half of the participants had experience gardening and yet did not garden at the time of the study. Those who expressed more experience gardening were more likely to have a garden, yet 31.37% of those who reported a strong lifetime interest in gardening still did not have a garden. When asked if they would like to learn more about gardening, 53% responded affirmatively. Figure 1

Figure 1. Gardening Rate Among Study Participants



demonstrates more clearly how few study participants were gardening, despite their interest level and past experiences.

Table 1 depicts the contrast between past gardening experiences and current involvement in gardening. Respondents were asked in a multiple-answer question to “Circle the option that tells us how much you garden,” to indicate their past gardening experiences. In a separate yes/no question, they were asked whether they currently garden. Some participants chose more than one option, and therefore several responses in Table 1 include these options separated by an ampersand (&). The number of questionnaire participants who responded in a certain way is indicated by f_j and the number of these who do not have a garden at the time of the study is indicated by NG (No Garden). The variable $\%f_j$ displays the percentage of individuals who gave each response, while the variable $\%NG$ displays the percentage of individuals who gave that response and also did not have a garden at the time of the study.

Barriers to gardening were collected quantitatively in the multiple-response section of question 6 of the questionnaire. Respondents could select more than one of these options, and self-reported nongardeners selected a total of 262 responses for why they were unable to garden. “No place to put a garden” and “need tools and seeds” were the top two responses. Some participants expressed a desire to learn more about certain gardening topics before they felt fully comfortable gardening, and others indicated a lack of time. There were two potential responses given in relation to knowledge of gardening, and some people circled both. These responses included “I don’t know how to garden” or “I need education on certain parts of gardening before I’ll feel comfortable doing it myself.” The results are summarized in Figure 2.

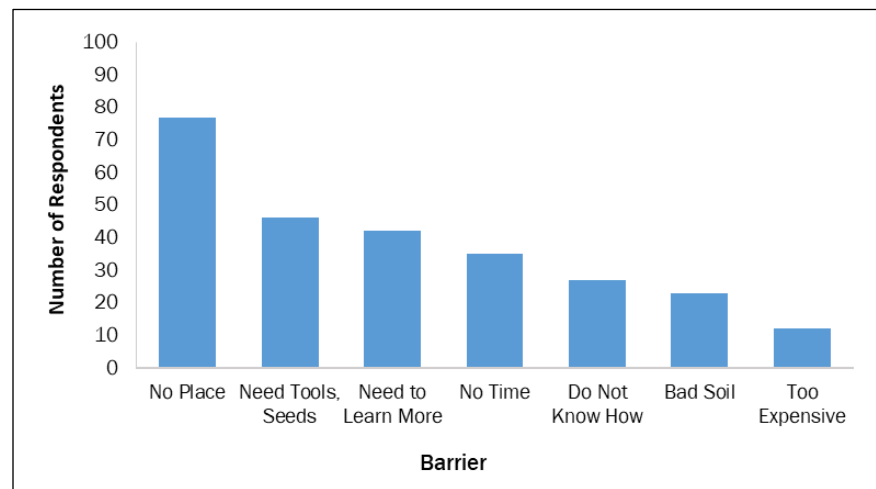
Qualitative data were additionally gathered from question 3

and the open-ended section of question 6 to ascertain the deeper reasons behind the barriers cited. A total of 120 individuals who did not have a garden responded to these questions. Of the 64 individuals who reported insufficient space to garden, 19 additionally mentioned that they lived in an apartment, six in a trailer park, five renting, and six were homeless. Mobility issues were behind 6 of the 12 references to poor health. Five of the seven money-related responses

were specific: two needed a tiller, two needed running water, and one needed a raised bed. These results are broken down in Figure 3.

When asked in an open-ended question “What would make these problems go away,” 106 nongardeners responded. The most frequent suggestions presented by nongardeners to overcome the barriers they face were moving their residence (to provide a place for a garden), access to resources, some form of garden education, or more time to garden. Some responses were less common, but

Figure 2. Barriers to Gardening as Reported Through a Multiple-Option Question by Food Pantry Customers Who Did Not Have a Garden



more specific and innovative: landlord permission to garden, access to any space to garden including community gardens or container gardens, a way to fix the soil, or a gardening companion for motivation and education. The summary of all responses given by nongardeners is found in Figure 4.

More specific written solutions for the barrier of no place to garden were addressed by 35% ($n = 46$) of nongardening respondents. Moving to a house, a place with a big yard, or just not living in their current situation was the main solution

Figure 3. Barriers to Gardening as Reported in an Open-Ended Written Question by Food Pantry Customers Who Had No Garden

Variable “no place” is separated by the specific reason given, if any

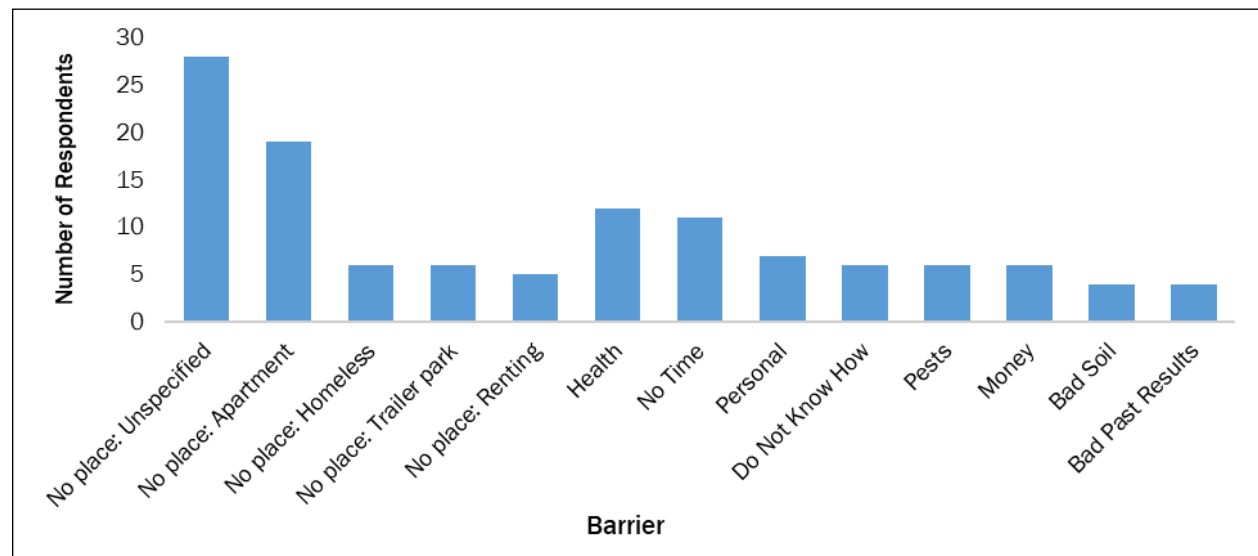
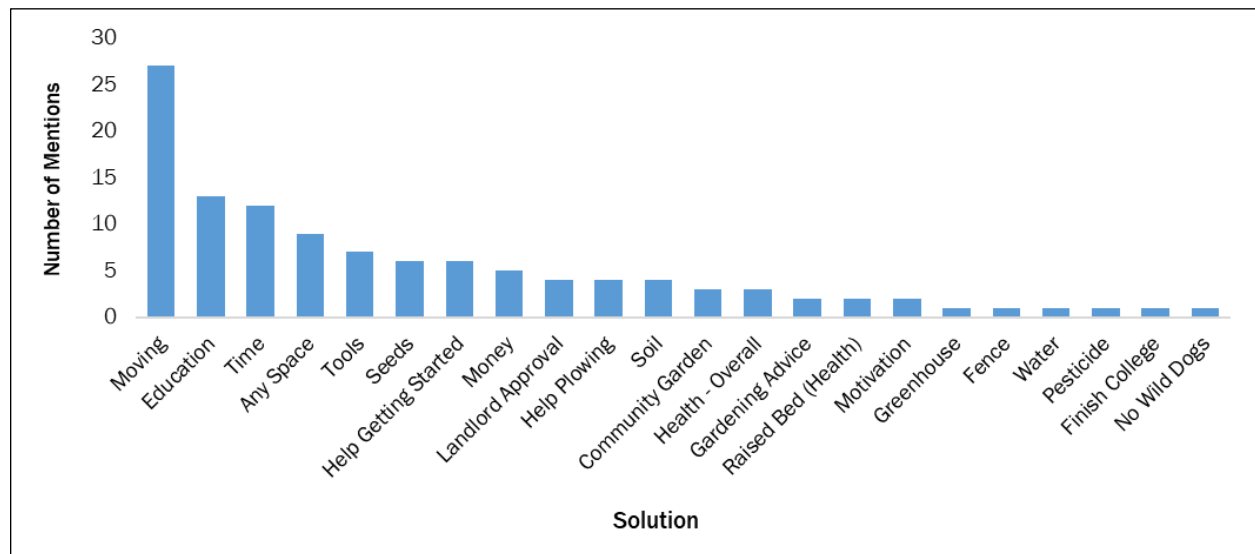


Figure 4. Solutions to Overcome the Barriers to Gardening, as Reported in an Open-Ended Response by Food Pantry Customers Who Did Not Have a Garden



offered by 27 of the 130 individuals who responded to the survey and reported that they did not currently have a garden. Any viable space to garden was requested by nine individuals. Community or collaborative garden access was specifically mentioned by three individuals, and four suggested that landlord approval for a garden would enable them to garden.

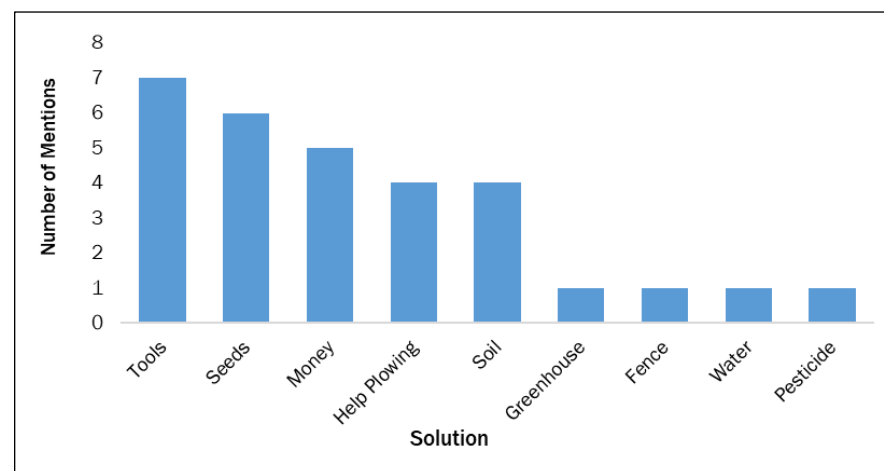
Solutions to the barriers of finances or resources were suggested by 28 people. A summary of these responses is in Figure 5. One specific tool

was mentioned: a shovel. Help with soil was requested in the form of amendments, fertilizer, black dirt or compost. The pesticide requested was for quack grass. Regarding seeds, one person commented that “stores in our area throw seeds away every year, they need to donate to people in need. Home Depot, Menards, etc.”

In summary, we saw that 31% of those who reported a strong lifetime interest in gardening were not active gardeners at the time of the study. Less than one-third of all questionnaire respondents

had a garden, although nearly all expressed that they would like to garden. Many stated that their primary barrier was the lack of a place to put a garden, especially those who were renting or facing homelessness. Finances were also commonly cited, whether to purchase basic garden supplies or to fund situational items such as a water spigot, a fence, or a raised bed for those with mobility challenges. Time and garden education were also mentioned.

Figure 5. Solutions to Overcome the Financial Barriers to Gardening, as Reported in an Open-Ended Response by Food Pantry Customers Who Did Not Have a Garden



Discussion

Most respondents (91%) expressed that they would garden—in a perfect world. This agrees with our hypothesis that lower rates of gardening among low-income households are caused by barriers rather than lack of desire. Although many barriers were identified, 85% of respondents had gardening experience and 27% had extensive gardening experiences. Still, 68% of respondents did not have a garden at the time of the study, and 31% of those with extensive gardening experiences did not have a garden. The barriers recorded by those who did not have a garden at the time of the study should give us insights into the reasons why they were unable to garden.

This concurs with the conclusion from previously held focus groups (performed by a different research team) at the same location: most participants “had positive past experiences with gardening, but very few are currently gardening” (Montgomery, 2018, p. 5). This previous study held two focus groups with 10 BCFS customers who had the time and interest to participate. Only two participants had never gardened before (Montgomery, 2018), which is comparable to the 15% of participants who reported on the questionnaire that they had never gardened before. Despite the dramatic difference in sample size and assumed interest level of participants, both the 2018 study and this study revealed similar attitudes toward gardening, and similar past garden experiences.

Barrier #1: Place to Garden

Of participants who did not have a garden at the time of the study, 53% reported in the short-answer section that their main barrier was the lack of space to put a garden, often due to their living situation such as an apartment or rental. For example, one respondent stated that 2021 was the “first year I haven’t had a garden in over 35 years” because “I had to move into town, landlord won’t allow” a garden. Space to garden was also a major concern among participants in the 2018 focus groups. A yard, a home of their own, permission from the landlord, or education about container gardening were all suggestions posed to solve their lack of access to gardening (Montgomery, 2018). This same challenge is echoed in other studies that

discuss barriers to gardening. In rural western Pennsylvania, 54% of respondents ($n = 137$) reported lack of space to garden, and 20% cited their landlord’s gardening restrictions (Darby et al., 2020). In Madison, Wisconsin, there was a disparity in gardening resources—especially community garden placement—between low-income and high-income neighborhoods (Smith et al., 2013). In rural New York, rented housing, poor soil, and fear that the land was contaminated all contributed to a lack of garden space (Webber & Dollahite, 2008). Resolving this one barrier is likely to greatly increase access to gardening in the Bemidji area.

Study participants proposed ways to create garden space. Landlord permission was often cited, and a program to work with landlords to facilitate garden access for their tenants would likely be well-received among tenants. Other options included increased community garden access or simply moving to a home with a yard. It is interesting that bureaucratic resistance, waitlists for community garden space, and low policymaker awareness were also major issues cited among community gardeners in Toronto (Wakefield et al., 2007). The same study found that “Community gardens that were situated near the homes of the gardeners involved seemed to be used regularly and consistently, whereas gardens in areas not immediately adjacent to the housing of participants were not frequented as regularly” (Wakefield et al., 2007, p. 95). If new community gardens are created in Bemidji, these factors should be kept in mind. Another study recommended a program to create “relationships with landlords and encourage creating lease language that allows gardening” (Darby et al., 2020, p. 66). An initiative in Bemidji to network with local landlords would boost garden access for tenants.

If BCFS goals still include “greater engagement [by BCFS customers] with the Farm” (Montgomery, 2018, p. 6), then BCFS leadership could re-address the option of making personal garden spaces available at the Farm, assuming that transportation is also available. This would solve the barrier of place to garden, as well as naturally solving the issues surrounding soil amendments, raised beds, and tilling. If gardeners had access to the Farm’s available seeds and tools while working their personal plots, then even more barriers would

be relieved. This would also get customers on-site at the Farm and could build interest in the greater Farm operation. Personal-plot gardeners would have expanded access to learn-by-doing opportunities and extra produce if they chose to accompany Farm staff in seasonal tasks on the Farm itself. However, since transportation to the garden space is a significant barrier, practitioners should balance the needs of organizational success and involvement with the success of the individuals being served. If the end goal is to promote personal engagement with gardening, then an initiative designed to support personal garden plots in home rental situations or nearby community gardens would be accessible to a greater number of community members.

Barrier #2: Gardening Supplies

The second most frequently cited barrier was a need for gardening supplies. Tools, seeds, soil amendments, tilling, and other resources were requested by gardeners and nongardeners alike. This still concurs with the prior focus groups done at BCFS, where participants expressed a need for starter plants, soil, tools, and materials for container gardening (Montgomery, 2018). Notably, one participant in this 2018 study suggested a tool rental program (Montgomery, 2018). Tools and seeds were the most mentioned resources by BCFS customers who responded to this questionnaire. One participant pointed out that the Bemidji Public Library is already equipped to rent books and some household equipment, and perhaps a garden tool rental program could be arranged there. Finally, several questionnaire respondents needed raised beds to solve mobility factors preventing them from gardening; several others needed a water spigot or a fence; others suggested soil amendments, a greenhouse for starting seeds, or help with tilling. A scholarship program could make these resources available to applicants with specific requests. Potential programs in any locality could look to the gardening program available through 4-Directions Development in Red Lake Nation for guidance and inspiration; this resource was mentioned by several respondents as a valuable resource providing materials, seeds, education, and help with tilling.

Barrier #3: Time

Lack of time was another factor for some BCFS respondents, and several specifically suggested that time-management skills would be useful. Time, although mentioned, was not a major factor for most participants, which contradicts many other studies. The study in Toronto found that time was a primary barrier for those interested in community gardening (Loopstra & Tarasuk, 2013), and other studies also factored time as an important barrier (Darby et al., 2020; Webber & Dollahite, 2008). Kortright and Wakefield (2011) suggest that garden skills and education can alleviate the time barrier, since “some interview participants were able to spend very little time on their gardens and still enjoy a substantial harvest. With their knowledge of gardening practices, they were able to focus their efforts more effectively. Others spent similar amounts of time with far less success” (p. 50). Perhaps garden education at BCFS could highlight efficiency techniques and time-saving methods so that participants have a backup plan when spare time is infrequent. However, any program designed for Bemidji residents should keep in mind that a place to garden and the tools to garden were much more prominent barriers for study participants.

Barrier #4: Education

It is worth noting that during the planning stage of this research, input from the BCFS Farm Committee suggested a belief that their nongardening customers would not know how to garden and that they simply needed more education. To accommodate their belief, a portion of the survey focused on educational issues. However, our findings did not support the assumptions. On the contrary, we found that many customers at the BCFS have motivation for and knowledge of gardening, but do not have a place to put the garden and/or gardening tools. This is important information to further investigate and confirm. Since much literature focuses on community gardening alone and not gardening as a whole, and/or focuses on urban populations as opposed to rural populations, the data is possibly misleading. In addition, practitioners commonly assume that their constituents do not garden because they are uneducated, and programs are designed to focus on garden education

and training. Darby et al. (2020) discuss this common misconception and dub it the “information deficit falsehood” (p. 65). If future studies are still consistent with our findings in rural Minnesota and with the findings of Darby et al. in rural Pennsylvania, these data are crucial to disseminate to practitioners to facilitate a better use of resources when planning programs among low-income, rural residents.

Limitations

We only began collecting data on time constraints and nonparticipation a little over halfway through the study. Ideally, this should have been done from the start for the most accurate representation of the population. These data showed that the sample size of our study was limited primarily by time, as approximately half of food pantry customers went straight from the interview room to the shopping area with little to no wait time. Approximately 10% of the population did have time, but still were not interested in completing the questionnaire. This, in turn, may have influenced our data on how many BCFS customers are truly interested in gardening.

Duplicate surveys were possible, since the food pantry changed its policy on frequency of visits shortly before data collection commenced. Although study participants were asked whether they had already completed the questionnaire, there is a chance that some duplicates occurred.

Our study did not differentiate between home gardening, community gardening, or other forms of gardening. We focused on the participants’ access to gardening in any form. There is still a dearth of research addressing home gardening and its accessibility for low-income households.

This study is additionally limited by its place-based nature. The unique cultures and history of the Bemidji area cannot be extrapolated to other areas. However, our findings agree with other place-based studies on rural populations. More research needs to be done on rural garden access as a whole.

Conclusions

Overall, this study found that customers at the BCFS food pantry are interested in gardening, and the majority have substantial gardening experience.

Resolving two key factors (a place to garden and access to gardening supplies) could resolve many of the greatest barriers to gardening that exist for BCFS customers. Gardening education in specific, targeted areas could fill in the gaps for others. Programs can be designed to relieve the barriers to gardening that low-income Bemidji area residents face.

The wealth of gardening knowledge held by low-income individuals should not be discounted, nor should their motivation to garden be in question. Most know how to garden but are prevented from gardening by a lack of space and resources. An assumption by policymakers that people simply do not want to garden, or do not know how to garden, may very well be damaging their organizations and patronizing the individuals they are attempting to serve.

Future research should seek to further understand the barriers faced by individuals who want to garden, especially where the research can inform the policies and programs surrounding garden access. Similar data collection should be carried out in other communities—especially before new programs or initiatives are launched—to avoid assumptions that lead to a waste of resources.

Community garden research is limited by the tendency of community gardens to fill to capacity, and therefore does not investigate more nuanced reasons why people may lack space for any form of garden—community, residential or otherwise. We hope to see more solid research conducted on the barriers to gardening, including gardening in any of its many forms—residential gardening, container gardening, community gardening, etc.—so that policymakers can create better programming with a more complete understanding of their participants.

Future research should add to the body of literature on residential gardening and other less-studied forms of gardening, especially in rural areas. More data is needed to determine whether low-income households are more likely to participate in residential gardening as opposed to community gardening, and whether this potential trend is connected to rural populations alone. Special attention should be given to the barriers faced by those experiencing food insecurity in both rural and urban settings, especially to ascertain whether

space and resources are ubiquitously more important than garden education. Research could note the barriers to the continued use of residential gardens after the first year. More solid research should be conducted with policymakers and community leaders in mind, to provide data for better programming and a more complete understanding of the food-insecure population's access to gardening in any of its varied forms.



Acknowledgments

Gratitude is extended to Michael Olson and Mary Mitchell, current and former directors of the

Bemidji Community Food Shelf, for their support of this project, advice to ensure its success, and grace in enabling the research to take place even in the midst of their transition of leadership.

Gratitude is extended to Debbie Johnson, the volunteer coordinator at the BCFS, for her helpfulness and cheerfulness in ensuring that all the little logistical details were smoothly provided for.

Gratitude is extended to the members of the BCFS Farm Board of Directors for their input in the early stages of this project and especially their ideas for specific areas of research that would benefit their policymaking and future projects.

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Growing together or growing apart? A study of food donation community garden programming during the COVID-19 pandemic

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Submitted February 18, 2024 / Revised May 27, July 29, and September 3, 2024 / Accepted September 4, 2024 /
Published online November 27, 2024

Citation: Wanyakha, M. T., Grudens-Schuck, N., & Oberhauser, A. M. (2025). Growing together or growing apart? A study of food donation community garden programming during the COVID-19 pandemic. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 285–307. <https://doi.org/10.5304/jafscd.2024.141.012>

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Abstract

The COVID-19 pandemic worsened food insecurity by curbing the food supply chain, slowing the delivery of provisions to food banks and pantries, and magnifying the impact of the pandemic on those depending on such resources to meet their nutritional needs. The study's objective was to identify areas of resilience and vulnerability in food

security intervention programming during the COVID-19 crisis, with specific attention to fresh produce donation partnerships.

This study examined the cultivation and provision of fresh produce to food pantries in Iowa before and during the pandemic. It also analyzed the

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Conflict of Interest

The authors declare that they have no conflict of interest.

Author Note

This article was originally completed as part of the corresponding author's dissertation (Wanyakha, 2023).

Acknowledgments

The Growing Together Program, under SNAP-ED of Iowa State University Extension and Outreach, provided support for this project. Special thanks to Christine Hradek, Katie Sorrel, and Susan DeBlieck.

Funding Disclosure

The source of funding was USDA's SNAP-Ed through Iowa State University's Growing Together program and the Department of Agricultural Education and Studies at Iowa State University. The opinions, views, results, and recommendations in this article are solely those of the researcher; they are not views of the USDA SNAP-Ed funders or the Growing Together program.

experiences of volunteers in a Master Gardener volunteer program in Iowa, which grew the donated produce. The study analyzes program data on donation quantities and labor hours and uses a time series analysis and content analysis to understand changes between the pre-pandemic and pandemic years. Findings include a significant decrease in labor hours during the pandemic years of 2020–2021, which volunteers attributed to multilevel government policies and social distancing requirements. Vulnerabilities revealed in this study were exacerbated by the pandemic rather than singly caused by it. Volunteer shortages, donation inconsistency, and exclusionary practices of community appeared to be inherent to the concept and structure of volunteer-based food donation partnership programs.

Keywords

food security, donation gardens, food emergency services, COVID-19, pandemic, fresh produce, cooperative extension, Master Gardener

Introduction

Food donation programs and charitable food organizations like Feeding America (2020) provide critical fresh produce donations to food pantries, aiming to meet patrons' nutritional needs. Distribution methods, however, vary due to the inconsistent nature of volunteer based, grant supported programming and fluctuations in garden harvests. The COVID-19 pandemic exposed the limitations of such partnership-based programs, as the number of food insecure individuals abruptly increased by from 8% in March 2020 to 10% in June 2020 (Nagata et al., 2021, p. 4); the pandemic circumstances also led to changes in social gatherings and increased financial strain (Manchia et al., 2022). Before the pandemic, one in nine Americans (35 million, 10.9%) and one in seven children (14.6%) experienced food insecurity (Feeding America, 2021, p. 2). In 2020, the first pandemic year, approximately 35 million people including 11 million children faced food insecurity (Feeding America, 2021; Rabbitt, et al., 2023).

Food insecurity is defined as a household or neighborhoods experiencing economic and social conditions characterized by limited access, availa-

bility, utilization, and stability of food (Coleman-Jensen et al., 2019). During the COVID-19 pandemic, food availability was affected in part by panic-buying due to disruptions in food supply chains, which raised concerns about long-term food availability (Aday & Aday, 2020). Accessibility was also hampered by rising food costs and changes in infrastructure, including shifts in food assistance programs, public transportation, and shortages of certain items (Chakraborty et al., 2023; Niles et al., 2020). Market reports highlight widespread shifts in food consumption and shopping behaviors due to the pandemic (McKenzie, 2020). The pandemic also posed significant challenges to both food banks and food pantries (Byrne & Just, 2022; Huang et al., 2023).

Kar et al. (2021) argue that the pandemic revealed the fragility and social injustices inherent in the current food and economic system. Their findings pertain not only to the pandemic years of 2020–2021, but also offer valuable lessons on the implementation and sustainability of fresh produce provision in future crises. While various studies have focused on the pandemic's impact on the food supply chain, food security, and nutrition, there is limited information about its influence on fresh produce donation programs. To understand this influence, it is critical to grasp the pandemic's ripple effect on charitable food donation more generally.

Before the pandemic, Feeding America (2019, p. 2) reported the lowest food insecurity rate in two decades. In 2020, the onset of the COVID-19 pandemic severely disrupted food supply chains. With the shift to prepackaged boxes, distribution of fresh produce became a challenge, as items selected for clients were not necessarily matched with client's preferences (Barman et al., 2021; Deconinck et al., 2020). This shift also required more volunteers for packing and distribution, coinciding with pantry labor shortages (Higgins et al., 2021; Huang et al., 2023). This disruption severely impacted food banks, which not only faced supply chain issues but also unprecedented demand from food-insecure households (Blessley & Mudambi, 2022). COVID-19 drastically altered consumption patterns due to closed restaurants, disrupted supermarket supply chains, increasing job losses, and

challenges in the movement of fresh produce from farms to processors, food banks, and consumers (Orden, 2020). Economic hardships created a surge in food demand from banks and pantries (Rabbitt et al., 2023), increasing from 50% to 140% (Kulish, 2020; Lakhani, 2020).

Food banks and pantries played a crucial role in serving 80% of the food-insecure population nationwide; however, volunteer numbers decreased further during the pandemic, with 58% of food banks reporting difficulties recruiting volunteers (Byrne & Just, 2022). Small-scale pantries and community-based organizations struggled to process goods, changing their operations, hours, and spatial capacity (Byrne & Just, 2022). The scale and source of donations also changed during the pandemic due to the U.S. Department of Agriculture (USDA) Farmers to Families Food Box Program (USDA, 2022b) and commercial surpluses, creating an influx that exacerbated ongoing volunteer shortages and spatial constraints (Huang et al., 2023).

The pandemic also led to operational alterations, resulting in food bank and pantry closures in food deserts, areas already lacking access to quality food sources (Kar et al., 2021). Food deserts are defined as areas where at least 100 households are located more than half a mile from the nearest supermarket without vehicle access or where at least 500 people, or 33% of the population, live more than 20 miles from the nearest supermarket regardless of vehicle availability (Dutko et al., 2012, p. 5; USDA, 2022c). As these areas already faced disparities in food access, the pandemic exacerbated household food and nutrition insecurity (Kar et al., 2021).

Programs supporting fresh produce provision to pantries were also affected. Growing Together, a program administered by Iowa State University Extension and Outreach and funded by the USDA's Supplemental Nutrition Assistance Program-Education (SNAP-Ed) initiative, was impacted in this way. Growing Together administers immigrants to county extension agents and Master Gardeners to grow and donate fruits and vegetables to their community food pantries (Chennault, 2019). As most of the Master Gardener Volunteers (MGVs) are older adult they often identified as high-risk during the pandemic and followed guidelines to

stay home or practice social distancing for their personal safety (Kingsley et al., 2022). In some places, volunteers' access to communal gardens at schools was forbidden or avoided (Kingsley et al., 2022). Although MGVs play a significant role in supporting food pantries with fresh produce donations to improve patron nutrition, there is a knowledge gap between how the COVID-19 pandemic disrupted MGV activities and how the disruptions altered the fresh produce distribution system.

Purpose and Aims

The primary purpose of this study was to understand how COVID-19 disrupted Growing Together's MGV fruit and vegetable distribution to food pantries. The study also aimed to use the findings to propose recommendations for increasing sustainable healthy food donations within existing food pantries. As most studies have focused on larger food supply chains, there is less knowledge and evidence on how protracted disasters could disrupt smaller or more localized supply chains, such as donation gardens and community food pantries. The COVID-19 pandemic created the opportunity to examine the impacts of these disruptions.

To learn more about these impacts, the study adopted a social-ecological model to understand food donation programming. It examined qualitative and quantitative data to understand how COVID-19 disrupted MGV activities and thus impacted fresh produce donation to food pantries during 2020 and 2021. This study sought to follow two main lines of inquiry:

- a) How did staffing and operating procedures and production shift from the nonpandemic year of 2019 to the COVID-19 pandemic years of 2020–2021, impacting Growing Together's fresh produce donations?
- b) What were the social implications of selected changes before and during COVID-19 in relation to the concept of the community donation garden?

Theoretical Framework

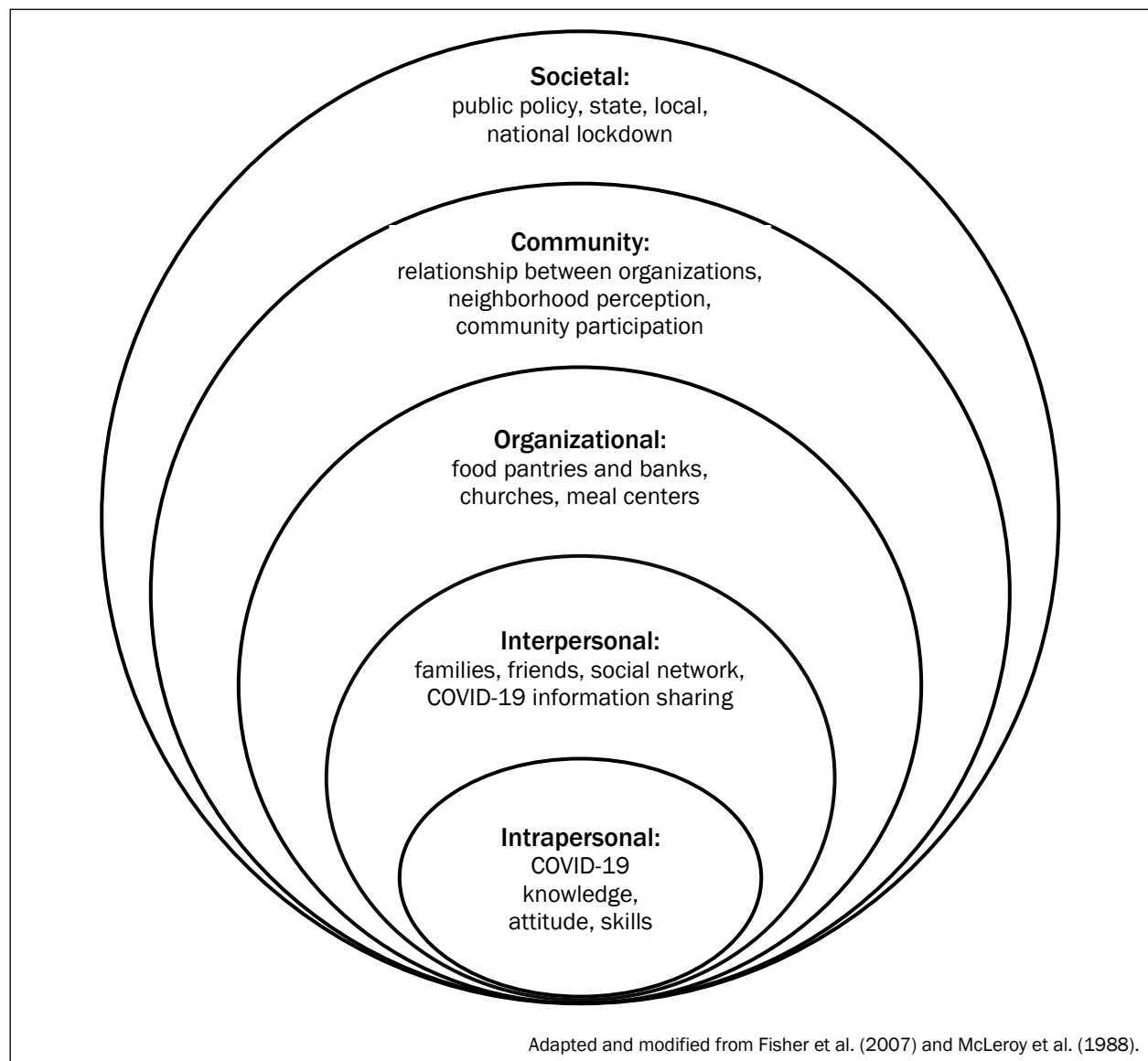
The social ecological model (SEM), originally de-

veloped by the scholar of human development Urie Bronfenbrenner in the 1970s (Figure 1) and widely utilized in public health research, posits that behavior is affected across multiple spheres of influence, which both determine and are determined by the social environment (Bronfenbrenner, 1976). The SEM allows a layered understanding of the impacts of COVID-19 on MGVs' fresh produce cultivation and donation to Iowa food pantries as well as the response strategies volunteers adopted to ensure program continuity. The SEM emphasizes that a myriad of exogenous factors can influence an in-

dividual to perform certain actions and, vice versa, the environment can be transformed by an individual's action (Dzimbiri et al., 2022). Exogenous activities include those in the categories of intrapersonal, interpersonal, organizational, community, and public policy (Anyanwu et al., 2022; Dzimbiri et al., 2022; Goldberg & Mawn, 2015). These categories are nested within a wider contextual perspective that includes policies that underpin certain values and individual behavior (Dzimbiri et al., 2022).

A number of studies have been conducted uti-

Figure 1. Relationships among the Strata of the Social Ecological Model (SEM)



lizing the SEM to examine issues related to food insecurity and public health in the U.S. and other countries. For example, Alaimo et al. (2016) examine the ways in which community gardens promote health in the U.S. The study utilized the SEM and found that individual, social, emotional, and environmental drivers promoted health via community gardening. Likewise, a study examining the perceived implications of COVID-19 policy on urban residents utilized the SEM and found that multiple intrapersonal, interpersonal, organizational, community, and public policy factors impacted food security among urban residents in Malawi (Dzimhiri et al., 2022).

The SEM can be adapted to the context of food donation programs such as Growing Together through analysis of these five spheres (Janssen et al., 2022). In the context of Growing Together, the intrapersonal sphere (Figure 1) includes the attitude, knowledge, and motivation of volunteers regarding COVID-19's impact on MGV participation and interactions among MGV. The interpersonal sphere refers to the ways in which the influence coming from friends, family, and relatives contributed to MGV participation during the COVID-19 crisis. The organizational level refers to operational procedures and protocols, including how these changed during the COVID-19 pandemic to accomplish several goals such as addressing the virus. The community sphere includes considerations of how organizations formed partnerships and collaborations during the pandemic to ensure continuity fresh produce donations to food pantries and food banks to meet the needs of low-income Iowans. The societal sphere addresses the county, state, and federal government policies, guidelines, and protocols for essential critical infrastructures to effect change during the pandemic.

Through these nested spheres, the SEM allows for an examination of which factors in each sphere facilitated or hindered the effective participation of MGVs and affected their donation of fresh produce to food pantries and food banks for low-income Iowans during the pandemic. In this study, we adopted the SEM to enable us to understand how COVID-19 affected MGVs at various levels of society as local, state, and federal government operating procedures disrupted fresh produce dis-

tribution to food pantries and curtailed patrons' access to healthy food.

Role of Master Gardeners in Food Donation Programs and Health

The Master Gardener program is a nationwide, state-administered initiative founded in the early 1970s (Gibby et al., 2008). The most active programs exist at land-grant universities. Typically, MGVs are an important component in extension strategy (Meyer, 2007).

For almost 50 years, Extension Master Gardeners (EMG) have educated millions about sustainable and environmentally friendly garden practices. USDA's National Institute of Food and Agriculture (NIFA) provides crucial support to the Extension Master Gardener program through capacity funding to Extension programs in all 50 states and the District of Columbia. (Lawrence, 2022, para. 1)

In some communities, MGVs share horticultural knowledge with community members, answer calls, create and care for demonstration gardens, and work with community members who are disabled, youth, and special groups (Dorn, 2019; The University of Tennessee Institute of Agriculture, n.d.).

These programs focus on expanding the number of MGVs to increase their impact. However, MGV programs and roles vary widely across land-grant universities. In Utah and California, MGVs participate in mitigating household water wastage (Muntz & Kopp, 2019; Regents of the University of California, 2024). In Pennsylvania, MGVs train communities in watershed management (Pennsylvania Master Gardener Program, n.d.). In Arkansas, MGVs run plant therapy programming and participate in horticulture education (Arkansas Master Gardener Program, 2021). In Iowa, Growing Together brings the Master Gardener program and community garden model together with food donation to increase fresh produce access at food pantries. A community donation garden is a piece of land set aside for collective gardening purposes to cultivate fruit, vegetables, and herbs for personal consumption (Egli et al., 2016). In addition to

providing fresh produce for community members, these gardens often function as teaching and demonstration opportunities for schools and the communities in which they exist.

Project Background: Growing Together

This article examines shifts in food availability through a case study Growing Together, which is funded by SNAP-Ed and the Iowa Master Gardener program (Chennault, 2021; Irish, 2018). Master Gardener programs primarily focus on educating the public about horticultural practices and garden production with a recent focus on increasing fresh produce access at food pantries (Gibby et al., 2008). Growing Together involves county Extension staff, MGVs, and non-Master Gardener volunteers, all operating within Iowa State University Extension and Outreach. The program aims to enhance fresh produce access for low-income Iowans and to address food insecurity through education programs. MGVs are pivotal in planting, managing, harvesting, and transporting produce to food pantries, often located at churches, low-income county public housing areas, or elsewhere on public lands.

Conceptualizing Community

Understanding how community garden volunteers experienced the pandemic requires understanding the concept of “community” in the context of gardening and donation programs. The contemporary sense of community as a social policy concept emerged during the 1960s to refocus political discourse and public programming away from top-down development approaches toward participatory models more inclusive of economically and racially diverse peoples (Fremaux, 2005). Community gardens are often perceived as a means of fostering unity and vitality within a conceptually established but materially underdeveloped “community” (Anderson, 2021; Fremaux, 2005). They are presumed to facilitate social bonds and create social capital (Firth et al., 2011). The concept of community often carries assumptions of cohesion, collaboration, and inclusion, which manifest through the portrayal of community as a space of shared interests, infused with beliefs in the public good (Dewey & Peters, 2001). On the other hand, commu-

nity donation garden programs, founded on this unitary understanding of community, also have the potential to perpetuate inequalities by simplifying and essentializing the concept of community, thereby neglecting those who do not neatly fit into this framework (Joseph, 2002).

Firth et al. (2011) argue that community is both a challenge and solution. For example, governance structures and rules controlling access to community donation gardens may inadvertently reinforce exclusion. Ghose and Pettygrove (2014) observed that gardens were marked by unequal power dynamics, hindering initiatives of certain groups. Exclusion within community donation gardens may extend beyond the distribution of produce, also encompassing the decision-making and distribution processes (Neo & Chua, 2017). Social support programs frequently adopt the term “community” without a deep understanding of its historical context, associated connotations, or underlying dynamics of linguistic, representational, and practical exclusion.

Fremaux (2005) emphasizes that programs promoting community without interrogating common monolithic assumptions risk overlooking and exacerbating dispossession and discrimination. In the case of Growing Together, the MGV program excludes patrons from planning, such as decisions regarding planting, budgeting, and harvesting. The COVID-19 pandemic demonstrated that the idea of community as common good may be a myth: as social distancing protocols operationalized, the MGVs could withdraw their gardening efforts without compromising their access to healthy, fresh food. Effective community gardening, however, became impossible (Huang et al., 2023). This is evidenced in the result sections in Figure 3, Figure 4, and Table 1. As the community of volunteers disintegrated, gardening reduced—resulting in dramatically lower yields. Pantry patrons, less likely to have access to fresh produce elsewhere (e.g., a grocery store), were more vulnerable to being affected by the stoppage of community donation gardening than the MGVs.

Methodology

This study used quantitative and qualitative methods to gather information about the community

donation garden operations and volunteering during the COVID-19 pandemic. The study was determined exempt from approval by Iowa State University's Institutional Review Board, but ethical procedures for human subjects were followed as professional practice. We employed a mixed-methods research design (Creswell & Plano, 2011), which collects data during a common period (Creswell, 2009, p. 214). We draw on primary method and secondary methods, with the latter supporting the process and being integrated into the predominant method (Creswell, 2009, p. 214).

Data Collection

Data provided for open-ended questions were obtained using Qualtrics software via an emailed link to 29 Growing Together MGVs and coordinators approved to participate in the program. The MGV coordinators lead and organize the MGVs. They also serve as liaisons with county Extension staff in the grant funding application process and grant reporting process, making them key professionals to include in the survey.

The MGV coordinators provided quantitative data by responding to the 15-question survey that focused on fresh produce donation quantities, demographics of coordinators, educational activities, engagement strategies, and time investments. Data were requested for the years 2016 to 2021. In 2020, short answer or open-end question was added concerning COVID-19 pandemic experiences from Master Gardeners; this question was only on the survey for the year 2020. The question prompt was: "Please share more details related to your responses above regarding how COVID-19 impacted your project." Responses to the open-ended question related to COVID-19 were received from 26 MGV coordinators.

Data Analysis

Content Analysis

Content analysis is a quantitative analysis of qualitative data (Bernard et al., 2016; Downe-Wamboldt, 1992). Text box responses were downloaded into an Excel sheet corresponding to each MGV coordinator. General descriptors/pseudonyms (i.e., MGV coordinator 1 to MGV coordinator 26) were

used to protect the privacy of the respondents.

The survey responses were entered into Microsoft Excel for management and analysis. The process included naïve reading of survey responses to learn MGVs' perspectives on operations of Growing Together during the COVID-19 pandemic years of 2020–2021 (Bernard et al., 2016; Lindseth & Norberg, 2004; Russomanno et al., 2019). We then conducted an iterative reading of all responses to develop a codebook for better understanding and to reduce biases. Responses were inductively analyzed following the guidelines of Bernard et al. (2016). Subsequently, we conducted the quantitative phase of content analysis using the code list to aggregate the number of times a word or phrase was mentioned. After all responses were coded, the codes were aggregated into five levels of influence, emulating aspects of the SEM framework (see Figure 1 and Bronfenbrenner, 1976). We analyzed the relationship between categories utilizing interpretative strategies with familiar sentiments, main ideas, and diversity of experiences manifested through summaries and essential quotes (Huang et al., 2023).

Time Series Analysis of Produce

We generated descriptive statistics to summarize the pounds of produce donated each year before the pandemic (2016–2018) and during the pandemic (late 2019–2022). We conducted a time series analysis on the pounds donated, number of MGVs, number of non–Master Gardener volunteers, and volunteer hours as the primary parameters of interest to assess changes between the pre-pandemic and pandemic years. To illustrate the direction of change, we fitted trend lines and linear trend line equations. Furthermore, we used simple linear regression to examine the relationship between pounds of fresh produce and MGV hours.

Validity and Analysis

Time series analysis designs have several control threats to validity, as described by Ary et al. (2018). Some validity threats merit particular attention. History often poses a significant threat to validity. There is the possibility that external phenomena may have influenced the observations in the time series. While in the case of this study another his-

torical event cannot be ruled out as the reason for the decline in participation and produce production, its qualitative aspect includes survey responses from MGVs who explicitly attribute these decreases to the pandemic. Additionally, similar studies on pandemic programming in other sectors and industries demonstrated similar issues. Therefore, history as a threat to the time-series analysis was minimal since the pandemic itself was the treatment and was experienced across all included counties, which were subject to similar state and federal public health constraints.

Instrumentation, the method of measuring the time series, represents another threat to validity, as noted by Ary et al. (2018). Issues with instrumentation might result from changes made in the instrument, potentially leading to errors in data collection. When there are changes in instrumentation, those changes should be documented. We controlled for this by using the same data collection instrument from 2016 to 2021 across all counties that participated in the program; the exception was the addition of a question concerning the COVID-19 pandemic. We collected the same variable data from the inception of the program and across counties. For a reliable measure of the pounds of fresh produce we used the pound scale, and weights were recorded in an Excel spreadsheet.

Findings

The aim of this study was to examine how COVID-19 impacted Master Gardener activities, specifically the production and distribution of fresh produce, across Iowa under the Growing Together program.

Content Analysis Results

Content analysis generated themes from the MGV COVID-19 short answer or open-end survey question, “Please share more details related to your responses above about how COVID-19 impacted your project.” These themes were volunteer availability, operating procedure changes, programming changes, and food patron attendance.

Theme 1: Changes in Volunteer Availability During COVID-19

COVID-19 significantly affected volunteer availa-

bility for Growing Together, impacting all SEM spheres (intrapersonal, interpersonal, community/organization, societal; Figure 2). The pandemic caused labor shortages as volunteers, particularly senior citizens and those in healthcare or public service, avoided participating due to health concerns. In the interpersonal sphere, volunteers reported that other volunteers missed social interactions and worried about virus transmission. MGV coordinator 2 pointed out, “volunteers, especially senior citizens, were impacted—they continued to practice social distancing and prioritized their safety. Additionally, some volunteers were part of the healthcare or public service sectors” (Table 1). A strong volunteer base is essential for the Master Gardeners program; their decreased participation due to social distancing delayed garden preparation, planting, and harvesting. Notably, 64% of Master Gardeners identified volunteer availability as the main challenge. MGV coordinator 11 reported that “the [p]roject had a delayed start due to the shortage of volunteers and the inability to align work schedules with the tasks that needed completion” (Table 1).

Theme 2: Changes in Operating Procedures: Organizational and Community Spheres

Historically, Growing Together MGVs played a key role in the broader community. MGVs formed relations with various entities in the community such as nurseries, churches, seed businesses, lumber, and landscaping businesses. MGVs utilized these partnerships to acquire free seedlings, timber, mulch, and seeds. However, during the pandemic, the community bond and interconnectedness disintegrated as many of these businesses closed. One MGV coordinator pointed out, “We did not purchase items for or do garden infrastructure projects that we had planned (such as fencing and raised garden beds). ... We are unable to carry out all or part of the proposed connect strategy from our immigrant application.”

Approximately 52% of Master Gardeners reported that operating procedures posed a challenge to the effective performance of their activities. MGV coordinator 13 expressed, “The most significant way the pandemic impacted our project this year was through the ongoing restrictions imposed

Figure 2. Relationships among Social Ecological Model (SEM) Spheres and Levels of Understanding about COVID-19's Impact on Master Gardener Volunteers' (MGVs') Participation in the Donation Program

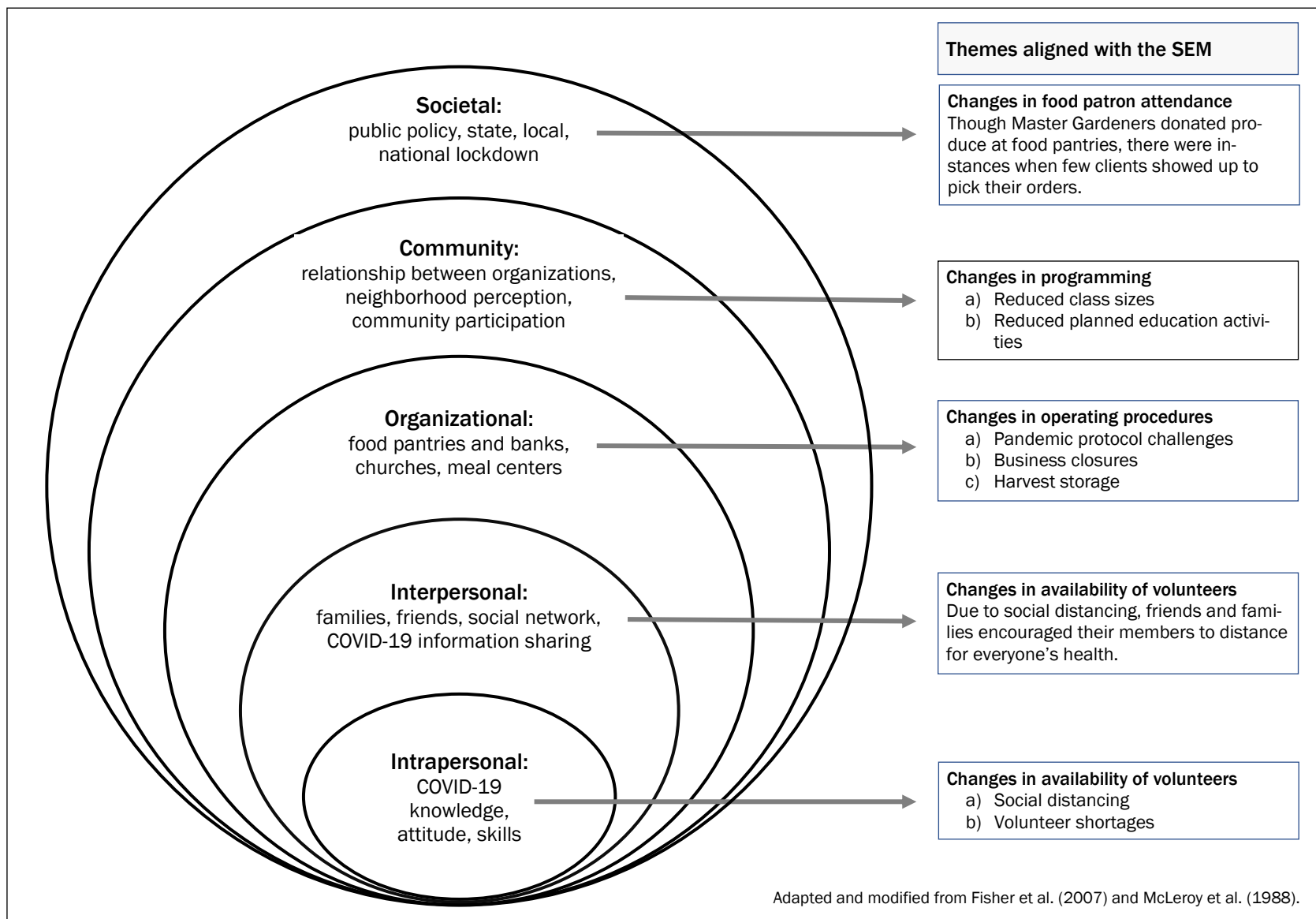


Table 1. Emerging Themes from Responses to Open-Ended Questions on Influence of COVID-19 on Experiences and Behaviors of Growing Together Master Gardeners (*n* = 26)

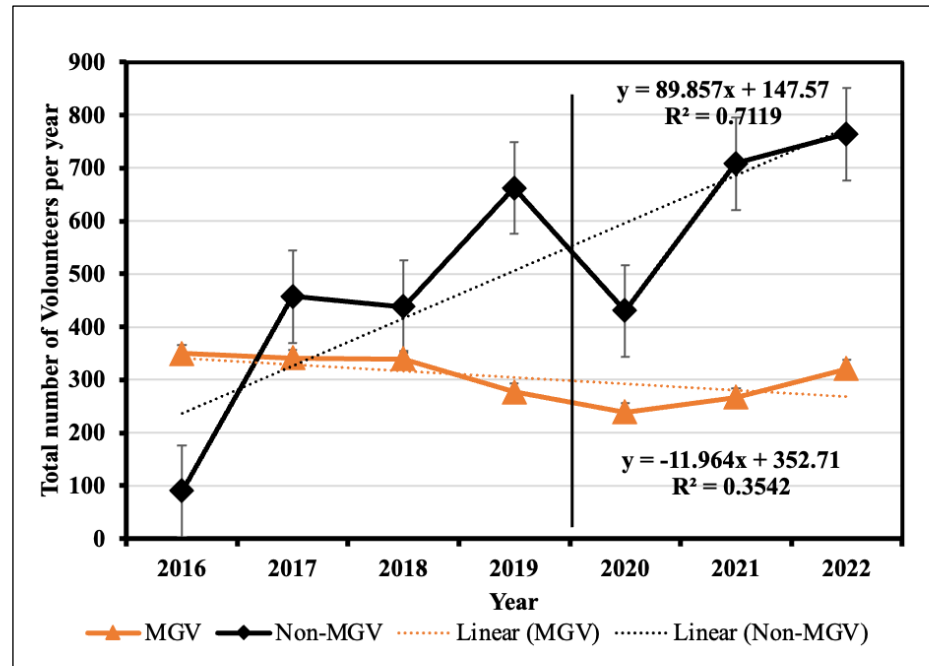
Themes	Operational Definition	Growing Together Master Gardeners' Verbatim Quotations	Code Frequency (%)
1. Changes in the availability of volunteers a) Social distancing b) Volunteer shortage	MGV explaining the challenges of finding volunteers during the pandemic	Changes in the availability emerged as the overarching themes concerning the influence of COVID-19 on GT-MGVs. "The Project started later due to volunteer pool—and inability to have compatible dates with work needed to be completed ... by volunteers." (MGV coordinator 11) "Some large groups that regularly volunteer in the Garden cancelled their events, and therefore, did not volunteer here. ... Volunteers were impacted from the senior citizen side—still social distancing and making sure they were safe. Other volunteers were in the health care or public." (MGV coordinator 2) "Other volunteers in the health care or public service sector did not have additional time to give as many had been stretched in their regular employment working over-time or double shift. We had two people who helped before tell us they couldn't because of COVID and they had immune-compromised people at home." (MGV coordinator 11)	64
2. Changes in operating procedures a) Pandemic protocol challenges b) Business closures c) Harvest storage	Reporting the changes that happened to work within the pandemic guidelines	Growing Together MGVs reported changes in operations and protocols that affected the operations of Master Gardeners. "They would not allow us to put up the shelving unit at their site with educational boxes as we had planned." (MGV coordinator 13) "The [biggest] way the pandemic affected our project this year was in the continued restrictions imposed by one pantry to keep the produce outside their building, exposed to the covid." (MGV coordinator 13) "[Also], we had planned to coordinate with a local church who offers free meals and do tastings, but the church changed their format to a drive-through so we weren't able to set up a tasting/information table like we had hoped." (MGV coordinator 9)	52
3. Changes in programming a) Reduced class sizes b) Reduced planned education activities	Participants report on the changes that happened to be able to conduct classes during the pandemic.	Due to the challenges elaborated in the previous themes, programmatic changes also occurred. Respondents noted reduced class sizes resulting from COVID-19-related restrictions. "Produce Basics food pantry classes was reduced by both the uncertainty surrounding Covid-19 restrictions and the safety in attending a public class." (MGV coordinator 6) "We had hoped to do programming at the food pantry, but because of this restriction we were not able to....[programming] was held at the county [Extension office]. MGV coordinator [I think] attendance would have been higher if it would have been held at the food pantry." (MGV coordinator 16)	20

		“[In general], COVID just reduced our ability to offer face-to-face education.” (MGV coordinator 9) “Our planned education directly to the food pantry clients was not possible so we would have liked more people to be reached in this way.” (MGV coordinator 5) “We were unable to have planned engagement with the food pantries and the low-income senior living facilities due to COVID concerns and the changes made to their regular programming.” (MGV coordinator 19) “We weren’t able to have the in-person classes at the pantry site that we had hoped to have that would have focused on using produce they received....[Instead], we had to rely on written information that was delivered with the produce.” (MGV coordinator 15) “The food pantry was open on a “pick up” option only. Patrons were not allowed to shop in the building and pick their own produce.” (MGV coordinator 16)		
4. Changes in food patron attendance	Participants described the decline in patron attendance as due to changes in operation.	Though Master Gardeners donated produce at food pantries, there were instances when few clients showed up to pick their orders. “[In August] very few clients were showing up at the food pantry when it reopened because of the trucks from one food bank making monthly deliveries at the high school. As well, [t]here were fewer volunteers than we expected.” (MGV coordinator 12)	8	

by one pantry, which required produce to be kept outside their building” (Table 1). Storing produce outside contradicted the food safety knowledge and skills they acquired through training provided by Iowa State University Extension and Outreach. The pandemic prompted a paradigm shift in the operations of programs and food pantries due to social distancing policies. These policies restricted the number of people allowed to gather in the same space, which in turn affected Master Gardeners as fewer volunteers attended gardening activities. The limitations on gatherings subsequently hampered the efficiency of MGCV operations in meeting food pantry clients’ needs. Due to social distancing guidelines, the number of MGVs and non-MGVs declined as well (Figure 3). With fewer gardening volunteers, produce poundage decreased from 120,000 to 80,000 (Figure 4).

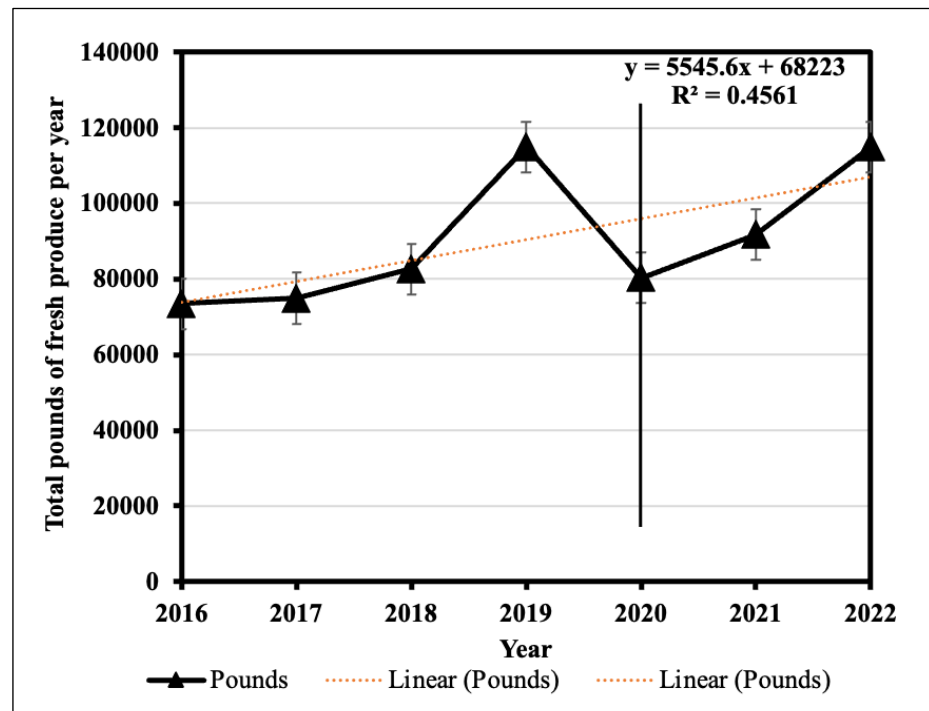
Theme 3: Changes in Programming: Organizational Sphere
Due to COVID-19 challenges, programmatic changes also occurred. The Growing Together programming originally

Figure 3. Trends of Master Gardener Volunteers in Iowa Since 2016



Note: A non-Master Gardener volunteer (non-MGV) is any member of the community who participated in volunteering but did not undergo a 10-week training course in gardening including participation in four in-person sessions through the county office. However, they are willing to volunteer to support

Figure 4. Trends of Total Fresh Produce Donated Each Year Since the Inception of the Master Garden Program in Iowa



engaged food pantries and low-income seniors. However, MGV coordinator 19 reported, “We were unable to engage as planned with the food pantries and the low-income senior living facilities due to COVID concerns and the alterations made to their regular programming” (Table 1). MGV coordinator 16 added, “We had hoped to conduct programming at the food pantry, but due to these restrictions, we were forced to hold our programming at the county [Extension office]. I believe attendance would have been higher if it had been held at the food pantry” (Table 1). Respondents noted that reduced class sizes resulted from COVID-19–related restrictions. Furthermore, given the high mortality rates from the pandemic, most clients hesitated to attend in-person classes, raising concerns about the long-term impact on class sizes. As one volunteer coordinator noted, “due to the challenges elaborated in the previous themes, programmatic changes also occurred. ... Respondents noted reduced class sizes resulting from COVID-19-related restrictions.” The reduced class sizes, attendance numbers, and programming were influenced as well by the volunteers’ social distancing (Figure 3). Food pantries were challenged with longer durations of receiving, storing, and distributing fresh produce during the pandemic years. As some MGVs observed, food pantries did not accept fresh produce due to storage constraints. Before the pandemic, the patrons knew when the fresh produce would be available and retrieved it on the same day. Food pantries’ declining to receive fresh produce donations posed a new challenge for the MGVs; previously, they did not have to worry about storing the produce. As community donation gardens do not have storage facilities, in some situations the produce was left outside on shelves at the food pantry premises, which risked compromising food safety rules.

Theme 4: Changes in Food Patron

Attendance: Societal Sphere

Despite Master Gardeners’ food pantry donations, there were instances when only a few clients came to collect their orders. In other cases, clients would arrive to find the pantries closed due to a shortage of volunteers. Changes in the location and delivery of food were not dominant trends, but their occur-

rence underscored how food needs dramatically surged during the pandemic. According to MGV coordinator 26, “There were fewer volunteers than we expected, but food pantry needs increased by 40%, so we redoubled our efforts” (Table 1). Despite the increased demand, patrons still struggled to safely retrieve food from the pantries or coordinate food pickups from various changing locations. The MGV leadership teams also faced communication challenges during the pandemic. As one volunteer noted, “we had fewer volunteers than planned—our project team had communication challenges. ... [We] had to scale back the size of the garden unable to carry out proposed activities.”

These comments speak to communication gaps between patrons and MGVs or supervisors. Very few comments suggested volunteers knew patrons well or had relationships with them. The content primarily concerned patrons as users. The lack of a communication system between volunteers, pantries, and patrons affected whether patrons knew of closures or shifts in availability. Communication was usually conducted by the pantries but may need to be considered across the food donation system. The benefit for the garden program would be closer social contact with people experiencing food insecurity, which could benefit both the patrons and volunteers, strengthening community relationships.

Times-Series Analysis Results

The results of the analysis revealed significant differences in fresh produce donations between the pre-COVID-19 years (2016–2019) and the pandemic years of 2020–2021. The quantities of fresh produce increased from 85,000 to 110,000 pounds from 2016 to 2019. However, the increase in fresh produce donations stagnated when the pandemic hit in 2020 (Figure 4). The time series analysis also showed significant differences in activities and participation between MGVs and non–Master Gardener volunteers. The number of volunteers exhibited fluctuations, with a notable decline from 690 to 470 volunteers in the year 2020 (see Figure 3). Figure 3 illustrates the year-to-year variability in the linear trend and trend line equation for non–Master Gardener participants since the program’s inception.

Notably, there was a decreasing trend between 2019 and 2020, followed by an increasing trend after 2020. The trends were influenced by community togetherness and disintegration, respectively. The best-fit line equation was positive ($y = 89.857x + 147.57$). The number of MGv participants decreased from the inception of the trend line (Figure 3). The linear trend line equation was negative ($y = -11.964x + 352.71$). The most significant decrease occurred in the year 2020, during the height of the pandemic protocols. However, in the years following 2020, both trends showed increases with an overall upward trajectory. After the initial year of the pandemic, more counties applied for Growing Together immigrant funding, which led to an increase in the number of gardens and thus the number of volunteers.

As shown in Figure 4, the results indicated a positive trend in the amount of fresh produce donated since the program's inception. The trend equation, $y = 5545.6x + 68223$, suggested a steady annual increase in donations. Figure 4 also depicts fresh produce donation variability, with notable fluctuations observed in 2020, the pandemic's peak. However, following 2020, there was a significant recovery approaching pre-pandemic donation levels seen in 2019, particularly in 2021 and 2022.

When comparing MGv activities to participation data over three years, a conspicuous difference emerges. In the nonpandemic year of 2019, an average of 4,500 pounds (2,041 kg) of fresh produce was donated, whereas during the pandemic years the average dropped to approximately 2,136 pounds (969 kg) of produce donated. During this period, the MGv community had largely stayed at home. These trends identified in the quantitative analysis align with themes from the qualitative analysis, reflecting the volunteers' perceptions of the pandemic's impact on their operations and the decline in the pounds of fresh produce donated to food banks and pantries—highlighting reasons for decline in both.

After 2020, however, donations spiked from 65,000 to 85,000 pounds (29,500 to 38,600 kg), then rose to 110,000 pounds (49,900 kg) in 2021 (Figure 4). This correlated with an increase in volunteer numbers, indicating that volunteers had returned to gardening at the pre-COVID production level.

Nonpandemic Year 2019

The year 2019 preceded the pandemic and is considered a nonpandemic year. There were 300 MGVs, and activities did not appear to be disrupted (Figure 3). Between 2018 and 2019, yield was high because of sufficient volunteer labor. The increase was attributed to the popularity of the program, leading more counties and MGVs to apply and join the program. In 2019, MGVs offered nutrition, cooking, and food safety lessons. The MGVs' gardening, delivery of fresh produce to food pantry for clients, and educational programming were largely able to begin on time and proceed as anticipated.

Pandemic Years 2020 and 2021

During 2020 and 2021, the impact of COVID-19 protocols was evident, as both quantitative and qualitative analyses revealed disruptions in the participation and activities of the MGVs. These disruptions led to a decline in volunteer participation and fresh produce donation, as depicted in Figures 3 and 4. MGVs reported pandemic-related programming impacts. In Theme 4, some volunteers mentioned a decrease in the number of patrons. They also pointed out a significant drop in the number of volunteers, which coincided with a sharp increase in the demand for their services.

Coordinating volunteers in the face of cancellations and illness posed substantial challenges, particularly because many volunteers belonged to groups highly affected by the pandemic, including the older adults, healthcare workers, and those employed in the service industry. These disruptions made it difficult for MGVs to operate successfully to meet the needs of Iowans. This aligns with Graham (2020), who argued that the older adults and children were among the most vulnerable populations during the COVID-19 pandemic, and who were often forced to remain homebound.

Discussion

The purpose of this study was to gain a deeper understanding of how a statewide food donation and education program associated with a land-grant institution was affected by the changing protocols and constraints of the COVID-19 pandemic years (2020–2021). The results show the COVID-19

pandemic contributed to operational changes in MGVs' activities, bringing opportunities and challenges at individual, interpersonal, communal, organizational, and societal levels.

Prior studies note that COVID-19 impacted food supply chains and food security (Barman et al., 2021; Larison et al., 2021; Wolfson et al., 2020). However, none of these studies attempted to analyze the impact using the multilevel modeling of the social ecological model. This study is important because it examined the impact of COVID-19 on a fresh produce donation garden program—a program that depends on master gardener activities and volunteer participation to grow, harvest, and donate fresh produce to food pantries for low-income Iowans. Because this program operates at multiple levels and mutually affects a variety of stakeholders, using the SEM framework allows an analysis of each discrete sphere of interaction as well as the interactions between and across spheres.

The four themes generated during the qualitative analysis—changes in the availability of volunteers, in operating procedures, in programming, and in food patron attendance—represent the major factors that affected Master Gardener participation and hence food production. By comparison, the quantitative analysis indicated that there was a significant difference between the nonpandemic year and pandemic years on Master Gardener participation in the Growing Together program and the quantity of pounds of fresh produce donated. The themes align well with the five levels of the SEM framework.

The findings from the quantitative analysis indicate that COVID-19 impacted Master Gardener participation in the program and the quantity of pounds donated. However, when examining the individual means of MGVs and pounds donated each year, there is a bigger difference between 2019 and 2020 than between 2020 and 2021 (Figures 3 and 4). At the level of the interpersonal sphere of the SEM, COVID-19 disruptions contributed to the decline of MGV participation. Many MGVs were at high risk of severe infection due to age and thus decided to distance socially to avoid contracting or spreading the virus. While gardening prior to the pandemic provided opportunities for primarily

older adult MGVs to exercise and build relationships with their peers, COVID-19 disrupted these socializing opportunities. Similar results were noted in the study of food banks and COVID-19, where food banks experienced a decline in volunteers, many of whom were older adults and thus a high-risk population (Byrne & Just, 2022; Capodistrias et al., 2022; Crooks et al., 2022; Lioutas & Charatsari, 2021). The decline of MGV participation had ripple effects across stakeholders during the pandemic years—for example, reduced volunteering lowered donations, which in turn affected pantry patrons' access to fresh produce.

Despite the overall decrease, the MGVs did not disappear altogether. Several MGVs did participate, especially those with a strong service conviction about the program. This minimal participation ensured a sustained supply of fresh produce, but it was significantly lower than nonpandemic years. These results are consistent with Stephens et al. (2020), Capodistrias et al. (2022), Song et al. (2021), and Weersink et al. (2021), which showed issues with labor availability in the agri-food sector, attributing the decline in labor to sudden quarantine restrictions. Restrictions for Growing Together included MGV planting delays, yet fresh produce donation depends on timely MGV labor (Figure 1). Delays in planting affected yield output and the entire supply chain. This finding is validated by Barman et al. (2020) and Stephens et al. (2020), who reported negative impacts on the food supply chain, noting that delayed starting interfered with the production cycle in the agri-farming system in terms of timely planting, harvesting, packing, and delivery.

Pandemic circumstances necessitated a paradigm shift in the operation strategy to ensure continued program delivery (Lioutas & Charatsari, 2021; Mejia et al., 2020; Osafo, 2021). At the community/organization sphere of SEM, operational changes regarding the community could be attributed to employee sickness, disruptions in the supply and quarantine measures, and restrictions that impacted availability and cost of supplies (Mejia et al., 2020). County offices where the MGVs used to meet to plan for gardens and social interactions closed, which contributed to isolation.

When disasters happen, communities often

come together to support each other in providing and sharing food, transportation, and housing. However, the COVID-19 pandemic challenged common notions of sharing. Community often refers to bonds of interconnectedness, commitment to each other, and caring and trust among community members (Anderson, 2021). However, the community bond during the pandemic could not be expressed in-person. Instead of devising creative ways to continue to support and share with one another, MGVs were primarily concerned with their personal health and safety (which did not depend on the gardens they volunteered at). Therefore, the notion of community in the case of Growing Together community donation gardens dissolved. MGV social distancing created labor shortages and impacted fresh produce production (Figure 4; Kingsley et al., 2022). The pandemic challenged the concept of community: interconnectedness was embraced when volunteers were not experiencing crisis or faced with a mortal threat. The threat of the COVID-19 virus, however, exposed the precarious nature of community through exposing patrons' dependence for fresh produce on volunteer stability.

One way to mitigate the impact of such a pandemic on the donation gardening program would have been to engage patrons as part of the community as gardeners or volunteers. If patrons were involved in the gardens before the pandemic rather than during it, they would have been able to cultivate and harvest as well. Patrons spanned age levels more than volunteers, and their motivations were linked more directly to food procurement.

At the community level, before COVID-19, MGVs established partnerships with several organizations to support fresh produce donation to food pantries, including meal centers, nursery businesses, garden supply and lumber shops, and churches. These partnerships generated food donations, fundraising, and relationships with families in need. However, during the pandemic these partnerships stalled. Many partner organizations were considered inessential and thus closed.

At the organization level of SEM, operating restrictions in some counties created hardships accessing input supplies for timely planting, harvesting, and donation. Many businesses also faced

labor shortages, including agribusiness stores; some closed or changed operating hours. Similar to Chitraker et al. (2021), these study results found the COVID-19 pandemic impacted access to garden supplies. MGVs' belated access to inputs delayed the donation, reducing services to clients (Mejia et al., 2020). When donations were ready, MGVs faced difficulties storing the harvest until food pantries opened. Some produce went to waste, especially easily perishable foods like tomatoes and leafy vegetables. Not unique to Growing Together, agricultural systems worldwide faced the problem of processing capacity and storage, which led to produce wastage. Many food pantries closed or operated half-time, especially meal centers (Stephen et al., 2020). At the community/organization level of SEM, meal centers that used to take in large quantities of fresh produce closed due to a limited number of volunteers for meal preparation.

While many programs also adopted virtual programming, fresh produce donation programs did not have this option, contributing to reduced education opportunities. As volunteer and client numbers reduced, class sizes reduced too. Teaching and learning became inconsistent: some clients did not see the need to continue to attend. The study established that COVID-19 impacted not only MGV operations regarding fresh produce production but also the quality and availability of nutrition education. Despite such setbacks, some MGVs were committed to ensuring the presence of fresh produce in food pantries that remained open, while several others found creative ways around pandemic restrictions to deliver some form of nutrition education.

This study highlights the complex, interconnected impacts of COVID-19 on a fresh produce donation program and the MGVs and food pantries involved across Iowa. In some cases, fresh produce donations were no longer accepted, and instead, financial donations were requested to enable food pantries to buy large volumes of food boxes. In others, gleaning and rescue programs from farms and grocery stores were suspended (Larison et al., 2021). These impacts resulted in food pantry patrons receiving prepacked food bags instead of choosing according to preference (Byrne

and Just, 2022; Huang et al., 2023; Kingsley et al., 2022; Sánchez et al., 2024).

These impacts underline challenges faced at multiple levels of community and organization, emphasizing the need for adaptive strategies to maintain program effectiveness during crises to ensure that underserved communities have consistent access to fresh produce. Additionally, such adaptive strategies would shield the program participants from growing apart.

Limitations

There are several limitations to this study. One limitation is that the study uses secondary data. Primary data through interviews or focus groups, such as for the data from Master Gardener coordinators, could have permitted probes for key areas, but the nature of the pandemic did not encourage primary data collection. Secondary data collection also limits the degree of control of instrumentation. Additionally, the survey did not collect ideal demographic data from respondents. This created challenges in further contextualizing responses from the participants. Having such information would allow us to understand how the pandemic affected MGVS according to age, location, income, education, and location.

Conclusion

This study explored the intersection of the COVID-19 pandemic on food insecurity and one of its anticipated remedies: fresh produce donation programming at the local, regional, and state levels in the U.S. The study asked how operational changes in a community donation gardening network in 2020–2021 may have been influenced by the pandemic in terms of its staffing and operating procedures and in production of fresh produce as donation tonnage. The study also probed a key and often neglected element: the social implications of selected changes prior to and during the pandemic related to donation gardens. The study focused on a fruit and vegetable donation program with some educational interventions run by MGVS associated with SNAP-Ed funding and Iowa State University Extension and Outreach. The donation program provided fresh produce mainly to food pantries and small-scale food distribution centers. Key find-

ings include disruptions coinciding with an increased nationwide demand for affordable fresh produce. Access to nutritious produce is crucial for addressing the health challenges of food pantry clients, but availability and other aspects of access were hindered by the pandemic.

Content analysis of Master Gardener survey comments identified four factors negatively affecting Growing Together operations: fewer volunteers and reduced availability, changes in procedures, reduced programming, and lower food pantry attendance. These factors hindered program functioning. Master Gardeners reported that most volunteers followed safety protocols and stayed home, which reduced labor availability for growing, harvesting, transportation, distribution, and educational programming, resulting in decreased garden output and donation. Growing Together's active programming also declined due to the suspension of field visitations, a suspension compelled by state and federal social distancing guidelines. With all operations transitioning to a virtual format, the impact was notable. The suspension of in-person visits posed a challenge for MGVS, who traditionally relied on direct guidance and interaction. The shift to virtual communication was particularly daunting for the volunteers, many of whom were older adults and less familiar with technology, requiring them to adapt to alternative means of communication with program leadership.

Furthermore, COVID-19 clarified how susceptible the current food system is to collapse during natural disasters and public health disruptions. As fewer volunteers were available to garden, people were also increasingly under more financial duress and their need for donated food rose. Those who did continue to volunteer to ensure the program realized its objectives were at risk of being exposed to the deadly virus, which exemplifies the contradictions during the pandemic between a functional fresh donation program and personal well-being (O'Hara & Toussaint, 2021). Failure to access healthy food should not be attributed to the MGVS program alone, but to the larger food system that is structured by policies and regulations that support large corporate food industry actors. This system inadvertently acts as a barrier to vulnerable populations reliant on localized food supply chains, espe-

cially in times of crisis. The challenges identified in this study are not only relevant to the years following the pandemic and pandemic circumstances but offer continued lessons on the implementation and sustainability of fresh produce provision for future crises.

This study points to the importance of food organizations having contingency plans to mitigate challenging circumstances, such as public health emergencies like COVID-19. One example of this is contingency financing (i.e., allocated program savings) structured into the budget, which could allow for adjustment to dynamic circumstances. Such funding could support the purchase of power tools, making gardening with fewer volunteers more efficient; had this been the case with the Growing Together donation gardens, it could have resolved the issue of social distancing. Youth recruitment could also support gardening, harvesting, and distribution. This could be done as summer programming, as part of formal education, or as a community-service opportunity. Fresh produce donation programs reliant solely on older adults need to implement financial or in-kind incentives to attract underemployed rural young adults to community gardening. A broader volunteer base could result in higher yield and more consistent deliverables.

On an organizational level it is critical to assess the precarity or pretense of “community.” If community gardens were truly a site of interdependence, they would have stuck together and perhaps even strengthened when the pandemic hit—finding ways to creatively support each other. As sites composed of disparate and disconnected groups of people with asymmetrical dependence on one another (i.e., patrons relied on gardeners, but gardeners did not rely on patrons), the pandemic revealed this asymmetry: those who could stay at home did so to care for themselves. It is thus important to revisit the framework of the community garden itself, to interrogate what is meant by the term “community,” and to reconsider the role patrons play (or do not play) in the cultivation of fresh produce in the gardens and Growing Together programming.

Recommendations

This study underscores the vulnerable nature of the volunteer labor base associated with Growing Together and which is common among similar fresh produce donation programs. These programs depend almost wholly on volunteers who are mainly older adults and at a vulnerable stage of life, especially during public health crises. While Master Gardeners have long contributed to gardening education in many states, the move to the direct provision of fresh produce to underserved families changes their responsibility profile and might prompt Master Gardener organization and organizations like it to consider shifting the current volunteer strategy. This would not only ensure a more stable labor base but also foster intergenerational learning, aligning with the Master Gardener initiative’s educational vision. The organization might look to other organizations that have experienced something similar.

It might also be important to critically reevaluate the concept of “community” within volunteer-run community programs like Growing Together donation gardens. The title of this article asks whether the community food donation program examined here experienced growing together or growing apart during the pandemic. The article concludes that the pandemic exposed and exacerbated disconnections among groups of people rather than fostering improved communication and community cohesion. As noted in the discussion, MGV survey respondents explained that COVID-19 protocols disrupted programming that would have connected them to patrons at food pantries. Nutritional education classes were often cancelled, moved online, or shifted to a less accessible venue off-site; in-person donation drop-off and patron pick-up was frequently cancelled; and both pantry and garden volunteer groups declined in size or withdrew from programming, which shifted the availability of fresh produce for patrons. Volunteers stayed home from both gardens and pantries to protect their health, sourcing their food from elsewhere. However, pantry patrons, likely to be food-insecure and suffering from diet-related chronic diseases that increased their susceptibility to serious infection, still needed the produce and could not necessarily access another source. If pa-

trons had access to the garden site directly rather than just the food pantry, they could have worked with garden coordinators and pantry staff to assist with cultivation, harvest, and consumption. A critical mutual review would assist the community in establishing togetherness and identifying and meeting each other's needs. This work focuses on issues related to inclusion, diversity, and belonging due to racial, ethnic, and class differences between patrons, volunteers, and programmatic staff.

A challenge facing food pantries regarding community is demographic data collection (Martinchek, 2020; Sánchez et al., 2024). Pantries are often understaffed with part-time workers and thus lack the labor capacity to collect data. Food pantries also have limited resources to invest in data collection; they dedicate their primary resources to obtaining food most needed by their patrons. Martinchek (2020) observed patrons are constantly moving, which makes it challenging to track and collect follow-up data from them. This, in turn, creates difficulties in analyzing program impact. Additionally, many food pantries collect no client

data out of respect for patron privacy, to foster broader access, and to combat the persistent stigma associated with utilizing pantries. Because of these challenges, there was no demographic data available to analyze the demographic composition of patrons and volunteers for this study. Future research should examine demographics of patrons who consume fresh produce from Iowa's pantries. Further research on pantry client levels of participation in decision-making process and planning for community gardens is also critical.

Acknowledgments

We thank Growing Together Program-SNAP-Ed of Iowa State University Extension and Outreach for the support extended during the research. Moses would like to extend his gratitude to Christine Hradek, Katie Sorrel, and Susanne Deblieck, program leaders at Iowa State University, for supporting him, sharing the database, and answering some of the questions about the program to enable him to complete his program of study.

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Supporting new gardeners: Perspectives of gardeners and garden leaders

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Submitted January 17, 2024 / Revised July 10 and August 28, 2024 / Accepted August 30, 2024 /
Published online November 1, 2024

Citation: Beavers, A. W., Ray, R., Lacy, K. M., Coringrato, E., Sachs, A. L., Kelly, Z., Buchenau, H., Decker, E. K., Wirtz Fahnestock, L., Quist, P. A., Hébert, J. R., Litt, J. S., & Alaimo, K. (2025). Supporting new gardeners: Perspectives of gardeners and garden leaders. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 309–326. <https://doi.org/10.5304/jafscd.2024.141.007>

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Abstract

While gardening has been shown to have wide-ranging benefits, very little research has focused on the experiences of new community gardeners. Our study examined the experiences of new community gardeners, as well as the perspectives of garden leaders, to determine how to best meet new community gardeners’ needs. We conducted qualitative interviews with a subset of new community gar-

deners ($N = 34$) participating in a randomized controlled trial (RCT) of community gardening, and garden leaders ($N = 47$). New community gardeners learned to garden through classes, from other gardeners and leaders, from friends and family, and through teaching themselves. Garden leaders provided varied support to new community gardeners, including hands-on assistance and orientations. The events and degree of social interactions with

other gardeners in the gardens also varied, although most gardens had a culture of helping and reciprocity, and gardeners frequently brought family and friends with them to their gardens. Challenges reported by new community gardeners and leaders included lack of gardening knowledge and support; responsibility and time commitment of gardening; poor communication from garden leaders; water,

weeds, and pests; plot abandonment; and theft, vandalism, and safety. New community gardeners desired and benefited from social interaction, guidance, and support in their gardens. However, because garden leaders already have substantial garden responsibilities, placing this responsibility solely on garden leaders is frequently not feasible. This study provides insight into new community gardeners' experiences and can be used to inform programs that support gardeners.

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Conflict of Interest Disclosure

The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results. All authors declare no conflicts of interest.

Funding Disclosure

The qualitative component of the Community Activation for Prevention study was funded by Michigan State University Subaward No. 1554944 of the Research Scholars Health Equity Grant from the American Cancer Society (University of Colorado Boulder 130091-RSG-16-169-01-CPPB). Additional support was provided by the University of Colorado Boulder, the USDA National Institute of Food and Agriculture, Michigan AgBioResearch Hatch projects MICL02410 and MICL02711, and the Wayne State University Department of Nutrition and Food Science Faculty Start-up Fund.

Trial Registration

NCT03089177 at [ClinicalTrials.gov](https://clinicaltrials.gov); <https://clinicaltrials.gov/ct2/show/NCT03089177>

Keywords

community gardening, garden support, new community gardeners

Introduction

Community gardening is associated with numerous health and psychosocial benefits, including increased fruit and vegetable consumption (Alaimo et al., 2008, 2023; Barnidge et al., 2013; Litt et al., 2011), increased physical activity (Park et al., 2011, 2014), improved mental wellbeing (Hawkins et al., 2011; Soga et al., 2017; van den Berg et al., 2010), and positive social interactions (Teig et al., 2009; Toda & Lowe, 2022). These benefits may arise through the synergistic processes of spending time in an attractive natural setting, nurturing plants, producing fresh food, interacting with others socially, and collective efficacy (Bailey & Kingsley, 2020; Hale et al., 2011; Hawkins et al., 2013; Kingsley & Townsend, 2006; Porter, 2018; Saldivar-Tanaka & Krasny, 2004; Teig et al., 2009; van Holstein, 2017).

Additionally, benefits of community gardening can extend beyond the boundaries of the garden and impact the neighborhoods in which they are located. Being part of a community garden can impart a sense of belonging and develop a more cohesive feeling of community to residents of a neighborhood (Glover, 2004; Glover et al., 2005; Teig et al., 2009). Relationships that begin in the garden often extend beyond the garden, resulting in the creation of new friendships, social support in times of need, or neighbors looking out for each other (Glover, 2004; Glover et al., 2005; Teig et al., 2009). There is even evidence that community gardens are associated with reduced crime and increased property values (Beam et al., 2021; Voicu & Been, 2008).

Despite the many benefits of community gardening, there are significant hurdles that must be overcome when people begin gardening. Gardening requires developing new knowledge, skills, and habits in order to successfully produce food (Conway, 2016; Diaz et al., 2018; Hale et al., 2011). New community gardeners must learn when to plant and harvest vegetables; how to prepare their soil, plant seeds, and transplant seedlings; and must habituate themselves to visiting the garden regu-

larly to water and weed. Without adequate skills, knowledge, and support, new community gardeners may struggle and ultimately quit gardening (Diaz et al., 2018; Tharrey et al., 2020). When new community gardeners quit gardening, they may not achieve the aforementioned benefits to their own physical, mental, and social health. Additionally, the sustainability of the community garden is put in jeopardy. In a survey of 445 organizations that support community gardens in the U.S. and Canada, respondents reported a loss of 1,615 community gardens over a five-year period (Drake & Lawson, 2015). Getting new gardeners involved and keeping people involved over the long term were the second and third most commonly reported challenges experienced by these organizations, behind the top challenge of obtaining material resources for the gardens (Drake & Lawson, 2015). Thus, it is important to ensure the success of new community gardeners and support their continued participation in gardening. While substantial research has examined gardening's potential to influence health behaviors and physical and mental health, very little research has focused on the experiences of new community gardeners (Sachs et al., 2022). In most studies of gardening, either research participants are primarily experienced gardeners or data regarding how long participants have been gardening are not provided. To expand the uptake of gardening and enhance the sustainability of community gardens, it is imperative to explore new community gardeners' experiences and needs.

In the context of community gardens, governance or leadership also influences gardeners' experiences. There are a wide variety of leadership approaches used in community gardens (Fox-Kämper et al., 2018; Toda & Lowe, 2022), but there is scant research regarding gardeners' perceptions of community garden leadership. However, what little literature exists indicates that leadership is influential in improving or hindering the experience of community gardeners (Aptekar, 2015; Egerer & Fairbairn, 2018; Gilbert et al., 2020; Kingsley & Townsend, 2006). To understand the role that garden leaders can play in influencing the success of new community gardeners, more research is needed; additionally, it is important that this research includes the perspectives of both new

community gardeners and garden leaders.

This study aimed to explore the experiences of new community gardeners, as well as the perspectives of garden leaders, to learn how to best support new community gardeners. This paper describes new community gardeners' perceptions of garden leadership, garden social culture, and management of gardening challenges, as well as insights from garden leaders.

Methods

In this study, we conducted qualitative interviews with a subset of new community gardeners and their garden leaders participating in or supporting the Community Activation for Prevention Study (CAPS). CAPS is a randomized controlled trial investigating the health impacts of community gardening (Litt et al., 2018, 2023). This study was conducted between 2017 and 2020 in collaboration with Denver Urban Gardens (DUG). DUG is a nonprofit organization that manages community gardens in the metro Denver, Colorado, area, and also offers gardening education, provides subsidized or free seeds and seedlings for low-income gardeners, and recruits and trains garden leaders.

CAPS was designed with three waves of data collection in which each wave consisted of a full gardening season. Interviewees for this current qualitative study were selected from wave one and wave two of the CAPS trial. Participants were eligible for the study if they were 18 years old or older, able to give consent in English or Spanish, willing to be put on a waitlist for a community garden plot, and had not gardened in the past two gardening seasons. Descriptions of recruitment and randomization, intervention, and eligibility for CAPS have been published previously (Litt et al., 2018; Villalobos et al., 2019). Briefly, recruitment for the study was conducted in two phases. First, community gardens and leaders were invited to participate. Gardens were prioritized if they were located in low-income and minority areas as determined by 2010 census data, had a waitlist for garden plots, and had the capacity to reserve two to six plots for study participants. Second, prospective gardeners were recruited to participate in the areas surrounding the garden through 12 methods, including contacting people on the garden waitlists, referrals, dis-

plays at health fairs, posting flyers, social media, and canvassing neighborhoods.

The CAPS intervention consisted of material resources and technical support for cultivating a community garden plot, typical of what is provided to new community gardeners through DUG. Both intervention participants and control participants were offered the same intervention package, although the timing was different. Control participants were offered the intervention package after their participation in the RCT had ended. Each participant was provided a garden plot averaging 116 square feet (10.8 square meters) in a community garden. The plot fee was paid by CAPS, and participants were provided free vegetable seeds and transplants. Participants were invited to attend a free beginner gardening class. Depending on the community garden, garden leaders, master gardeners, and/or CAPS staff were available to answer gardening questions and assist participants.

An advisory team of DUG staff members, community garden leaders, past American Community Gardening Association presidents, nutritionists, and academic partners informed the design and implementation of CAPS. Both the present study and the full randomized controlled trial were approved by the University of Colorado Boulder institutional review board. Results presented here answered the research question: What were the experiences of new community gardeners and garden leaders with respect to how new gardeners learned to garden, their perceptions of garden leadership and structure, their social interactions in the garden, and obstacles to their participation?

Interviews with Community Gardeners

After their participation in the RCT was complete, a subsample of CAPS participants was contacted by phone and invited to complete semi-structured qualitative interviews. The participants were selected by purposive sampling to ensure variation in level of gardening engagement, demographics, and assigned community garden. Twenty-nine intervention participants and 26 control participants were contacted to participate in interviews; 25 intervention participants and 24 control participants who gardened in 24 different DUG gardens

agreed to be interviewed, and six declined or did not respond to researchers. Intervention participants were invited to be interviewed one time, after their first season of gardening. Control participants were invited to be interviewed twice: before gardening and after their first season of gardening. The analysis presented here included interviews with 11 control and 23 intervention participants who were all interviewed after their first season of gardening ($n = 34$); one intervention participant interview was excluded from the analysis because of incomplete data, and 12 control participant interviews were excluded because they were interviewed only before they began gardening, but not after. Participants provided written informed consent prior to the interviews and were provided a US\$20 gift card for participation. Interviews were tape-recorded and transcribed, and transcripts were corrected for accuracy. Demographic characteristics were obtained from data captured in CAPS surveys.

The interview guide was reviewed, revised, and approved by the advisory team. To obtain feedback on appropriateness and clarity of question wording, pilot testing of interview questions was conducted with four community gardeners in the Lansing, Michigan, area. Topics of the interview guide analyzed for this study included previous gardening experiences, learning to garden, perceptions of garden leadership, the social culture of the garden, and challenges experienced. The interview guide was split into two parts for the control participants, and they were interviewed about previous gardening experiences during their first interview (conducted prior to gardening) and interviewed about their experiences gardening (the rest of the interview topics) during their second interview (conducted after their first season gardening). Because both the intervention participants and control participants were offered the same gardening package and were interviewed after their first season of gardening (except for the question on previous gardening experiences), gardening and control participants were analyzed together.

The overarching analysis methodologies included grounded theory (i.e., codes and themes were constructed inductively from the data without a pre-existing coding frame) and comparative case

study analysis (i.e., each participants' garden experience was analyzed as a discrete unit and compared with the experiences of other participants) (Miles et al., 2014; Yin, 2017). The research team included researchers who were themselves gardeners; grounded theory was used to encourage the researchers to listen carefully to the voices of the participants and develop codes and themes based on the data. During each stage of analysis, the researchers held group meetings to discuss the codes, themes, and findings, and to ensure consistency.

First, transcripts were coded using Atlas.ti software (Version 8). Three researchers coded five interviews independently to generate initial codes and collaboratively reached consensus on code meaning and definitions. Coding was then completed for each interview and checked by an alternative researcher to ensure the finalized codes were applied uniformly, with team discussions to clarify discrepancies.

In the next stage, comparative cases study analysis, themes were created, and PowerPoint displays were completed for each participant by writing summary statements for each theme to enable researchers to understand the connections and disparities between themes and different participants. The PowerPoint displays enabled the researchers to be able to "see" participants' experiences as a whole and draw connections between themes within each participant experience. Summary statements for each theme were added to an Microsoft Excel table, which facilitated the comparison of similar and disparate experiences for each participant. Conclusions were drawn based on systematically comparing PowerPoint displays and summary statements across participants. Descriptions of and theories of connections between themes were extensively discussed by the team and were produced iteratively and by consensus. This article reports on the themes related to supporting new gardeners. Codes groups and themes are displayed in the Appendix.

Interviews with Garden Leaders

Garden leaders in the DUG network are volunteers. Garden leaders attend an introductory training session and are supported in their positions by

DUG staff. For the present study, all garden leaders at participating gardens were invited to participate in an interview, and 47 of 65 garden leaders representing 29 different community gardens were interviewed. Interview guides captured similar themes as the participant interviews. Garden leaders were interviewed either via telephone or in person. Leader interviews were documented by audio-recording plus field notes or note-taking by hand or computer. Recordings were transcribed. Content from each interview was summarized using Microsoft Excel. Using the main themes and key ideas from the interview guide, codes were developed for each topic, and codes and themes were applied to text, counted, and summarized.

Results

Results are described below, including experiences of new community gardeners and garden leaders with respect to (1) learning to garden, (2) garden leadership and structure, (3) social culture of the community garden, and (4) obstacles to participation.

Description of Participants and Community Gardens

The 34 gardeners interviewed were mostly white (79%), non-Hispanic (79%), and female (71%). Ages ranged from 20 to 70 years, with a mean age of 41. Garden leaders interviewed represented 29 of the 37 community gardens participating in the CAPS trial. The number of plots in each garden ranged from seven to 90, and gardens were established between 1976 and 2019.

Learning to Garden

Participants learned to garden in a variety of ways. A class on vegetable gardening basics was offered by DUG as part of the intervention, which 24 participants (70%) reported attending. Over half of these participants mentioned that the class was helpful. For example, one participant described the class as “lovely” and enjoyed getting to sit with others who had a shared interest (P.J).

More than half of participants ($n = 20$) learned from others both in and outside of the garden. Inside the garden, participants learned by observing others’ garden plots and conversations with other

gardeners: “People were really super knowledgeable so it was cool to ask people questions and ... they’d spew out all these interesting facts.” For some participants, garden leaders were an important learning resource, especially if the garden leader(s) were often present at the garden when the participant was. One participant said, “we sometimes look at each other’s plots. ... it was good to show [the leader] and say, ‘What’s going on here? Do I need to be worried?’” (P.Z). Some garden leaders described making themselves available to gardeners, especially new community gardeners. One of the most common forms of support garden leaders offered was hands-on troubleshooting in the garden, and some invited master gardeners to garden workdays and/or placed new gardeners next to more experienced gardeners. Participants also learned from friends, family, and neighbors, both outside of the garden and by bringing them to their gardens. Some gardeners also learned from involvement in local gardening organizations.

Notably, almost all participants took initiative to teach themselves to garden. All successfully grew vegetables. Participants sought out gardening information from books, the internet, and trial and error. For over half of participants ($n = 21$), their biggest teacher was simply learning “by doing” (P.AA) or experimentation. Most of these participants valued trial-and-error in their first season and “seeing what works” (P.BB), although one participant felt this trial and error was “wasted time” (P.N) and would have liked more direct instruction and guidance. About half of participants ($n = 16$) mentioned building on prior experience or exposure to farming and gardening. Eighteen participants indicated having gardened in the past, and most participants mentioned at least some previous exposure to gardening in their life, primarily through a family or household garden growing up; this experience ranged from tending flowerpots to working at a 10-acre farm.

Garden Leadership and Structure

Each DUG community garden has at least one volunteer (unpaid) garden member who serves as a leader. Garden leader responsibilities include introducing gardeners to the garden, enforcing garden rules and regulations, communicating with garden-

ers, coordinating with DUG, and organizing garden events such as workdays and potlucks. DUG highly encourages—but does not require—garden leaders to attend a training course.

Role of the garden leader

Garden leaders had differing perspectives of how much support they were expected to provide new community gardeners. For example, one garden leader said, “I don’t think it’s my responsibility to hold their hands. I explain everything to them when they sign on” (GL.L). Others were eager to learn ways to welcome and help new community gardeners, while balancing their other responsibilities. This variation was reflected in participants’ perspectives on garden leader support. About half of participants ($n = 16$) said they received support from their garden leader, and these participants valued having an engaged garden leader who they saw frequently and who served as a source of gardening knowledge. For example, one participant said, “I looked forward to seeing [the garden leader] in the morning. ... [Having him there] made my experience, really. He was very willing to help me in every way” (P.L). Another participant said, “The garden leader really stood out to me because she, in my opinion, had the right idea of what I expected with a community garden. ... She had a lot of information and she’s just really pleasant to be around and work with, and that made it not feel like work when I went to the community garden” (P.E.). Another participant who saw their garden leader often was inspired to become a garden leader in the future (P.AA).

Other participants had much less interaction with their garden leaders. These participants either never met their garden leader, did not know who their garden leader was, or only saw them a few times. For example, one participant described their garden leader as “rather absent,” and “gave no particular guidance or direction whatsoever” (P.J). Other participants discussed leadership turnover throughout the season. Participants who lacked engagement with their garden leaders desired more support including seeing their leader in the garden more frequently and receiving hands-on instruction and check-ins. In some cases, participants described their garden leader as “overworked,” “in a

hurry,” or “stressed.” This aligned with sentiments from garden leaders who suggested the role was “way too much for one person. ... There should be four garden leaders in every garden” (GL.K). In fact, DUG’s garden leader training suggests having a garden leadership team of at least three people. While most gardeners reported having a single garden leader, one reported that their garden had quadrant leaders (four leaders in four areas of the community garden). This participant reported that their quadrant leader was at the garden frequently, provided help and shared tips, and organized workshops (P.BB).

Orientation to the community garden

Garden leaders reported holding group orientations in March, April, or May each year, where expectations and guidelines were communicated to gardeners, and felt they worked well. However, many interviewees missed the formal orientation because they were not assigned their garden plots until May. The delay occurred because baseline data collection (informed consent, health surveys, dietary recalls, and accelerometry) needed to occur prior to randomization. Most participants ($n = 31$) reported either not receiving an orientation or receiving a brief overview at the garden led by either their garden leader or a CAPS staff member. Only three participants reported having a thorough, useful orientation to their garden. Orientation, if received, included signing paperwork, locating garden equipment, and being instructed on how to use the water system. About one-third ($n = 11$) of participants reported wanting more from the orientation, including more help getting started in their plot, the opportunity to meet other gardeners, and a more thorough explanation of resources available to them.

A lack of orientation left participants without key information about the garden, knowing what DUG and the garden leadership expected of gardeners, or knowing who to approach with questions. One participant described receiving “very little guidance ... about how things work, where resources are, or how to get started gardening” (P.A). Another participant did not know how to operate the watering system in her garden, which prevented her from watering her plants at the

beginning of the season. Regarding expectations of gardeners, a few participants reported receiving abrasive or combative emails about responsibilities to weed communal areas, but they were never told that this was an expectation. One of these participants reported feeling attacked and not wanting to be involved in the garden after receiving that email (P.B). In contrast, one participant received a “very thorough” orientation with their garden leader with printed rules and a demonstration on how to deal with weeds, and thus, she “felt prepared to get started gardening after the orientation” (P.L).

Participants recommended providing a clearer explanation of the governance and structure of the garden, as well as the expectations and responsibilities of gardeners, which could be outlined at garden orientation meetings as well as on the plot application. Participants also wanted additional information about events, gardeners’ responsibilities for tending communal areas, and resources available to the gardener (such as hoses, sheds, rakes, seeds, and seedlings). Participants thought that frustrations early on could have been alleviated by communicating the amount of help a garden leader could realistically provide—understanding they were unpaid volunteers and were not always available. Such information could encourage new community gardeners to turn to other people with questions.

Communication

Perceptions of communication in the gardens varied widely. Most garden leaders reported communicating via email newsletters, text messages, and phone calls; other methods included physical message boards at the garden, social media, event calendars, and in-person communication. Twenty-six of the leaders said they believed communication in the garden was “adequate.” Garden leaders attempted to communicate with all gardeners but experienced challenges connecting with everyone, and most leaders acknowledged that communication could improve. For example, one leader said, “We can always use better communication and more communication. But with a garden this size and with a diverse population agewise, there doesn’t seem to be one method that fits everyone” (GL.M).

Participants echoed that communicative garden leaders often sent out emails with newsletters or Facebook group messages where they announced upcoming gatherings, planned communal workdays, information about water issues or shared produce available, and sometimes offered gardening tips. Participants of the more organized or more established gardens had whiteboards that included announcements such as expected inclement weather (e.g., hail), notification of upcoming communal workdays or social events, and tips on gardening. For other participants, it was unclear what the main form of communication was supposed to be, or there was no communication. Participants who reported having absent or unengaged garden leaders often reported poor communication. A very few participants reported abrasive communication, including emails reprimanding people for excessive weeds, the appearance of their garden plot, or violating rules.

Events in the community gardens

DUG community gardens often have group events, such as workdays, potlucks, gardening lessons, and other social events. About one-third of participants reported at least one event in their community garden, the most common being communal workdays, which included weeding, harvesting, and caring for communal areas. Few participants reported other types of garden events, but some of the more established gardens had festivals, workshops, potlucks, or weekly happy hours. Participants who attended events enjoyed them, especially relishing the opportunity to meet and socialize with other gardeners. For example, one participant attended a few workdays and said, “It was good to meet other gardeners, because typically I wouldn’t see anybody when I was there. It was interesting to see what people were growing and who was doing what” (P.C).

About one-third of participants said they did not participate in any events associated with the community garden. Some gardeners reported that events were not offered, or they could not attend due to scheduling conflicts. Others chose not to go for various reasons, for example because they were uncomfortable not knowing other gardeners. One gardener said others encouraged her not to go to

communal workdays because it was “a waste of time” (P.D) and another participant stopped going to events because they were not well attended (P.E).

Garden leaders reported trying to organize events but encountered challenges finding times that worked for most gardeners, communicating the events to gardeners in time, and balancing multiple responsibilities with organizing social events. One garden leader acknowledged the desire for more events, saying there was disappointment among participants at the end of the season around low participation in garden events and activities (GL.A).

Social Culture of the Community Garden

Participants’ perceptions of the culture of their community garden were mixed with regards to socializing in the garden, diversity of cultures in the garden and intergenerational interactions, the promotion of learning with other gardeners in the garden, and acts of helping others and reciprocity.

Social interactions in the garden

The extent of interactions with other gardeners varied widely among participants, ranging from seeing other gardeners every time they went to the garden, to seeing other gardeners only a few times during the entire season. Those who had frequent interactions with other gardeners enjoyed and benefited from those interactions. For example, one participant said, “I just thought I’d go to my garden, tend my plot, and go. ... I didn’t really think that there would be the other aspect of it, of making friends and really having a community within the neighborhood” (P.T). The more structured communal events—happy hours, workdays, meetups—were special features for some participants, and they benefited greatly from having community garden experiences with others.

For some, the gardens provided an opportunity to interact with people from other cultures, which several participants enjoyed:

It [the garden] had probably four or five different nationalities as far as folks that gardened there. ... While they didn’t speak my language and I didn’t speak theirs, we could communi-

cate through smiles and hugs and handing over vegetables and things like that, which was lovely. I absolutely adored that piece of it. (P.J)

One participant said her cultural identity was respected at the garden, and everyone “welcomed ideas from where you were from, or seeds from your country” (P.H). Others enjoyed learning about gardening techniques from gardeners from other countries. Some participants also enjoyed intergenerational interactions, including seeing kids around the garden and interacting with people older and younger than themselves. For example, one participant said, “For me, just being around young kids like that, and then it’s a teaching opportunity, because they may think it’s boring until they get engaged” (P.K). Gardening also provided an opportunity for participants to socialize with their friends and families, which more than half of the participants reported appreciating.

Fifteen participants reported minimal interactions with other gardeners in the garden. Some reported that their visits to the garden simply did not coincide with other gardeners’ visits or that interactions with other gardeners, although friendly, tended to be limited to brief exchanges. Several participants explained that the other gardeners were “there to do their own thing,” and did not try to interact. Some participants expected more community engagement in the garden and found the lack of social interaction disappointing. As one participant said, “It was lonely. ... I could be there longer if there was somebody there” (P.G). A few other participants reported that there was social interaction among other gardeners, but that they felt left out of the main group. For example, one participant described themselves as a “black sheep” because many other gardeners worked together at the school at the garden site. Another participant said, “it was almost cliquey” and she felt like an “outsider” (P.A).

Helping others and reciprocity

Even though there was not extensive interaction among gardeners in many gardens, most participants reported a culture of helping others or reciprocity, especially with watering. One participant said, “We just learn to take care of each other. I

would come in sometimes and look around, I've noticed my garden was watered. Yes, or I would do it for others ... or I would see weeds along their pathway, I would pull them up. We learned to do little things for each other" (P.I). Another gardener reported that once when there was an unplanned water shutoff at the garden, one of the gardeners who lived near the garden allowed other gardeners to fill up buckets of water at her house. Another participant said, "I felt like [helping others] is part of working as a community. It's helping each other out, especially people who are less able-bodied" (P.E).

Several participants gave other examples of reciprocity: helping each other with gardening tasks, sharing resources such as seeds and food, and sharing knowledge. Gardeners also sometimes solved problems together. For example, one participant described how other gardeners created a text chain and made plans to help each other feel safe after there was a safety issue in the garden: "We were always looking out for each other, ... making sure no one was there alone" (P.H). Furthermore, many participants described working together to tend communal areas of the garden, often informally (not associated with a planned event).

Obstacles to Participation

Participants and leaders described varied challenges to gardening and how they worked to overcome them.

Responsibility of garden and time commitment

The time and/or level of commitment required to garden were commonly cited as challenges for both participants and garden leaders. For some it was hard to fit in visits to the garden on top of their other responsibilities. One participant, who had many responsibilities outside of the garden, enjoyed and benefited from gardening but still eventually stopped gardening due to the stress of the time commitment: "When I started ... realizing that it was just more than I could deal with, it dwindled little by little until I wasn't going any longer. ... When I stopped going it was a tremendous relief as far as time, that sort of thing. It took a lot of pressure off" (P.J).

Garden leaders made similar observations

about the responsibility of gardening for new community gardeners, particularly early in the gardening season. One leader observed that people often start out feeling really enthusiastic, but then sometimes lose momentum over the season. Another leader echoed this saying some "realiz[e] how much work it is and or hav[e] other life events interfere. ... They're not able to tend to it" (G.L.D). Garden leaders and participants also mentioned that summer vacations make gardening responsibilities challenging.

The commitment was especially challenging if the garden was over a mile from the participant's home, or there were other barriers to getting to the garden such as lack of transportation or needing to cross busy or dangerous intersections on foot. This led to participants feeling guilty for not tending the garden enough. Some participants mentioned it would be easier to garden at home. One participant stated, "it wasn't in my back yard where I could just wake up and do it. ... It was close [but] ... sometimes, I would even drive and just make it as quick as possible and not really spend time there" (P.D). Most participants who experienced challenges with the distance of the garden from their home said that if they continued gardening, they may garden at home.

Lack of gardening knowledge and support

Many participants ($n = 17$) cited a lack of gardening knowledge, such as how to get started, what and when to plant, and when to harvest, as a major challenge. Some noted that they were too intimidated to ask questions or were unsure who to ask. As described above, some learned from others in or outside the garden, but others did not feel supported. One such participant reported feeling "thrown in the fire" with learning how to garden, and left the community garden halfway through the season and continued gardening at home. A few others also reported quitting gardening or, more commonly, leaving the community garden to garden at home due to a lack of feeling supported. Garden leaders also noted the challenge of onboarding gardeners, particularly if they were new to gardening and needed a lot of support; sometimes this contributed to turnover rates of 50% in some gardens each year (G.L.N).

To help new community gardeners learn, some garden leaders recommended having accessible resources such as handouts or videos. Garden leaders also suggested having more people involved in garden leadership to help address the needs of new community gardeners. Gardeners had similar recommendations: many participants recommended providing hands-on support and gardening information to new community gardeners, which was very helpful for those who received it. Hands-on help in the garden was especially desired early in the season when plots often had a lot of weeds, because preparing the soil and planting was intimidating and physically challenging.

Most participants overcame the challenge of lack of gardening knowledge through taking initiative to learn on their own, typically through trial and error in the garden or seeking out resources on the internet or asking questions of friends and family members. Many of these participants expressed a sense of pride for teaching themselves how to garden. For example, one participant described how gardening was difficult in the beginning because she had no gardening experience, but she overcame this by learning from other gardeners and just “doing it” (P.16). Another participant said she overcame her intimidation around gardening by just doing it, saying, “[I wanted to] prove, like, everybody can grow something” (P.P). Another participant said the learning through trial and error “gave me confidence” (P.E).

Environmental challenges: Weeds, water, and pests

Several participants talked about environmental challenges to gardening, particularly the short gardening season and dry climate in Denver. Other weather challenges were also reported. For example, there were late frosts in June that killed recently planted seedlings, and early frosts in September that killed harvests. Several participants noted challenges with water access in the garden. For example, one participant described losing access to water for his plot when a hydrant needed repair, and the lack of water damaged several of his plants. When confronted with water access issues, gardeners reported working together to provide access to water in the garden or else bringing their own water to the garden. One participant said that

due to hydrant repair in their garden, gardeners strung hoses together from a neighboring house to water their plots in the early part of the season. Some participants reported delays in the water being turned on in the garden, often resulting in lost plants, forcing gardeners to replant.

Challenges such as pests and plant diseases were also common. Several participants developed or adopted means of pest management including making organic, homemade herbicides; sprinkling spices on plants to deter squirrels; and planting flowers around other crops to deter insects. Weeds were another problem, particularly at the beginning of the season, as some plots were entirely covered with weeds when participants arrived. This led to a feeling of being overwhelmed for many participants. As one participant said, “the plot was just filled with weeds. I mean, just filled. ... [When] I saw those weeds, I about died” (P.L); a garden leader ultimately helped this participant remove weeds. Another participant almost did not finish the season because she did not think she could manage the weeds on her own (P.O).

Abandoned plots

Numerous participants discussed abandoned or idle plots at their community garden. Abandoned plots caused other associated challenges like social conflict about appearance, low morale, and disagreement about how to repurpose the extra space. Sometimes low participation caused more work for others: “With ten plots but only four gardeners, it was a lot of work for just us four to maintain the whole garden” (P.V).

Garden leaders discussed idle plots in their interviews as well: 23 said garden abandonment is a problem in their community garden. Leaders cited the most common reasons they were given by the participants included personal matters (moving, illness) and being overwhelmed or too busy for the garden. One leader mentioned that some participants have gotten frustrated with produce being stolen from the garden (see more below), which led them to abandon the garden (GL.F). Several leaders mentioned that gardeners, especially new community gardeners, were surprised by the amount of work getting started early in the season and gave up because they could not keep up: “I had people

after May say ‘gosh, no, I’m sorry I won’t be able to work on it, more than I expected’” (GL.D).

Theft, vandalism, and safety

Some gardeners reported vandalism (including trampled vegetables, smashed pumpkins or broken stalks of corn) or theft. One participant said that by the end of the season, much of his produce was stolen or destroyed by others. Some participants also had physical safety concerns when they were at the garden alone, in the garden at night, or were approached by individuals who made them uncomfortable. Some participants worked together to address safety concerns by supporting each other and putting resources into the safety of the garden. One participant organized their community garden to “have a better presence of people throughout the day to deter theft” (P.I). Another participant discussed talking with the garden leader about getting a fence and/or cameras set up at the garden.

Garden leaders also addressed safety. Thirty reported that their gardens were safe. These gardens tended to have fences or locks and were often located next to schools. Even those that did mention safety concerns often said there was a sense of comradery among participants in the garden, and they would usually address it together by asking the police to patrol the area at night, putting up fences or signs that ask folks not to steal the produce, or buying additional resources for the garden to increase safety.

Fourteen garden leaders cited concerns for physical safety. Some leaders noted that broken or cracked sidewalks leading to the garden create risks for older gardeners to fall and difficulty for those in wheelchairs. Some leaders reported vandalism, theft of produce from the garden, or break-ins of garden sheds; several of these garden leaders installed cameras at the garden to help deter vandalism. Several leaders advised gardeners to only garden when it was light outside.

Twenty-two garden leaders discussed community concerns outside their control that affected participants’ ability to feel safe and welcome in the garden related to violent or discriminative behavior in the surrounding community. One garden leader noted a nearby drive-by shooting, a person overdosing on opioids in the garden, gang violence, and

finding bullet casings inside the garden (GL.H). A few garden leaders said gardeners had been harassed by passersby, including one man who repeatedly harassed a female gardener and another passerby shouting racial insults at a gardener.

Discussion

This study examined the experiences of new community gardeners with respect to how they learned to garden, perceptions of garden leadership, the social culture of the community garden, and challenges experienced, while also including the perceptions of garden leaders. To our knowledge, this is one of the first studies to focus on the experiences of new community gardeners. Understanding new community gardeners’ and their garden leaders’ perspectives is crucial if the benefits of community gardening are to be extended to more people. Helpful recommendations were offered by gardeners and garden leaders to address the needs of new community gardeners and address the challenges they experience, providing important information for community garden organizers. An overview of the major findings and recommendations for community garden organizers is in Table 1.

Guidance and Support for New Community Gardeners

We found that guidance and support with learning gardening knowledge and skills, and sometimes also hands-on help gardening, are important to new community gardeners. Most gardeners reported seeking information out by themselves, and garden leaders and new community gardeners alike recommended providing new community gardeners with resource lists such as websites at the beginning of the season. Hands-on help was especially important at the beginning of the season due to the amount of work to get the garden started. The importance of guidance and support was evident from the appreciation of the knowledge and support that some participants received from their garden leader or other gardeners. As found in other studies, many participants benefitted from knowledge and skill sharing that occurred within the garden (Hale et al., 2011; Kingsley & Townsend, 2006; Milligan et al., 2004; Teig et al., 2009; Wakefield et al., 2007).

The importance of support was also evident from other participants who wished they had more support and/or brought supportive family and friends to the garden. While many of these participants desired more support from their garden leaders, garden leaders have many other responsibilities managing the garden. DUG recommends an engaged team of at least three leaders per garden but also acknowledged that it can be difficult to find multiple leaders for each garden (L. Fahnestock, personal communication, 2021). Other studies have also reported difficulty in recruiting and/or retaining garden leadership (Aptekar, 2015; Diaz et al., 2018; Toda & Lowe, 2022). To avoid overburdening leaders, other experienced gardeners within the garden could be encouraged to help the new community gardeners. Additionally, formal

mentorship programs using volunteers from programs such as Master Gardeners or graduates of DUG's Master Community Gardening Program could pair experienced mentors with new gardeners to offer education and hands-on help to new community gardeners. Other gardening intervention studies have utilized Master Gardeners to provide one-on-one mentorship to participants (Bail et al., 2022; Blair et al., 2021).

Challenges Experienced by Gardeners

Aside from lack of gardening knowledge and skills, the level of responsibility and commitment of gardening was one of the most common challenges experienced. Gardening inherently requires consistent time and effort, and additional time may be required to travel to a community garden. Both

Table 1. Major Findings and Recommendations for Community Garden Organizers

Topic	Summary of Major Findings	Key Recommendations*
How did new community gardeners learn how to garden?	• Beginner gardener class, other gardeners, friends and/or family, self-teaching (e.g. internet, books), and prior experience or exposure.	• Provide gardeners with resource lists that can provide answers to most common questions and challenges.
What were new community gardeners' and garden leaders' perceptions of garden leadership and structure?	• About half of new community gardeners had an engaged leader who provided support; many who did not receive support from their leader desired this. • Some garden leaders felt that teaching new community gardeners to garden was not their responsibility, especially given their many other garden management responsibilities. • The new community gardeners who did not receive an orientation were often left unaware of expectations, responsibilities, and understanding of garden resources.	• Communicate clearly about the expectations and responsibilities of both gardeners and garden leaders and how to use garden resources (e.g., water system). • When possible, have a garden leadership team instead of a single garden leader. • Encourage informal mentorship or offer a formal mentorship program for new community gardeners (authors' recommendations).
What were new community gardeners' perceptions of garden social culture?	• Extent of interaction with others in garden ranged from minimal to always seeing other gardeners. • However, a culture of reciprocity and helping others was present in many gardens.	
What did new community gardeners and garden leaders perceive to be obstacles to participation?	• Lack of gardening knowledge, lack of support, and environmental challenges (e.g., weeds, water, pests) reported by new community gardeners. • Responsibility and time commitment of gardening; abandoned plots; and theft, vandalism, and/or safety concerns reported by both new community gardeners and garden leaders.	

* Recommendations are from new community gardeners and/or garden leaders, unless otherwise specified.

time and distance are challenges to community gardening found in other studies (Hale et al., 2011; Kingsley & Townsend, 2006). Education on time-saving strategies, such as mulching to reduce weeds and water use, may reduce this challenge.

Regarding garden governance and structure, gardeners recommended clear communication about their responsibilities, what to expect from a garden leader, what resources were available, and how to use resources (such as the water system and shed). Unfortunately, few interviewees attended a group garden orientation, likely due to the study timeline assigning participants to their gardens after orientations typically occurred. Garden orientations are the ideal time to share this information, but undoubtedly not all garden members will be able to attend a group garden orientation, and so additional ways of sharing this information should also be used.

Perceptions of Social Culture

Participants' experiences related to the social culture of their gardens differed considerably. Extensive research has demonstrated that community gardens are places where gardeners meet new people, build friendships that often extend outside of the garden, and confer a sense of belonging (Bailey & Kingsley, 2020; Hale et al., 2011; Kingsley & Townsend, 2006; Saldivar-Tanaka & Krasny, 2004; Teig et al., 2009). Some participants in this study enjoyed and valued interacting with other gardeners during their routine visits to the garden or during more formal events. Even in gardens where gardeners did not interact extensively, there was a culture of helping others or reciprocity such as with watering and weeding, which has been found in other studies (Bailey & Kingsley, 2020; Hale et al., 2011; Toda & Lowe, 2022). Some participants enjoyed intercultural interactions with gardeners from other countries, which is consistent with other studies finding that community gardens bring diverse groups of people together, including different socioeconomic statuses, nationalities, and races (Kettle, 2014; Kingsley & Townsend, 2006; Ober Allen et al., 2008).

However, other participants in this study saw other gardeners infrequently. This was disappointing for participants who were motivated, in part, to

join the garden by the potential to meet new people. Additionally, these participants were not able to benefit from other gardeners' knowledge and skills. There are several factors that may have contributed to the relatively low level of social interaction among gardeners found in our study compared to other published research. Most studies on social interaction and community gardening do not indicate how long participants have belonged to the community garden. It may take participants several years in a community garden to forge social ties. Additionally, study participants were placed only at community gardens that were able to reserve at least two plots for study participants. This may have precluded more established gardens from participating in this study; more established gardens may have stronger social interaction and foster a deeper sense of community.

Strengths and Limitations

Very few studies have examined the experiences of new community gardeners or included the perspectives of garden leaders. By incorporating both new community gardeners and garden leaders' perspectives on how to best support new community gardeners, our study provides valuable information for community garden organizers. Further, it is noteworthy that this study took place in real-world conditions. Rather than creating community gardens for participants to join for research purposes, we placed participants in existing community gardens; participants' experiences were likely very similar to non-research participants' experiences. However, several aspects of this study may limit the transferability of findings to broader new gardener experiences. The majority of participants were non-Hispanic white and female. Thus, while this is similar to the demographics of the host city, the experiences of interviewees in this study may not be representative of other demographic groups.

We interviewed both intervention and control participants after their first season of gardening, but the intervention participants participated in their community garden while they were enrolled in an RCT, and the control group participated in their community garden after their enrollment in the RCT had ended. Approximately the same percentage of qualitative participants (5 out of 23 interven-

tion participants [22%] and two out of 11 control participants [18%] received CAPS staff support for gardening during their first gardening season; however, because control participants received attention from study staff (i.e., participation in RCT data collection) before gardening, while the intervention participants received attention from study staff during the gardening season, their experiences may have been different. Our analysis did not account for these differences and thus is a limitation of the study. Moreover, since participants were part of a larger RCT of community gardening, the results may not be representative of gardeners who do not participate in an RCT. Additionally, due to the study timeline, most participants were assigned to their gardens after group garden orientations. Missing an orientation, which may also occur when gardeners sign up to gardens after orientations have occurred, can make it more difficult to get to know their garden leader and meet other gardeners, potentially limiting subsequent garden social interactions in the garden.

Conclusions

This study examined the experiences of community gardeners and garden leaders participating in

an RCT of community gardening and health. It offers important insights into the experiences of new community gardeners, a topic that has been only minimally addressed in the research literature. These findings demonstrate the types of guidance and support needed by new community gardeners, as well as specific suggestions for providing needed support. They can be used to inform the operation of community gardening programs or gardening interventions that are focused on new community gardeners. Future research with new community gardeners who are not part of a randomized controlled trial study are needed to elucidate whether the experiences presented in this study are typical of new community gardeners more generally.

Acknowledgments

The authors warmly thank the participants whose commitment and dedication made this trial possible, the garden leaders who supported and believed in this study, and our partner, Denver Urban Gardens. We are grateful for the contributions of the study investigators, study personnel, students, and advisory committee.

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Appendix

Table A1. Participant Categories, Themes, and Code Groups

Participant category	Theme	Definition	Code Groups
New Community Gardeners			
	Community garden environment	Describe garden and plot	DESC.GARDEN
	Engagement	Activities in garden	TYP.VISIT
	Learning to garden	How the participant learned to garden	PREV.GARDEN.EXP LEARN.HOW
	Leadership, governance, events, orientation, communication	Leadership styles, interactions with leader, governance of the garden, and garden events	LEADER EVENTS SOC.INTERACTIONS
	Social culture of garden	General culture of garden, social interactions in the garden, intergenerational and intercultural experiences, social support from garden leaders, other gardeners, culture of garden, and friends and family conflict	CULTURE SOC.INTERACTIONS HELP.IN.GARDEN HELP.OTHERS VALUE OF GARDEN SOC.CONFLICT
	Challenges	Challenges and whether and how they were overcome	CHALLENGE
Garden Leaders			
	Recruitment, orientation, assistance, events, and retention	Resources and assistance provided to new community gardeners	BEGINNER.GARDENERS
	Challenges	Challenges and whether and how they were overcome	GARDEN.BARRIERS
	Communication	Methods and means of communicating with gardeners	COMMUNICATION

Empowering local food security: A systematic review of community grain banks

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Submitted July 12, 2024 / Revised September 3 and September 20, 2024 /
Accepted September 20, 2024 / Published online November 3, 2024

Citation: Sharma, V. (2025). Empowering local food security: A systematic review of community grain banks. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 327–349. <https://doi.org/10.5304/jafscd.2024.141.006>

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Abstract

Community food systems, exemplified by initiatives like community grain banks (CGBs), play a crucial role in achieving Sustainable Development Goal 2 (SDG 2), which aims to achieve zero hunger and ensure food security by 2030. This paper draws upon a systematic review of the literature on CGBs to emphasize the relevance of community institutions in enhancing local food security. Adhering to Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines, this paper reviews 16 academic articles, two theses, and 19 online sources. The study reveals that CGBs offer immediate relief during food shortages, empower women, stabilize farmers' income, reduce debt burdens, foster social trust, and enhance community resilience. This review highlights the need for international stakeholders to prioritize supporting CGBs to preserve the self-sustaining systems. Tailoring CGB designs to community-specific needs could significantly

enhance local food security, offering actionable strategies to mitigate severe food insecurity globally and regionally.

Keywords

community grain banks, local food security, farmer wellbeing, women's empowerment, systematic literature review

Introduction

Food is essential for sustaining all life on the planet; thus, ensuring food security is crucial for the overall wellbeing of humans. The concept of food security emerged widely at the World Food Summit in 1996, where it is defined by the Food and Agricultural Organization of the United Nations (FAO) as "Food security exists when all people have physical, social, and economic access to sufficient, safe, and nutritious needs at all times to meet their dietary needs and food preferences for an active and healthy lifestyle" (FAO, 1996, p. 2). Since then, the research and analysis of food security have been continuously expanding, and

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Disclosure Statement

The author declares that there is no conflict of interest.

recently, they have moved from a global-level analysis to local levels with a focus on communities and households (Akbari et al., 2022). Subsequently, the role of the local became crucial in fulfilling the global Millennium Development Goals (MDGs) until 2015 and continues to be vital in advancing the Sustainable Development Goals (SDGs) today. SDG 2 aims to achieve zero hunger and access to safe and nutritious food for all people by 2030 (United Nations, 2015). However, achieving this goal appears to be a distant aspiration, as global food security trends have been static or reversing since the COVID-19 pandemic. As per the *Sustainable Development Goals Report* of 2024, around 29.6% of the global population were moderately to severely food insecure in 2022 (United Nations, 2024), and the trends of SDG 2 in different parts of the world have either remained static or experienced reversals since 2020. The *State of Food Security and Nutrition in the World* (SOFI) report revealed that in 2022, approximately 122 million additional people worldwide faced food insecurity compared to the pre-pandemic period due to the impact of the pandemic along with climate shocks and war-like conflicts (FAO et al., 2023). Additionally, the reports highlight that there has been a rise in the cost of maintaining a healthy diet and a reduction in the affordability of healthy and nutritious diets, especially in the Asian and African regions. Moreover, the self-sustaining practices among rural communities of these regions are disappearing, and they are increasingly becoming dependent on national and global markets for their food supply (Woodhill et al., 2022).

Addressing the problems highlighted in these reports requires more robust solutions to achieve zero hunger and ensure food and nutritional security, particularly by revitalizing local community food systems. Community food systems, rooted at the local level, operate on the principles of democracy and sustainability (Borsellino et al., 2024). They aim to be economically viable for local communities while enhancing social cohesion, trust, and democracy (Feenstra, 1997). Additionally, they foster food sovereignty among the community members (Leventon & Laudan, 2017). While there is growing research on local food systems, the research remains unevenly distributed, focusing

more on the production and consumption aspects (Kang et al., 2022) than the social and institutional aspects. However, local institutions like a community grain bank are vital in addressing these dynamics. A CGB not only engages the community in grain credit circulation and grain credit creation but enhances community resilience and self-reliance and promotes stability in community food security dynamics in local food systems (Bhattamishra, 2007; Commandeur et al., 2016; Reji, 2013). In consideration of the need to emphasize the institutional aspect of the community food system, this paper focuses on reviewing the literature on CGBs using a systematic literature review approach.

The paper has three aims. The first is to contribute to enhanced clarity around the concept of a community grain bank and present a comprehensive overview of current understanding and knowledge about CGBs from the existing literature. The second aim is to identify and critically evaluate the interrelated and divergent epistemological strands of research and discuss their implications on food policy research and practices. The third aim is to lay out the policy framework and outline the scope for future research in this area. In pursuing these goals, the review adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines, ensuring a systematic and structured approach to explore CGBs comprehensively (Page et al., 2021).

Following the introduction, the structure of the article is organized as follows. In section 2, the article extensively explains the methods employed for systematic literature review. It outlines the specific approach and techniques used to gather and analyze the relevant literature around CGBs. The following section is dedicated to the systematic synthesis of literature. The synthesis is organized into five interrelated key topics that recur consistently throughout the literature. Synthesis aims to provide central insights and arguments identified in the literature for each topic. In the next section, the article discusses research gaps, critically assesses the literature synthesis, and provides direction for future research, followed by a discussion and the limitations of this review article. The last section serves as the article's conclusion and provides policy guidelines and future research scopes.

Methods and Approach

I conducted a systematic literature review for this study, following the updated PRISMA data screening and selection guidelines of 2020 (Page et al., 2021). A systematic review involves systematic, structured, and methodical identification, collection, and analysis of available literature and information within a specific context (Mwamfupe Davis et al., 2014). This approach was chosen over other review methods due to its well-defined, structured, and stepwise approach, which enhances the research reliability and increases the trustworthiness of the research claims (Gough et al., 2017). By meticulously adhering to the PRISMA 2020 guidelines, including the use of a detailed flow chart diagram to track study selection and comprehensive reporting of the included and excluded studies, this review ensures the findings are replicable, presented with clarity and transparency, and free from bias (Petticrew & Roberts, 2008).

The literature search process was conducted using Publish or Perish software. Scopus, Semantic Scholar, Web of Science, and Google Scholar were the primary search engines used in Publish and Perish for literature searches. Additionally, news articles, blogs, and the United Nations and World Bank websites were searched via the Google search engine to find up-to-date information about CGBs, as there is a dearth of academic literature research on CGBs (Li et al., 2021). Based on my initial practical knowledge of CGBs, various keywords and search phrases were chosen to search and collect the corpus of studies. The search terms used are categorized into four categories:

Category I: “community grain banks”, “cereal banks”, “anaj bank”

Category II: “food security” and “food sustainability”

Category III: “nutrition”, “health”, “hunger”

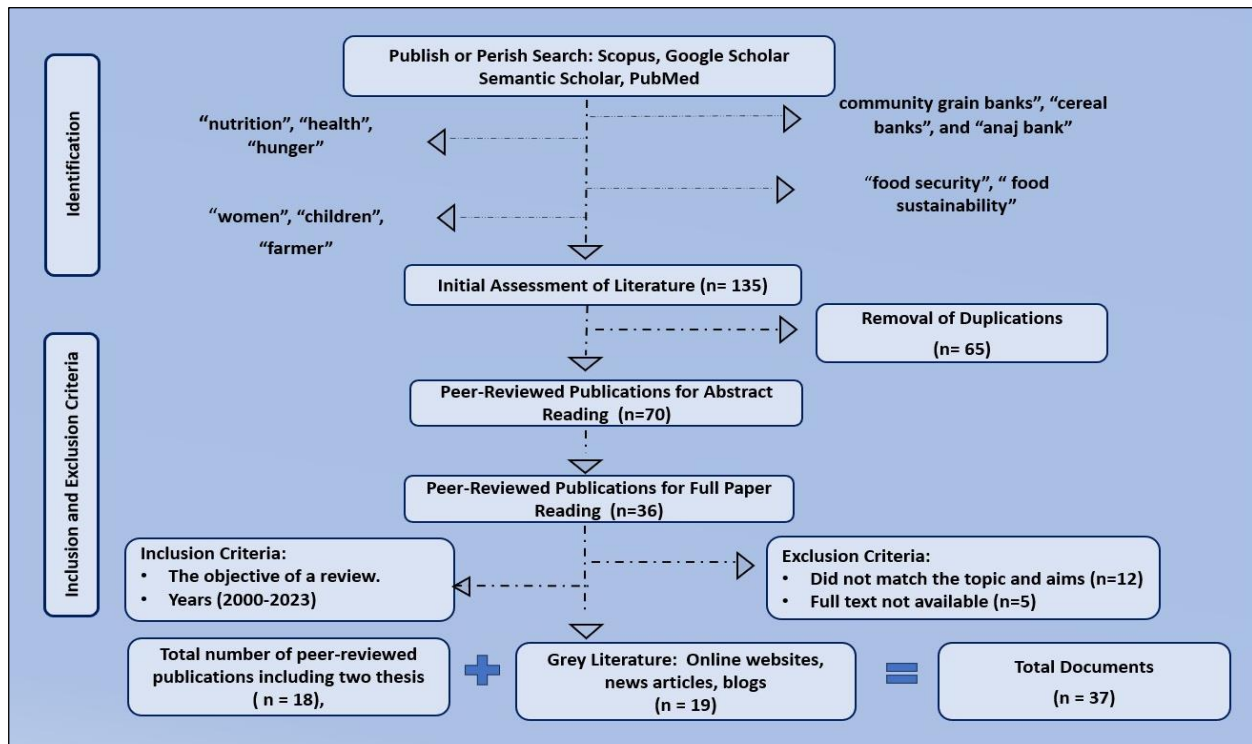
Category IV: “women”, “children”, “farmer”

Using the Boolean search operators such as AND, OR, and NOT, the above categories were mixed within and in between the categories to expand the search horizon and streamline the searches for more relevant results (Hollier, 2020). Further, keywords with suffixes or prefixes such as

“food secure*” and “grain bank” were used alongside each category to get the targeted literature and maximize the chances of obtaining desired results. The selection of literature through these databases followed the stepwise approach to include and exclude the data (Figure 1). Around 135 peer-reviewed articles were extracted as an Excel file from Publish or Perish. The titles of all the articles were initially scanned, duplicates were removed, and reports were filtered for abstract reading. After reviewing the abstracts, 36 articles were read in their entirety, and inclusion and exclusion criteria were applied to form the final body of literature. This involved a manual selection process to ensure all publications contained relevant empirical, theoretical, and substantive content on CGBs

In addition, grey literature was also retrieved from online blogs and news articles using similar Boolean operators to refine the search. The key term “community grain bank” was combined with different geographic locations, such as “community grain banks AND South Asia.” The first five to six pages on Google were reviewed for each search, totalling approximately 280 results. Additionally, search settings were adjusted to filter results by date to focus on the most recent articles. This thorough approach facilitated a robust and comprehensive collection of relevant literature, leading to a final selection of 19 articles from grey literature for the final review. Thus, the last body of literature consists of 16 papers, two theses or dissertations, and 19 articles from other alternative sources, leading to 37 documents in total.

The preliminary literature assessment screened sources based on three primary inclusion criteria. First, the publications considered were peer-reviewed articles, conference papers, theses and dissertations, and grey literature. Second, acknowledging the dearth of relevant literature, a language restriction was not applied as a criterion. Although most of the documents were in English, one paper in Spanish was also included to broaden the geographic scope. Third, the inclusion criterion focused on the primary objective of the review, which is to explore and comprehensively analyze the literature related to CGBs. Further, the selection of literature also followed three exclusion criteria: duplication of results, literature published

Figure 1. The Stepwise Approach Followed for Data Collection

before 2000, and the unavailability of full texts. Literature published before 2000 was excluded to incorporate the current issues, trends, and advancements in the field of CGBs. The timeframe ensured the inclusion of the latest developments while simultaneously assessing the relevance of these local institutions.

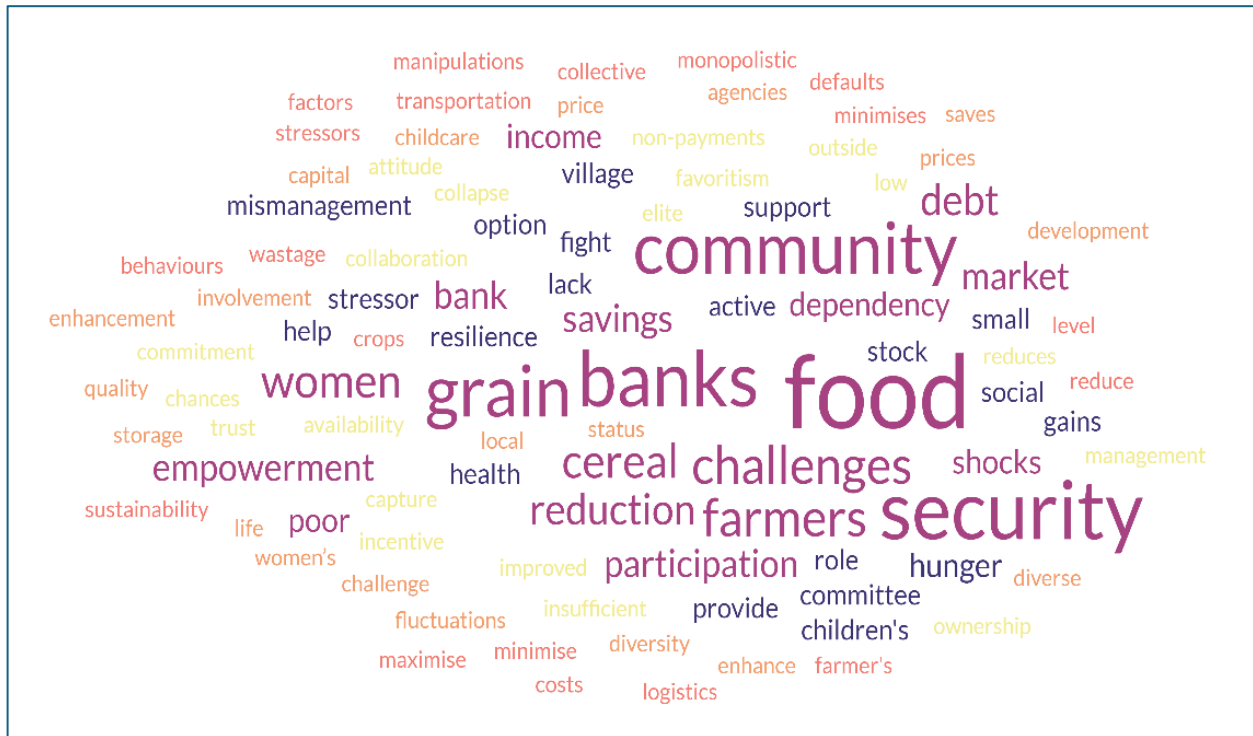
To organize the literature review, the final peer-reviewed publications and the grey literature were carefully examined to identify and summarize the most important findings. Each key finding was then refined into keywords, such as food security, debt reduction, community resilience, and women's empowerment. This refinement was crucial for focusing the analysis on essential concepts that align with the overall research aims, as keywords help capture the significant findings effectively (Carrera-Rivera et al., 2022). These keywords were analyzed in depth and revisited through a recursive process (Mateos & Solé, 2009), where patterns were identified and re-evaluated to convert them into major topics for literature synthesis. The frequency of these keywords and their interconnections were systematically examined, revealing their

prominence and relationships (see Figure 2). For instance, "food security" appeared 14 times, highlighting its central role in the research, while keywords like "debt reduction" and "community resilience" were also frequently discussed. By analyzing these patterns and connections, significant topics related to CGBs were identified, including challenges such as mismanagement and storage issues. These topics were then organized into clear, well-defined sections. This structured approach facilitated a thorough and coherent summary of the research both from peer-reviewed (Appendix A) and grey literature (Appendix B), presenting a clear and integrated overview of the current knowledge on CGBs, reflecting their impact on women's empowerment, farmers' accessibility to market, community development, and overall food security.

Synthesis of the Literature

The synthesis provided in this section is structured around five interrelated key themes with CGBs: (a) the grain banking concept, (b) local food security, (c) women's empowerment, (d) farmers market access, and (e) management imperatives.

Figure 2. Keywords Identified in the Field of Community Grain Banks



These themes are selected based on the re-occurrence of various literary themes. The themes are structured to provide a logical flow to the audience wherein they can easily understand the concept of CGBs and their multifaceted benefits and challenges. Within each theme, the central ideas and arguments are presented as they are found in literature.

The Grain Banking Concept: Governance, Operations and Models

The term “grain bank” suggests a function similar to financial banking, wherein it accepts deposits and provides credits in the form of grains, much like financial institutions do in cash (Li et al., 2021). Thus, a grain bank is a local community institution that procures, reserves, and sells basic food grains (Bhattamishra, 2012) and provides saving and credit services to a local community (Shija, 2010) to ensure food security throughout the year. While most of the transactions in grain banks are conducted using grains, cash transactions are not ruled out in some grain bank models (Shija, 2010). Grain banks, while not widespread institutions around

the globe, are commonly found in many Asian and African regions, often with different names, such as cereal banks in countries like Tanzania, Kenya and Ghana (Commandeur et al., 2016; Eibisch, 2015; Mwaura et al., 2012), and anaj banks and grain gola in countries like India and Bangladesh (Bhattamishra, 2007; Khan, 2017; Misra, 2014; A. Singh, 2020).

The concept of grain banks is not new and has been a part of traditional culture among many communities. However, the conventional idea of grain banks gradually disappeared (Bhattamishra, 2012), only to resurface in a modified form shaped by prevailing social-economic and regional contexts. The existing grain banks across the regions are mostly initiated and initially funded by governments (P. Singh, 2014), local nongovernmental organizations (NGOs; Commandeur et al., 2016; N. Singh, 2021), and global organizations like the World Bank and United Nations (Food Security Information Network [FSIN] & Global Network Against Food Crises, 2023; World Bank, 2019) by mobilizing the local communities. They are established with or without the necessity for

contributions from member households (Bhattamishra, 2007), and thereafter they are managed by members themselves, making them an entirely community-driven system (A. Pandey, 2023).

While the core principle of all the CGBs, that is, the circulation of grains, remains the same, their operation mechanisms vary regionally. In Spain, they run as a government cooperative (Carmona & Simpson, 2019). In China, the grain banking system runs on a different business model, wherein the warehousing companies act as the primary entities while absorbing the participation of rural cooperatives, food processing companies, and the state financial sector to collaborate in various capacities (Li et al., 2021). In India, grain banks today are initiated by the government (Singh, 2014) or NGOs. However, the grain banks formed by NGOs are the most successful examples of community institutions. Grain banks are formed either by establishing new self-help groups (SHGs) or creating them within already-established SHGs (Bhattamishra, 2019; Misra, 2014; Reji, 2013; N. Singh, 2021). The process of forming a CGB starts with mobilizing the village community to discuss the role of community-based arrangements in food and nutritional security. The SHGs are then formed, generally consisting of 10 to 30 women from village households, with the specific number depending on the population of the village (A. Pandey, 2023; K. Pandey, 2015). Within these SHGs, members democratically appoint a managing committee for the grain bank, mainly consisting of a co-coordinator and subcoordinator. Following this, local nonprofit organizations offer initial assistance with storage containers and a grain supply to set up the CGB.

Each member of the village community is encouraged to make a modest grain contribution. Once established, the grain circulation process starts, and member households become eligible to take grain loans from the CGB anytime of the year when there is a shortage of grain within a household to fulfill its food needs. The member pays back the grain loan with a predecided interest rate, after the harvest period (Bhattamishra, 2007; A. Pandey, 2023). While CGB membership is the eligibility criterion for availing loans, some banks lend loans to nonmembers in need. However, the managing committee maintains records and disburses

grains; the call for such a decision is collective, where all members' opinions count (Bhattamishra, 2019; Krishna, 2021).

In most African countries, the CGB model of grain banks has some regional and geographical differences from India's. Most of the grain or cereal banks in countries like Cameroon, Nigeria, Tanzania, and Niger are initiated by local NGOs that were established with the help of community participation (Carmona & Simpson, 2019; Commandeur et al., 2016; Jatta, 2016; Msaki et al., 2013; Ng, 2014). Most of these banks' models exist in the rural communities of these countries. Farmers' producer organizations in Kenya run cereal banks, offering them a secure storage system for their surplus produce and providing access to better markets for selling their crops (Mwamfupe Davis, 2015). In addition, the ownership of agricultural produce remains with the farmers themselves. In Ethiopia, grain banks were formed as a community intervention to ensure nutritional security among children who are 6–23 months old. The model is unique, as it offered a barter system wherein mothers exchanged a single raw cereal crop for a mixture of various legumes and cereals (Roche et al., 2017). In Guinea-Bissau, cereal banks were introduced to shift from a monocropping to a diversified multicropping approach, with these banks serving as repositories for various cereal seeds, effectively functioning as both seed and cereal banks (Mane, 2019).

Based on the descriptions of grain bank models in various regions, it is evident that they share common goals and purposes. These shared objectives include:

- Securing a steady food supply to all, particularly in times of scarcity or lean seasons, to ensure year-round food security.
- Offering barter arrangements and, in specific models, a reliable source of income to farmers to safeguard their purchasing power parity against various natural and non-natural shocks and stressors.
- Empowering the communities to become resilient to disasters and calamities.

In the following sections, the article delves

deeper into these common goals that CGBs offer. It explains how grain banks play a pivotal role in food security and economic stability.

Community Grain Banks and Local Food Security

Today, the lost concept of CGBs has been revived by multiple stakeholders to address and combat the persistent challenges of food insecurity, especially at the level where food producers themselves face moderate to severe food insecurity. As the main aim of CGBs is to address food security issues, many studies reviewed for this article have found that they have been effectively contributing to local food security among their member households in various ways. Grain banks are unique in their form as they provide a consumption credit system (Bhattamishra, 2007) to individuals who can borrow grains for immediate food needs with the intent of repayment when their food situation improves. These grain banks within the beneficiary communities excel in creating local food reserve services and responding promptly to food shortages compared to more significant centralized food security measures, which often face transportation and distribution delays (Bhattamishra, 2019). With grain bank facilities, people can save the time they would need to travel long distances in search of food during lean seasons. Additionally, they provide safety nets during droughts and famine, which are crucial in saving households from hunger and malnutrition (Aylward, 2013).

By providing a storage facility, a CGB also provides an opportunity for farming communities to preserve various varieties of crop seeds, which eventually leads to a diversification of grain production and consumption, making it possible for the communities to reduce hunger and increase the nutritional value of their diets (Carmona & Simpson, 2019; Mane, 2019). Simultaneously, they emphasize a capability approach, which aids in motivating mothers to acquire new skills to improve their children's nutrition (Sako et al., 2018).

Studies found that grain and cereal banking reduced the significant food gap and interseasonal food price disparities (Abdourhamane, 2018; Jatta, 2016). They help avoid market price fluctuations, as they are locally managed and owned by the com-

munity (Li et al., 2021; Msaki et al., 2013; P. Singh, 2014). Moreover, the grain bank initiatives are set up mostly in homogeneous communities with uniform social, cultural, and economic backgrounds. This shared homogeneity simplifies the functioning of grain banks and becomes an effective solution to tackle food security issues on a local scale (K. Pandey, 2015). Sometimes, when a member cannot return the grain loans due to idiosyncratic shocks (medical sickness, weddings, deaths) or covariate shocks (droughts, floods, crop failures), they get an extension to repay their loans and do not necessarily lose their membership (Bhattamishra, 2012, 2019). The grain bank also allows them to buy additional grain loans in emergencies, reducing their dependence on village traders and lenders who provide grain credit at high interest rates (Bhattamishra, 2007; Eibisch, 2015; A. Pandey, 2023; Reji, 2013), which helps them move out of the debt trap.

Thus, the revival of CGBs today offers a promising approach to combat food insecurity. Alongside this benefit, they offer long-term, community-driven solutions for diversifying grain production, empowering communities, building resilience, and improving the well-being of vulnerable populations.

Women's Empowerment through Community Grain Banks

In a contemporary world, progress is measured not only through economic metrics but also by people's empowerment. CGBs are a simple yet powerful initiative that plays a transformative role in women's lives. Most grain or cereal banks are managed and run by women, especially in rural and agricultural setups (Aylward, 2013; Khan, 2017; Ng, 2014; Saikia, 2023; N. Singh, 2021). The longevity of a grain bank depends on the women represented in its managing committees, as women are more invested in these initiatives because they prioritize the nutritional and physical well-being of their children and families (Aylward, 2013; Bhattamishra, 2019; Sako et al., 2018; A. Singh, 2020). This offers women more control over household resources and decision-making, particularly related to household food security (Bhattamishra, 2019). As a result, they have the potential to break the

patriarchal system that restricts women from making decisions for their households (A. Singh, 2020).

Additionally, these initiatives provide training and capacity-building to boost women's engagement and confidence in undertaking income-generating activities, promoting an equitable decision-making process within the community (Ng, 2014; Reji, 2013). Even the interest rates on loaned grains are decided by the members collectively (Chakravorty et al., 2018). Several studies discovered that having more women on grain bank committees is linked to a lower probability of failure (Bhattamishra, 2019; A. Singh, 2020; N. Singh, 2021).

Grain banks enable women to collectively take the lead, allowing them to engage in initiatives such as community farming for self-sustained livelihoods. This collective effort promotes their self-determination, catalyzes their empowerment, and fosters a sense of solidarity and mutual support that enables them to shift from passive recipients to proactive agents of change. This transformation facilitates their individual growth and is crucial in advancing their community's food security, thereby lessening their reliance on powerful landlords (Bhattamishra, 2007; Khan, 2017; Sako et al., 2018). As women gain social recognition for their active involvement in grain bank initiatives, their motivation to further expand and strengthen these banks continues to grow (Sako et al., 2018). This also encourages disciplined membership, with women being more likely to repay the loan promptly and without default (Bhattamishra, 2019). Therefore, women's management of grain banks is preferred due to their perceived transparency in financial management and their skillfulness in handling food supplies, especially during crises (Mwamfupe Davis et al., 2014; P. Singh, 2014).

In many developing countries, women primarily shoulder the responsibility of processing grains into raw food and then preparing cooked meals, which often involves labor-intensive tasks such as threshing, husking, shelling, and milling, leading to the premature aging of women. CGBs, as a communal measure, play a crucial role in alleviating this burden, where everyone works together to prevent the overburdening of a single woman. This collective effort contributes to reducing the physical toll

on women and fosters a more equitable distribution of labor (Shija, 2010). Moreover, when husbands travel to urban areas for employment with erratic wages and payments, women frequently take on the sole task of providing for the family's food needs. In such a situation, a grain bank provides a sense of security and acts as a form of capital to safeguard against food scarcity and the vulnerabilities that come with it (Krishna, 2021; Misra, 2014). Additionally, this collective effort proved invaluable during the COVID-19 pandemic, as it allowed the migrants to return home with faith that grain banks would meet their food requirements (N. Singh, 2021).

Thus, CGBs impact goes beyond the providing local granaries and empowers women to make decisions for themselves and their households, contributing to household food security.

Community Grain Banks and Farmers Market Access

In many developing regions, despite technological advancements and innovations, the depletion of natural and land resources has contributed to a growing number of small and marginal farmers (Altieri & Koohafkan, 2008). Despite serving as the backbone of the agriculture sector, these farmers often face a battle to put food on their tables. Thus, one of the aims of CGBs is to secure food security for these farming communities and prevent them from selling their produce at lower prices and buying back at high prices (Msaki et al., 2013). In this section, the article explores the role of CGB initiatives in providing better market access to farming communities.

CGB institutional arrangements offer significant support to farmers on multiple fronts. Farmers can use these banks for the institutional retention of their surplus food grains, allowing for better management of their produce for future use and sale (Chakravorty et al., 2018; Li et al., 2021). Grain banks safeguard farmers from the deceptive practices of hoarders, cartels, and traders, which frequently result in elevated food prices and diminished farmer income (Njagi, 2018). This protective function is particularly crucial because it prevents farmers from experiencing fluctuations in their food security during the lean season when they

often turn from net sellers to net buyers (Jatta, 2016). Grain banks thus act as a financial buffer for vulnerable and affected farmers against adverse market dynamics, provide stability, and ensure their well-being throughout the year (Carmona & Simpson, 2019).

The grain banks work as mutually beneficial arrangements that make them efficient local institutions, where the farmers gather to produce and store grains for their livelihoods (Li et al., 2021) instead of each farmer operating independently and competing against one another (Msaki et al., 2013). The farmers' association with the centralized CGB storage serves a dual purpose by offering farmers an alternative option for selling their grain at times other than harvest when prices tend to be lower. In doing so, they contribute to food security in the community and simultaneously enhance their bargaining power to play a crucial role in market regulation and preventing harvest losses (Commandeur et al., 2016). Additionally, membership opens up income opportunities to these farmers, and they provide better prices to the local caterers, reducing their transportation costs and dependence on traders (Eibisch, 2015). Research has shown that an association of small and marginal farmers, including CGBs, serves as an effective means for the farmers to develop essential skills in problem-solving and small-scale enterprise management (Shija, 2010). Many reports have shown that in the absence of community-based arrangements in rural locations, for various reasons small farmers are often forced to borrow grains or money from big landlords and moneylenders at a high interest rate to fulfill their basic needs. In such a scenario, CGBs reduce dependence on big landlords and moneylenders to secure their households/community food (Bhattamishra, 2007; N. Singh, 2021). Grain banks also play a crucial role in accelerating agricultural recovery by enabling farmers to cultivate their fields near their family rather than migrate somewhere else in search of work.

In essence, CGBs play a crucial role in supporting farming communities. They protect farmers from market fluctuations, enhance their bargaining power, and ensure food security for the community. By fostering cooperation among farm-

ers and reducing dependence on external sources, CGBs promote self-reliance in farming communities and thus contribute to their wellbeing.

Management Imperatives of Community Grain Banks

To realize Zero Hunger (SDG 2), promote food security, and foster sustainable agriculture at the local community level, (CGBs have emerged as significant institutions. While these institutions play a critical role in alleviating the impact of food scarcity, particularly during the lean season, they are not exempt from various challenges. The main challenges that CGBs face include a complex management system, human resource limitations, and concerns about sustainability (Roche et al., 2017). In rural settings, the widespread illiteracy among CGB managing teams presents a formidable obstacle to effective record-keeping and management of grain quantities. This situation can lead to misappropriation and pave the way for dominance by powerful individuals, resulting in favoritism toward certain members of the community (A. Singh, 2020). Additionally, grain banks are often kept in private houses with no dedicated storage facilities, making them unsuitable for community usage (P. Singh, 2014), especially in the absence of strong leadership and cohesive social structures (Reji, 2013).

Consequently, mismanagement, misappropriation, and defaults have become the prime reasons for the failure of grain banks (Bhattamishra, 2012). Most grain banks have a stock of a single grain and lack a diverse range of food such as pulses, oil, and spices, making them insufficient to support food and nutritional security (Chakravorty et al., 2018; Khedkar, 2008; Shija, 2010). While they have capabilities of improving nutritional status among infant and children (Roche et al., 2017), at time they fail to improve children's nutrition and health, due of the lack of nutritional diversity (Bhattamishra, 2007; Singh, 2014). Sometimes, questions are raised about the bartering model's long-term viability, especially in the context of the participation of landless agricultural laborers and mothers (Roche et al., 2017). The inability to deposit a sufficient quantity of cereals and the subsequent inability to access loans from CGBs are attributed

to the cycle of food poverty in which many farmers are trapped (Commandeur et al., 2016).

The initial lack of clarity about the grain banking concept to its members hampers their ability to understand its financial and social benefits (Mwamfupe Davis, 2015). The farmers' participation in these grain banks is limited by factors like existing organizational memberships and harvest levels, which hinder the broader adoption of CGBs, presenting a challenge in achieving inclusivity within these institutions (Mwaura et al., 2012). Additionally, weak monitoring practices and a lack of systematic evidence prevent timely adjustments in the successful implementation of programs (Sako et al., 2018). Moreover, these institutions are not necessarily sustainable, often experiencing a gradual depletion of resources and disappearance of external support from governmental and non-governmental agencies (Msaki et al., 2013). While women get social recognition through grain banks, their motivation collapses as they lack incentives (Roche et al., 2017). CGBs, when working as a business model, face greater chances of monopolistic behaviour of dominating stakeholders and more market manipulation (Li et al., 2021).

These challenges, identified by various studies, are crucial for policymakers and implementors in strengthening the CGBs to enhance local food security. Despite the vital role of CGBs in addressing food security issues, they face obstacles and need comprehensive solutions that can improve their effectiveness and longevity. By addressing such challenges, CGBs can be enhanced as a community arrangement and continue their mission of promoting food security and alleviating poverty at the local level.

Discussion

The synthesis of literature presented in the previous section highlights that significant research on grain and cereal banks has emerged over the last two decades. This review demonstrates a substantial association between grain and cereal banks and local food security. Nonetheless, it is worth noting that research about grain banks is still in its initial phases, and several unanswered questions and challenges persist. This section will summarize the review's key findings and attempt to identify the

research gaps that can give potential scope for future research.

The literature reviewed reveals that CGBs have been instrumental in ensuring year-round food security at the local level. They serve as reliance food sources during lean seasons (A. Singh, 2020), providing a safety net for community members (Bhattamishra, 2007; K. Pandey, 2015; Roche et al., 2017; A. Singh, 2020). This is of paramount importance in areas where food access can be uncertain. The CGBs contribute to the economic stability of a household as they offer a consumption credit system, allowing them to borrow grains for immediate needs and repay them during the harvest when their food security improves. Moreover, CGBs serve as safety nets during droughts and famines, preventing households from experiencing hunger (Bhattamishra, 2007). They have also successfully reduced food price disparities and market price fluctuations, saving households from the cycle of debt and dependence on external lenders, and subsequently increased their purchasing power parity (Li et al., 2021; Msaki et al., 2013; Mwaura et al., 2012). However, despite these promising findings on the link between CGBs and local food security, there is a need for future research to explore the long-term sustainability and scalability of CGBs and their impact on other aspects of regional food security, such as dietary diversity and nutritional outcome.

The empowerment of women emerged as a prominent theme in this review. CGBs have proven to be a catalyst for women's empowerment, particularly in rural and agricultural settings. As women run most grain banks, they often take on leadership roles that empower them to make decisions related to household food security (Aylward, 2013; Reji, 2013; N. Singh, 2021). This shift in decision-making authority challenges traditional patriarchal systems and promotes equitable resource management within households and communities. Furthermore, CGBs provide training and capacity-building for women, boosting their confidence in income-generating activities and collectively engaging in initiatives like community farming, promoting self-determination and fostering a sense of solidarity (N. Singh, 2021). Women's active participation in CGBs results in more trans-

parent financial management and skilful handling of food supplies, contributing to the institution's overall success. While these findings highlight the positive impact of women's engagement in CGBs, future research should delve into the long-term effects of women's empowerment on their social and economic status and reflect on the intersectionality and power dynamics within this group.

Additionally, the review article also reflected on farmers' well-being through CGBs. CGBs have been identified as protectors and supporters of farmers' welfare. By offering collective bargaining and alternatives to store their grains for longer after the harvest period, CGBs contribute to the economic welfare of farming communities (Commandeur et al., 2016; Sako et al., 2018), which reduces their dependence on moneylenders (Bhattamishra 2007; Li et al., 2021; Njagi, 2018), traders (Li et al., 2021) and cartels (Njagi, 2018). Thus, CGBs help them become self-reliant in food production and consumption and provide them with skills to engage in additional income opportunities that can take shape in small-scale agricultural enterprises. However, farmers' overall well-being cannot solely depend on one community institution. Thus, future research can focus on quantifying the economic and social impact of CGBs, including changes in income, agricultural practices, and overall well-being, considering other crucial factors that play their roles.

The review also discusses challenges identified in existing literature, from mismanagement and misappropriation (Li et al., 2021) to dominance of powerful individuals (A. Singh, 2020) to lack of food diversity (P. Singh, 2014). Despite having found common challenges in different models, the reviewed studies have overlooked the opportunity to systematically map and analyze the similarities and differences. Analyzing these institutions could produce solutions to strengthen them by establishing a universally applicable core set of principles. Henceforth, research can focus on this comparative approach, enabling a better understanding of these challenges and the development of adaptable, effective models for diverse communities.

In light of the above discussion on the reviewed literature, it is evident that CGBs hold substantial potential to enhance local food security,

women's empowerment, and farmers' well-being. Nevertheless, it also calls for continued research to unravel their full potential and address ongoing challenges. By addressing the research gaps and exploring the future research opportunities outlined in this review, we can gain deeper insights into the potential of CGBs. This, in turn, will enable us to formulate more effective policies and initiatives to enhance food security and foster community development.

Limitations

While presenting a comprehensive overview of CGBs, this review article acknowledges the presence of various limitations. First, due to a dearth of peer-reviewed literature on grain banks, the review may exhibit selection bias as it incorporated many news articles, blogs, and documents from grey literature that generally lack critical evaluation compared to peer-reviewed articles. Second, geographical bias may exist as most of the literature review covers developing nations, potentially failing to encompass the full spectrum of CGB models and experiences in the developed world. Third, a language bias emerged, as most of the reviewed literature was in English, with one Spanish article included. However, translating the Spanish paper to English using Google Translate failed to provide a complete understanding of grain banks, undermining the understanding of grain banks in the Western world. Fourth, one significant limitation of this review is the absence of a comparative analysis of different models of CGBs that are evolving differently in changing socio-economic and environmental conditions. Last, the review does not delve into the intersectionalities of gender, class, and caste dynamics. These points not only highlight the limitations of this review article but also open the avenues for future research.

Conclusion

This systematic review is the first of its kind to comprehensively study and describe community grain banks in the context of community food systems, thereby making a significant contribution to the literature on community institutions for local food systems. While the importance of local food systems, including food banks, has been recognized

worldwide, the knowledge and research on grain and cereal banks remain scattered and fragmented. Through this review, efforts have been made to synthesize and integrate these scattered pieces of literature to present a cohesive and thorough understanding of CGBs. This is particularly important now due to the need to revive self-sustaining practices and local institutions, thereby advancing efforts toward zero hunger goals.

The synthesis of the literature divided into five key topics sheds light on the diverse models and operational mechanisms of CGBs, their positive impacts on local food security, the transformative role they can play in women's lives, their protection of farmers against market fluctuations, and the challenges that CGBs encounter. Critically reflecting on each theme, the article suggests that research on CGBs should be interdisciplinary, collaborative, and focused on practical solutions, since community-driven institutions have the potential to make communities more progressive and resilient. Food policy research plays a pivotal role in unlocking this potential.

Policy Recommendation and Future Research Scope

Drawing on the comprehensive review findings and synthesized literature, this review paper offers targeted policy recommendations for CGBs across three critical areas: design, execution, and sustainability.

1. **Design of Community Grain Banks:** The design phase should prioritize the establishment of robust infrastructure, including modern storage facilities and effective resource management systems (Li et al., 2021). Adopting best practices and standardized management guidelines will ensure consistency and efficiency. Additionally, fostering inclusivity in the design process will help to reflect the needs and contributions of diverse community members.
2. **Execution of Community Grain Banks:** During execution, it is crucial to provide comprehensive training and ongoing support to CGB staff to ensure effective man-

agement. Securing adequate funding and financial resources is essential for smooth operations. Special attention should be given to empowering women by supporting their leadership roles and providing necessary incentives, which can significantly enhance the effectiveness of grain banks.

3. **Sustainability of Community Grain Banks:** To ensure the sustainability of CGBs, it is essential to establish strong partnerships with government agencies, NGOs, and private-sector organizations. These partnerships can provide ongoing financial support, technical assistance, and resources. Implementing regular monitoring and evaluation processes will help adapt to changing needs and improve operations. Additionally, investing in capacity-building initiatives and promoting community engagement will enhance the resilience and long-term success of CGBs.

The policy recommendations and research gaps highlighted in the discussion section above outline the essential directions for future research on CGBs. Future studies can focus on evaluating the impact of robust infrastructure and effective resource management on the operational efficiency of CGBs. Research could also explore how inclusive design processes, comprehensive staff training, adequate funding, and support for women's leadership roles influence the success of CGBs. Additionally, investigating how partnerships with stakeholders contribute to the sustainability of CGBs, including their role in providing financial support and technical assistance, is crucial. Future research may also investigate the integration of advanced technologies in CGB operations and assess how community engagement can enhance the resilience and long-term success of these institutions. Furthermore, studying how CGB models can be adapted to specific geographic regions and local contexts will be essential in ensuring their relevance and effectiveness. Addressing these areas will contribute to optimizing CGB models and improving community-driven strategies for local food security.

Reflexivity Statement

As the author of this systematic review on community grain banks and local food security, I acknowledge that my academic background and field experience may have influenced the research approach. My direct observations of grain banks in practice, combined with my interest in food security, informed the selection of studies, interpretation of data, and framing of conclusions. While this review adhered to rigorous systematic review guidelines, my perspective on the practical roles of grain banks in enhancing food security may have shaped the synthesis of findings and the discussion

of potential implications. I have maintained objectivity and transparency throughout the review process, applying established PRISMA guidelines to minimize any bias.



Acknowledgments

I want to extend my sincere thanks to Dr. Naresh Singh and Dr. Komal Sahai for their invaluable guidance and support in systematically organizing my thoughts and writing for this literature review. Their insights were crucial in shaping the clarity and structure of this work.

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Appendix. Listing of Peer-Reviewed and Grey Literature in this Study

Table A1. Summary of Peer-Reviewed Articles on Community Grain Banks (CGBs)

Reference	Study Design	Study Location	Research Aim and/or Objective	Key Findings	Keywords
Bhattachamishra (2007)	Mixed-Method	Raigad, Orissa (India)	Examine the impact of grain bank participation by household on the incidence of borrowing from private, informal moneylenders. The impact of grain bank participation by households on young children's health outcomes.	Grain banks do not have a statistically significant impact on various anthropometric measures examined, indicating that they may not be effective in improving children's health status. Grain banks have a large, statistically significant displacement effect on moneylenders, and this impact is even more effective in longer-lived grain bank villages. Grain banks are structured to offer credit for consumption credit in the form of grains, making them unsuitable as a comprehensive credit capable of addressing the potential issue of the region's underdeveloped or absent credit market.	Debt reduction Reduced dependency Savings Children's health
Bhattachamishra (2012)	Mixed-Method	Block: Dasmatur District: Koraput Orissa (India)	Exploring the reasons behind the closure of numerous grain banks in Orissa. Investigating the rationale behind continued investment in these initiatives by government and nongovernmental organizations despite a track record of failure.	Survival of grain banks appears to depend significantly on village-level factors, including social cohesion. Thus, the same design in different ecosystems may not be conducive to their sustainability. Grain banks struggle to cope with covariate risks, particularly unbalanced rainfall and crop failures. This highlights their vulnerability to weather-related shocks. The statistical model in the study revealed that grain banks in less developed villages had a higher predicted probability of survival. In addition, a higher share of women in the grain bank committee was associated with more prolonged survival. Their active role ensured the sustainability of these institutions. Mismanagement by committees was reported as the main reason for the failure of grain banks; however, there were other reasons, like storage facilities.	Shocks and stressors Village-level factors The active role of the village committee Challenge: Mismanagement
Bhattachamishra (2019)	Mixed-Method	Orissa (India)	To examine the impact of grain banks on children's health. To examine the impact of borrowing from moneylenders.	Grain banks combat food shortages in Odisha. Limited short-term health impact. Provide credit alternatives and reduce reliance on moneylenders. Sanitation issues may hinder health impact. Impact variation due to sample size limitations. Potential for cost-effective, innovative solutions in remote areas.	Food security Debt reduction Reduce dependency Children's health
Carmona & Simpson (2019)	Policy Analysis	Spain	Analyze government reports on grain banks from 1912 to 1914 that showcased the nature of the failure.	In contrast to the government's negative assessment, it has been found that grain banks had a remarkable success in the 20 th century and managed to navigate decades of difficulties successfully. The success of these institutions depended on various factors such as the volume of resources, community involvement, social capital, and accessibility levels.	Community involvement Social capital

Chakravorty, Joshi, Gills, Sharma, & Sharma (2018)	Review Paper	India	Review the grain bank concept in India and examine its possible advantages and disadvantages.	Grain banking benefited farmers by lowering their debt to money-lenders, fostering self-employment, and improving disaster resilience while enhancing women's role and status within families and the community. Grain banks help the villages where they exist and the neighboring villages. Thus, they serve as a potential food source for a broader community during lean seasons. They contributed to reduced migration and saved transportation costs. They are a source of pride for a community.	Farmers' income Debt reduction Women's role and status enhancement Community resilience Reduced migration
Davis, Mengersen, Bennett, & Mazerolle (2014)	Mixed-Method	Districts: Kongwa & Chamwino (Tanzania)	Evaluate the contribution of cereal banks in improving food security	Cereal banks are likely to collapse in the poorest and food-deficient areas compared to areas with ample food production. Food relief from the government and other agencies hinders the people's participation in cereal banks. Other factors responsible for its poor performance include insufficient cereal stock, decapitalization due to repayment or nonpayments of loans, and certain attitudes of members toward donor assistance.	Food security Challenges: Chances of collapse, insufficient stock, nonpayments, attitude
Jatta (2016)	Mixed-Method Study	Gambia	Assess the role of the cereal banking scheme in food and nutritional security.	Cereal banking positively impacts food and nutrition security. Reduces food price variability and the food gap by over 25%. Implementation must consider village-specific characteristics. Involves community participation and empowers communities. Proximity of banks reduces transportation and administrative costs.	Food security Sustainability Collective participation Community resilience
Khedkar (2008)	Qualitative Study	Village - Bhaguchiwadi District- Raigad, Maharashtra (India)	Identify what led to the reduced relevance of grain banks. How is the state government trying to revive them?	Grain banks received more support and worked well, whereas local Panch Committees were more robust and better coordinated. (Panch committees are the members, including ward members and the president, of a Gram Panchayat, or village council.) The impact of grain banking goes beyond food security, as its members extend their involvement to other community development programs such as land rights, land development, and housing. Grain banks are disadvantaged as they cannot meet diverse food needs.	Local committee Food security Community development Challenge: Do not provide food diversity

Li, Zhou, Razzaq, & Wang (2021)	Case Study	Hubei Province, China	Examine the historical development of grain banks. Analyze the economic reasons behind the development of grain banks.	The establishment and operation of grain banks depend on specific conditions which are not widely prevalent. They thrive when small-scale farmers encounter limited non-agricultural employment and inadequate storage and acknowledge the significance of minimizing grain wastage. Grain banks use market conditions to maximize farmers' income by unifying procurement, employing dry storage methods, and ensuring easy access. Grain banks are crucial in supporting the government's efforts to maintain food security as they provide minimum reserves required by the government to help monitor grain stocks and flows. Alongside their role in food security, they focus on minimizing transportation and logistics costs. Grain banks, however, have specific risks, including the monopolistic behavior of different stakeholders, market manipulation, and other faults.	Minimize grain wastage Maximize farmers' income Food security Minimizes transportation and logistics costs. Challenges: Monopolistic behaviors, manipulations, defaults
Msaki, Mwenda, & Regnard (2013)	Cross-Sectional	Village: Makoja, Dodoma Region (Tanzania)	Assess the importance of cereal bank on the livelihood of farming households.	Cereal banks help stabilize the local market prices as cereal banks allow farmers to sell their produce collectively. This collective strength acts as their bargaining power to negotiate the prices for their produce. Cereal banks can potentially improve farmers' income, which empowers them to invest in different aspects of their lives and thus enhance their quality of life.	Market prices Farmers' income Enhance life quality
Mwaura, Tungani, Sikuku, & Woomer (2012)	Mixed-Method	District: Bungoma, Western Kenya	Assess how well small-holders embrace cereal banks as a marketing intervention.	Despite the low enrollment rate initially, farmers started to adopt cereal banking systems, attributing this to the newness of this concept. The linkage between cereal bank membership and production level significantly influenced farmers' participation in cereal banking, as they see these associations to market surplus. Working in a group as members of cereal banks improved their perception of it. Prior experience of farmers being associated with local organizations helps them adopt new systems like cereal banks.	Community participation Farmers' market surplus
Pandey (2023)	Case Study	District: Palamu, Jharkhand (India)	Role of CGBs in mitigating the impact of drought, equity issues, and loan recovery. Investigate methods and techniques used by communities to strengthen their CGBs.	Provides workable solutions for food security. No technical external existence is needed. Promotes community ownership. Reduces dependency on moneylenders. It is merely a relief rather than a proper institution.	Food security Shocks and stressor Community empowerment Reduces debt dependency

Reji (2013)	Case Study	Village: Brujuvada District: Srikakulam, Uttar Pradesh (India)	Examine if grassroots initiatives such as CGBs are crucial in securing food security for the tribal population.	CGBs reduce the dependence of tribal communities on money-lenders and traders for food. Member households benefit from improved food availability during the lean season. CGBs empower women, promote livelihoods, and increase social trust. Beneficiaries are not passive recipients but active collaborators who identify solutions to their challenges.	Women's empowerment Improved food availability Social trust Debt reduction Active collaboration
Roche, Sako, Osendarp, Adish, & Tolossa (2017)	Qualitative Study	Ethiopia	Assess the acceptability, perceived impact, feasibility, and essential inputs to sustain local grain banks.	The community's strong appreciation for using locally sourced ingredients in the grains offered by grain banks results in higher acceptance for these institutions. Cultural significance to local food and biodiversity contributed to the strength of grain banks, as the members felt more empowered than using the food donated by outside agencies. The barter system was significant as a motivator for rural women to participate. Women valued the project's potential time savings, positively impacting mothers' involvement in childcare and other productive activities.	Women's participation Savings Childcare Local food Food security
Sako, Leerlooijer, Lelisa, Hailemariam, Brouwer, Brown, & Osendarp (2018)	Case Study	Ethiopia	Explore what promotes or hinders the successful enlargement of the grain bank project in Ethiopia's rural kebeles.	The Grain Bank Project is aligned with the National Nutrition Plan and has government support. The bartering system is appreciated for its simple process. The participatory approach fostered a sense of ownership among communities. The women's groups played an essential role in scaling up the project and were motivated by social recognition, but received little or no incentive.	Women's empowerment Food security Community participation Ownership Challenges: No incentive to women
Shija (2010)	Case Study	Dodoma region (Tanzania)	Assess the role of group-managed grain banks in ensuring rural food security for smallholder households.	The demand for food grains from grain banks has increased as smallholder households mostly rely on grain banks during the food shortage. Initiatives like grain banks are effective when small farmers know about food insecurity and collaborate to find solutions. Grain banks suffer from problems such as poor management, low member commitment, inadequate government, and poor institutional support. Services ensured by grain banks, such as food loans and grain storage and management, have contributed to positive household food security, which further contributed to the enhancement of farmers' efforts toward their agricultural activities, enhancing overall food security.	Food security Farmers' challenges: Poor management, low commitment, lack of support from outside agencies

Singh, A. (2020)	Case Study	Block: Rampura, District: Jalaun, Uttar Pradesh (India)	Assess the role and impact of the anaj bank in alleviating hunger and improving food security in remote areas. Evaluate the effectiveness of the anaj bank in reducing hunger and improving food security.	Anaj banks promote women's engagement in organizational activities. Anaj banks give insurance against unexpected shocks and vulnerability. They encourage savings, addressing the issue of impulsive spending during post-harvest festivities. They are susceptible to challenges such as leakages, misappropriation of resources, and capture by local elites. Their success depends on effective management, addressing issues of favoritism, and potentially exploring new models to enhance their impact.	Women's empowerment Shocks and stressors Savings Food security Challenges: Mismanagement, elite capture, favoritism
Singh, P. (2014)	Policy Review	India	Review the government's Village Grain Bank scheme	The scheme aimed to protect all Below Poverty Line (BPL) families in food-deficit areas against starvation, especially during the lean season. Grain banks help indebted tribes break the cycle of dependency on moneylenders and generate surplus grain stock in food-deficit areas. Grain banks help avoid market price fluctuations as they are locally managed and owned by the community. Grain banks provide long-lasting solutions to food insecurity but also face specific challenges, including storage, uneven distribution, lack of diverse crops, etc.	Debt reduction Saves from market price fluctuations Challenges: Storage, lack of diverse crops

Appendix A2. Summaries of Grey Literature

Author(s)	Title	Location	Summary
Abdourhamane (2018)	Cereal banks strengthen food security in Mali	Mali	The article highlights the story of a household in the eastern region of Mali who faced severe food insecurity after the death of the household breadwinner. The family managed their needs after the establishment of cereal banks. Not just food security, cereal banks empower residents by teaching them to create and lead village saving groups. This multifaceted approach addresses food needs and enhances long-term sustainability and economic resilience in these regions.
Akinfenwa (2023)	Stakeholders mull community grain bank initiative to end post-harvest losses.	Nigeria	The article highlights the post-harvest loss faced by the agricultural sector in Nigeria and the need for Community Grain Banks to curb the losses. These CGBs are run locally by farmers and can potentially alleviate seed shortages, especially during droughts. It has been argued that CGBs can solve food crises if appropriately implemented with funding for improved seeds. However, authorities warned about its challenges, from politics to majorities.
Atabong (2017)	Can community grain banks help Cameroon tackle its chronic food insecurity?	Cameroon	In northern Cameroon, CGBs combat food insecurity caused by various factors, including the BOKO Haram insurgency and climate-induced mistake grain ruptions. Instead of selling their crops immediately after harvest, farmers save their crops like maize, sorghum, and wheat in village granaries. When households run out of their reserves, they take grains in the form of loans in the lean season. This not only stabilizes the prices but also ensures food accessibility.
Aylward (2013)	Cereal banks empower women and fight famine in Africa's Sahel Region	Sahel Region of Africa	In 2012, the Sahel region of Africa faced drought and high food prices, threatening food security for over 18 million people. Organizations like the World Food Program (WFP) AND Care created women-managed cereal banks in Sahel Villages. These banks provided food security shields and empowered women as they were taught essential skills like bookkeeping and stock monitoring.
Commandeur, Ekpe, & Abu (2016)	Grain banks in Ghana: Credit for caterers brings farmers into the market	Ghana	Initially aimed at ensuring food security, the grain bank program now connects smallholder farmers to the school feeding market, benefiting farmers and caterers. Successful in a pilot project with positive outcomes, the program had led to increased farmers' income and improved access to quality grains. The model can be scaled for five banks in Ghana to engage more farmers nationwide. However, some banks need to expand to meet year-round demand. The project received essential funding from the PG-HGSF initiative.
Eibisch (2015)	Cereal banks in The Gambia—A case study	Gambia	The case study identifies that cereal banks have been successful in Gambia because of four critical factors that influence their success and failure: leadership, collateral security, peer pressure to repay grain loans, and strict adherence to rules for all. They play a crucial role in enhancing the food security challenges in the region.
IRIN News (2008)	Are cereal banks the best option to fight hunger?	Niger	Historically, cereal banks in the Sahel region, including Niger, have struggled to sustain due to issues of mismanagement, corruption, and external interference. However, women's new setting of cereal banks aims to avoid outside support and promote community ownership.
Khan (2017)	In a Bihar District, an Anaj Bank has freed Dalit women from hunger and exploitation.	India	Anaj (Grain) Bank has come to rescue women in marginalized Maha Dalit communities in Bihar, and it was established with the organization's help. The Anaj Banks provide rice on credit, enabling women to feed their families during times of scarcity. This has brought hope, confidence, and self-reliance to these women, allowing them to escape hunger and bonded labour.
Krishna (2021)	Great gains from small grain banks	India	In the rural village of Bijapur, Uttar Pradesh, India, a community grain bank established by Shramik Bharti empowers local farmers. Each member contributes rice to join the bank, and the bank provides food security, particularly during times of crop failure and economic hardship. The bank has been a lifeline for its members during the COVID-19 pandemic, ensuring they have access to food. These community grain banks offer a grassroots solution to address hunger and food insecurity, especially among marginal farmers and labourers in rural India.

Lahangir (2012)	The gains from grain banks	India	The high level of indebtedness among farmers and agricultural labourers has led to the creation of grain banks. Self-help groups manage these grain banks and charge minimal interest rates. Excess stock is sold in the market, and the proceeds are reinvested to earn interest. These positively impact food security and have reduced farmers' dependence on moneylenders who charge exorbitant interest rates. This has also brought significant autonomy to tribal communities in the region.
Mane (2019)	Cereal banks improving food security and incomes in Guinea-Bissau	Guinea-Bissau	In Guinea-Bissau, reliance on cashew monoculture and declining cereal yields led to severe food insecurity. With the help of the cereal banking system, varieties of local cereal were promoted. This ensured a steady supply of grains during food scarcity and helped local communities avoid hunger. The initiative empowered local communities by including farmers/producers in seed selection and cereal bank management as they gain control over their food resources, become more self-reliant and take ownership of their food security.
Misra (2014)	Saving for rainy days	India	In the Sunder Ban region of West Bengal, a community grain bank has been established by a women's self-help group with the help of a local organization. These banks ensure food security, particularly for landless agricultural labourers during the lean season. The grain banks are managed collectively by their members, and grains are provided with a modest interest rate. This initiative has reduced poverty overall and the need for loans from local moneylenders.
Ng (2014)	Women-run food banks provide cereal grains to poor farmers	Niger	In Niger, cereal banks/food banks supported by International Fund for Agricultural Development (IFAD) are operated exclusively by women to help local farmers during food shortages. These banks were initiated as a response to the 2005 food crises caused by droughts. Since then, the initiative expanded, benefiting thousands of people. It empowers women and facilitates community development activities.
Njagi (2018)	Rain or shine, grain banks help Kenyan farmers beat trade cartels.	Kenya	In Kenya, CGBs are helping farmers manage surplus crops and food security. It eliminates dealing with mediators, and farmers can sell their harvest to Grain Banks at appropriate prices. The initiative helps impoverished families become more resilient to the effects of natural calamities on their income and food needs.
Pandey, K. (2015)	Stock option	Bangladesh	Paddy banks in Bangladesh, initiated by Rangpur Dinajpur Rural Service, are innovative solutions to combat seasonal food insecurity among impoverished communities. The system reduces the reliance on moneylenders and offers a safety net to vulnerable households' creating a sustainable food reserve.
Saikai (2023)	She sowed seeds of grain bank to feed people experiencing poverty	India	The article highlights the story of a woman – Uemilaben, from a village in Gujarat, who started a grain bank to address malnutrition and food scarcity. With support from an organization, a self-help group was created to manage the grain bank. A barter system was included, where families exchanged commonly consumed pulses and grains for more nutritious options of equal weight to encourage a healthier diet.
Singh, N. (2021)	Rural women's 'grain banks' in Uttar Pradesh support small farmers aid food security amidst COVID-19	India	The Grain Bank initiative in Uttar Pradesh, initiated by Shramik Bharti in 2016, is a testament to women's solidarity and empowerment in rural communities. The initiative has been crucial in addressing food security challenges, especially during COVID-19. It has proven to be a lifeline for small landholders and landless farmers, ensuring their household survival and grain needs.
Waldron (2019)	Community grain banks create a pathway out of poverty	Malawi	A Malawian farmer, Grace Levison, overcame food shortages through a community grain bank collaboration with United Purpose. With better inputs and a smart storage system, they increased crop yields, food security, and economic wellbeing, showcasing the power of local initiatives in tackling agricultural issues.
World Bank (2019)	Community grain bank staves off hunger in food insecure households	Kabul Province, Afghanistan	The Guldara District of Kabul Province community grain banks support vulnerable households, including landless farmers and agricultural labourers. They are helpful in natural disasters and economic stress. The programme, supported by the Citizen's Charter Afghanistan Project, aims to combat seasonal hunger by distributing food and necessities.

Food insecurity in paradise: An exploration of food system resilience in the U.S. Virgin Islands

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Submitted April 12, 2024 / Revised July 7 and August 29, 2024 / Accepted August 30, 2024 /
Published online November 25, 2024

Citation: Gruver, J. B., Lee, K. A., & Hayes, E. B. (2025). Food insecurity in paradise: An exploration of food system resilience in the U.S. Virgin Islands. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 351–369. <https://doi.org/10.5304/jafscd.2024.141.010>

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Abstract

Despite being a world-class tourist destination, the U.S. Virgin Islands (USVI—St. Thomas, St. Croix, and St. John) face significant challenges related to diversified crop production, food distribution, and food security. High poverty rates among islanders perpetuated by historical iniquities, frequent hurri-

cane damage, drought, poor soil quality, high food production costs, and limited food distribution networks are just a few of the challenges residents face. Consequently, 97% of the food consumed in the USVI is imported. Frequent hurricane damage, such as the recent damage from Irma and Maria (back-to-back Category 5 storms that hit the islands in 2017) complicated these challenges even more and disrupted food import processes. This manuscript focuses on a case study involving a literature review, participant observation, and a series of semi-structured, face-to-face interviews with key informants about issues related to food insecurity, resilience, and farmer needs regarding business sustainability. The results highlight how the political,

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Conflict of Interest Statement

No author of this work has a conflict of interest, including specific financial interests, relationships, and/or affiliations relevant to the subject matter or materials in this work.

Funding Disclosure

Partial financial support for this project was provided by an internal grant from the Sponsored Program Administration at Ball State University.

economic, and cultural complexities of the USVI stymie efforts to lower barriers related to food accessibility and affordability. The results also reveal a new and vibrant entrepreneurial spirit among native islanders and transplants alike, providing novel entryways into food system change and development. Finally, we share policy implications and next steps toward building agriculture and food system resiliency.

Keywords

food security, food system sustainability, resilience, semi-structured interviews, U.S. Virgin Islands

Introduction

The U.S. Virgin Islands (USVI)—St. Thomas (STT), St. Croix (STX), and St. John (STJ)—are a premier tourist destination located in the Caribbean Sea nestled between Puerto Rico and the British Virgin Islands (BVI). The islands are part of a Caribbean archipelago, the Lesser Antilles, stretching eastward from Puerto Rico and arching southward toward South America (see Figure 1). These are volcanic islands, with lush, tropical northern sides and dry, arid southern sides, producing a remarkable biodiversity of plant and animal life across their divergent geographies. St. Thomas and St. John have significant slope and elevation change while St. Croix is flatter, particularly in the middle of the island. St. Thomas is the most populous and houses the territory government. St. Croix is the largest island, 70 miles south of St. Thomas and St. John. St. John is the smallest and least populated, with 75% of the island designated as a national park. The islands are a short flight from the U.S. mainland and easily accessible by cruise ship, yacht, and sailboat.

The islands were sold to the U.S. in 1917 by Denmark and are currently considered an unincorporated U.S. territory. On the surface, the USVIs are a tourist haven with their tropical setting, clear blue waters, and remarkable beaches. Beneath the surface, however, residents and communities on the islands are dealing with an array of significant environmental issues. Food insecurity and the lack of agricultural production at the scale needed to feed residents consistently and sustainably are two of the most serious issues (Crossman et al., 2010;

Martinez-Brockman et al., 2023). Using the Food Insecurity Experience Scale (FIES), the moderate to severe food insecurity rate in the Caribbean region was 71.3% in 2020—the highest rate in Latin America (Martinez-Brockman et al., 2023). For comparison, the global food insecurity average is approximately 29.6% according to *The State of Food Security and Nutrition in the World 2023* (Food and Agriculture Organization of the United Nations [FAO] et al., 2023, p. xvi). Residents in the USVI consistently experience significant food shortages and accessibility issues for many reasons. The most prominent of these issues are high poverty rates among Afro-Caribbean islanders, frequent hurricane damage and drought (potentially due to shifting climate regimes), poor soil quality, high food production costs, and challenges with food distribution (Barker 2012; Lenderking et al., 2021). In September 2017, the USVI experienced

Figure 1. The U.S. Virgin Islands (USVI) Shown Alongside the British Virgin Islands (BVI), as Part of the Greater and Lesser Antilles Chains in the Caribbean Sea



two hurricanes (Irma and Maria) that damaged the islands' natural and built environments. Recovery efforts have been slow, and access to food and fresh water have been seriously lacking. Other documented problems related to food security and resilience are:

- the USVI imports approximately 97% of its food;
- there is little to no value-added processing on the islands;
- there is a lack of government programs or incentives to start food or agricultural businesses; and
- the islands are carrying significant government debt (~US\$2.6 billion) (U.S. Government Accountability Office, 2023)

This paper provides a snapshot into the USVI food system, including obstacles and opportunities, and offers suggestions for moving forward using case study methodology to (a) explore the island's historical experiences of slavery and the global sugar trade; (b) interview key informants about the challenges and opportunities the islands face related to food production and agricultural resiliency; and (c) observe and participate in current-day agricultural and food-forward events.

Resiliency

Ensuring a stable supply of food in the face of environmental change and natural disasters is a crucial component of resiliency. The development of diverse and sustainable agricultural practices can enhance the ability of food systems to withstand shocks and stressors. Investing in local food production and distribution networks further strengthens resilience by reducing dependence on global supply chains, which the pandemic illustrated can be especially fragile during times of international catastrophe. Tendall et al. (2015) defines food system resilience as “capacity over time of a food system and its units at multiple levels, to provide sufficient, appropriate and accessible food to all, in the face of various and even unforeseen disturbances” (p. 19).

Within a given food system, people grow, purchase, eat, and transport food. These food stake-

holders are challenged to collaborate and find ways to implement sustainable strategies in response to climate change, economic uncertainties, and unequal distribution of wealth. Food systems can be understood utilizing the same theoretical approach that guides complex, ecological food webs. Ideally, communities work toward an interconnected approach that considers large-scale impacts that lead to small-scale, local effects, while also recognizing that resilience is “not a finite or objective outcome, but rather a continuously contested process of responding, adaptation, and livelihood making” (Walsh-Dilley et al., 2016, p. 6).

In tropical island systems, two major geographical considerations emerge: (a) response to climate change; and (b) reliance on imports. Climate change is driving biodiversity loss, disease outbreaks, northward expansion, and shifts in growing seasons (in the Northern Hemisphere). Island systems have limited arable land, often imperfect infrastructure, high development costs, and little room for expansion, making them even more vulnerable to environmental disasters (Beckford, 2012; Beckford & Campbell, 2015; Saint Ville et al., 2015). The United Kingdom is an example of a fragile island ecosystem that relies on significant food imports (approximately 48%) to feed the population; Most island nations, in general, are susceptible to disruptions in trade, both logistically and politically (Zurek et al., 2022). Many island systems import double the proportion of the UK imports, which warrants reimagining and possibly rebuilding island food systems so that resiliency is not out of reach. Based on current food imports in the USVI and the other challenges already mentioned, agricultural and food system resiliency seems almost out of reach. Agriculture continues to be the least supported sector in the USVI government, with tourism being the most supported, bringing in the most funding and capturing the most attention (L. Petersen, personal communication, November 5, 2018). Still, there is a growing recognition among farmers, food system actors, and stakeholders globally that, particularly after COVID-19 and a climate crisis that does not seem to be going away, building in equity and resilience in food systems is essential (Stone et al., 2024).

Change Is Coming

In 2008, rising public demand for locally grown products and increasing inclusion of farmers across various sectors prompted a resurgence in agriculture in the USVI, prioritizing agritourism and education (Laurencin, 2017). Farmers were no longer satisfied relying on governmental assistance and began operating as independent entrepreneurs to regain control of their lives and achieve greater self-sufficiency (Freeman, 2014; Laurencin, 2017). In addition, they aimed to redefine the narrative that farmers are backward, uneducated, and unskilled by embracing modern pursuits in innovation and flexibility in business practices, such as introducing new crops and collaborating with other farmers to form cooperative relationships to advance product marketing. Given the lack of governmental support in the form of incentives, equipment, suitable market locations, etc., they took matters into their own hands (Freeman, 2014; Laurencin, 2017).

Despite the obstacles preventing a sustainable and resilient USVI food system, there are many reasons to be optimistic regarding increased food security and development of a regionalized food production strategy on the islands. University of the Virgin Islands (UVI) Agricultural Experiment Station (AES), located on St. Croix, worked with students and faculty to conduct basic and applied research designed around the needs of the local agricultural community. AES explored ways to support farmers on the islands, including teaching and training in animal science, agroforestry, agronomy, and biotechnology. (Unfortunately, there has been little focus on regional food system development.) Also, according to the Censuses of Agriculture in 2007 and 2018, individually operated farms increased from 194 to 473 in the 10 years between (U.S. Department of Agriculture National Agricultural Statistics Service [USDA NASS], 2007, 2017). Further, agricultural sales increased from US\$2,071,022 in 2007 and to US\$3,334,662 in 2017 (USDA NASS, 2007, 2017).

There are several new agribusinesses in the USVI that, despite significant hardship, are beginning to take root. These new ventures represent reimagined ways to grow and distribute food locally and regionally. But what else is happening

on the islands regarding food system development and resilience? How have the historical experiences of slavery and indentured servitude of USVI residents impacted current day agriculture? What support and infrastructural needs do farmers in the USVI have that would help them grow and sustain their businesses, to strengthen the islands' food system resilience? How should island governance focus its support related to agricultural sustainability and food access?

A literature review provided the context for historical roots of slavery and experiences with early agriculture. Using a case study approach, we carried out a series of semi-structured, face-to-face interviews with key informants about issues related to food insecurity, food system resilience, and farmer needs related to business sustainability. In addition, we did participant observation at several agricultural events to explore these issues in an attempt to better understand the potential for increased food resiliency in USVI. The data we collected are qualitative and focuses on stakeholder interests and key areas of need. The data, analyses, and conclusions could help provide leverage for future funding.

Methods

We used a case study research approach that allowed us to inquire and observe events, individuals, and programs bounded by time and activity (Yin, 2009). A case study approach affords opportunities to triangulate data sources for comparing and integrating qualitative and quantitative data to better advocate and give a voice to underserved or underrepresented members of the community (Creswell & Creswell, 2017). This approach was appropriate for this study because it allowed us to develop a deeper contextual understanding of the USVI, the people living there, and their respective histories, followed by data analysis highlighting key themes and issues regarding food system resiliency in the USVI (Creswell & Creswell, 2017; Wolcott, 1994; Yin, 2009). Triangulation was used to strengthen the validity of our findings by recognizing the convergence of information from several different sources. This helped us identify and, at times, highlight information that was relayed to us multiple times and from multiple sources.

Historical Contextualization

Understanding USVI's current food system and implications for food and farming resiliency requires explorations into USVI's past experiences with agriculture, and how that shapes USVI's current food system with significant influences such as colonization, slavery, and the sugar trade. Understanding these historical roots helped us to contextualize our recently collected interview and participant observation data to untangle the complexities and dependencies embedded in USVI's current food system, and perhaps better understand how to move forward toward resilience. We focused our historical dive on the triangular trade involving slaves, sugar, and rum across the Atlantic Ocean and Caribbean Sea. Then we walk through USVI's agricultural history and the challenges their food system faces as a direct result of their history and life experiences.

Participant Observation

The authors used participant observation on several occasions, including a forum that featured a panel of speakers with expertise in agriculture and food systems. The forum followed the release of a documentary about food and farming in the USVI. Panel participants included the filmmaker, two native chefs, a native farmer, a representative from an agricultural training nonprofit organization, and an editor from the local paper. The authors also attended an agriculture festival in the Bordeaux region of St. Thomas. The event combined a farmers market and education, with booths representing agricultural and food-related organizations (e.g., USVI Agricultural Extension, USDA Natural Resources Conservation Service [USDA NASS], agricultural technologies, etc.). The authors also attended a farm-to-fork dinner event on St. Croix that featured locally grown produce and food items prepared by an island chef. This event was held at a farm that encouraged volunteers to help and interact with interns. The authors stayed two nights and participated in farm activities during that time.

Key Informant Interviews

Key informant interviews were used as a data collection method to gain a deeper understanding of the current barriers and opportunities facing farm-

ers in the USVI, regional perceptions of food insecurity, and impacts of extreme weather on both farming and food access. Recruiting interview participants was purposive. Key informants were selected based on their positions in the community, association with a particular agricultural or food security organization, or by their locally described reputations and knowledge surrounding farming and food insecurity in the USVI (Elmendorf & Luloff, 2001). The authors spoke with farmers (both native and transplants); government officials who worked in the agriculture sector; representatives from the extension service and USDA NRCS; and other key individuals. The authors deployed a snowball sampling procedure, which helped to identify additional informants who might not be readily identifiable. They might not be employed by a key organization or had an association with farming or agriculture directly, but they had specialized knowledge or adjacent experience that was related (Gordon et al. 2013; Heckathorn, 2002). Interviews took place on all of the three islands in November and December 2018. Discussions focused on food availability and costs in the USVI, perceptions of agriculture, trends in the local food movement, food distribution and disruptions related to extreme weather events, and visions for supporting local agriculture and food systems. The use of open-ended questions encouraged participants to offer spontaneous answers without having to respond to specific questions. Their rich and spur-of-the-moment replies provided an understanding of the reality of the USVI, including broad patterns of relationships among actions and actors with respect to agriculture and food insecurity within the local environment (Elmendorf & Luloff, 2001).

The authors obtained institutional review board (IRB) approval to conduct the interviews. Participants were asked to read a brief consent form relaying the purpose of the study, their rights, and benefits and harms related to participation. They were also asked to sign consent forms and authorize audio recordings. The interviews took place in locations convenient to the interviewee (e.g., their place of work or home) and were captured with a digital recorder. Supplemental notes augmented the recordings. Interviews lasted between 30 minutes and two hours and were con-

ducted until data saturation was reached. Recordings were transcribed verbatim, coded, and analyzed for common themes related to food system sustainability and food insecurity. The authors transcribed detailed observations during field site visits, which were also part of the coding process.

Digital recordings and transcribed documents were kept in the lead author's password-protected computer while at the study site and subsequently at Ball State University (BSU), Muncie, Indiana. The handwritten notes were kept in a locked suitcase while on site, and a locked file cabinet in the lead authors office at BSU. Only the authors had access to digital or handwritten data. The transcripts and recordings were reviewed multiple times to ensure reliable interpretation of each participant's intent and context.

Interview Analysis

Content analysis was used to code transcripts according to individual units of meaning. Similar codes were condensed (and recondensed) in a two-part process and ultimately organized into relevant themes. Words and ideas generated from the participants themselves revealed several common themes. The authors collaborated through multiple strategy sessions to ensure the themes and supporting quotes captured the true essence of what study participants were saying. Peer debriefing, in two independent sessions, enhanced the study's validity as authors shared the data collection methods, themes, and supporting quotes with two academic colleagues.

Results

USVI's past experiences with sugar and slavery frames modern-day farming and the complexities of its food system, which are hampered by dependencies like extremely high rates of food imports and cost of food. Also, the more recent transition from agriculture to tourism is part of this story that helps explain continued dependencies, miniscule economic support for agriculture, and the potential for new markets in the future. Our results begin with historical contextualization to help build the framework for understanding the current food system, which we explore through key informant interviews and observations while in the field.

Historical Context

Understanding the slave trade, the sugar industry, and the tourism juggernaut (circa 1960–70s) provides essential historical context, laying the groundwork for the associated decline in agriculture over the past decades. Before the Danish established sugar plantations in the USVI and before Christopher Columbus landed in St. Croix in 1493, native tribes lived there and worked the land. The islands were eventually purchased by the Kingdom of Denmark-Norway, then the Kingdom of Denmark, which established sugar plantations on the islands and brought slaves from west Africa to work the land (Knight, 1983).

The First (and Second) Coming of Colonization

By most chronological and geographical accounts, the Arawak tribe (South America) was likely the most dominant native group prior to the influx of enslaved peoples (Capetillo-Ponce & Galanes, 2013; de Albuquerque & McElroy, 2021; Roopnarine, 2021). Other accounts identify the Arawak and two subgroups: Taíno (Puerto Rico) and Ciboney (Cuba and Hispaniola) tribes as the likely inhabitants. Later, the Caribs, a Guianan subgroup of the South American Kalinago tribe, conquered many of the Taíno peoples and established residency. While this narrative may best align with a popular consensus of Caribbean historians, the authors wish to acknowledge the anecdotal nature and ambiguous accounts that make records difficult to confirm (Dick, 1977).

As the islands underwent expansion and development as U.S. territories, a legislative framework was established and several iterations of a constitution were drafted, none of which has been formally ratified (Klopf, 2004). Under what would be the second colonization event, the legislative descriptor “native” or “indigenous” was applied to the existing Afro-Caribbean dominant group.

USVI: The Birth of an Identity

Despite the uncertainty of the island identity prior to the U.S. acquisition, a few themes emerged during the years that followed: (a) Afro-Caribbean culture began to take shape; (b) land rights were not clearly outlined, leaving limited and unclear governance driving disputes that would span more than a

century; and (c) the goal of anti-colonial and agricultural independence became overshadowed by exploitation and disempowerment as the transition toward a tourism economy materialized.

Economy of Production: Slavery, Sugar, and Agriculture

The hilly terrain on St. Thomas and St. John was terraced and used to grow sugarcane, which was used to make molasses, then shipped to the north-eastern U.S. and Europe as a major ingredient for rum production. This triangular molasses trade lasted from the 16th to the 19th century (Campell, 2023) and relied significantly on slave labor to work the sugar cane fields and other ancillary and related tasks. This helped to establish agriculture, as Laurencin (2017) alludes, as an essential ingredient of the islands, representing a historical and cultural identity and tradition. Modern-day residents recall this as a time of horrendous cruelty, oppression, and significant inequality. Unfortunately, many farmers and others now view agriculture negatively—as a backwards and outdated occupation that people do as a last resort. The work was incredibly grueling as the steep hillsides had to be terraced and watered and sugar cane chopped and hauled to the sugar mills. The average life expectancy of enslaved workers in those times was 35 years (Ward, 2023). Eventually, the slaves rebelled in 1848, which fueled the abolishment of slavery—17 years before it was abolished in the United States.

Denmark sold the islands to the U.S. for US\$25 million in 1917. The U.S. kept the islands as an unincorporated territory, so they were taxed but not represented by Congress. The last sugar plantation was shut down in 1966. Oil and gas companies and other industries were invited in to fill the void, but eventually the USVI government saw the writing on the wall: the economic engine that would fuel growth in the USVI was not gas, oil, or industrial interests, but tourism.

Between 1790 and 1960, the USVI produced most of the food it consumed (Crossman et al., 2010). But as sugar production declined in the islands, so did agriculture in general (Mills, 1984). This decline continues to persist. Despite government interventions and modest federal funding

inputs, agriculture has had to compete with commercial, industrial, and most recently, tourism interests (Mills, 1984). Blaut et al. (1965) suggest that as the sugar industry was failing, many cane farmers did not know how to transition toward growing other crops, and the land used by previous generations to grow was overtaken by developmental interests rather than safeguarded for agricultural land use. During this time, the tourism sector burgeoned and afforded economic opportunities for seasonally employed sugar workers and the jobless. Mills (1984) comments, “given the social stigma that clings tenaciously to farm work throughout the region, many a farm laborer willingly traded his overalls for a bellboy’s garb” (p. 28). Working in tourism was perceived as lucrative, so as a result, the construction industry boomed. Tourism and construction were strong drivers of agricultural decline during this time. Not only were farmers trading their growing tools for hammers, but the influx of immigrant labor for construction demanded the use of agricultural land to build supplemental living quarters.

In addition, due to the proximity of the USVI to other island nations and the U.S., there was now easy access to significant amounts of low-cost foods like eggs, chicken, milk, pork, beef, and vegetables (McElroy, 1979). In the 1980s, the USVI was importing 99% of the food consumed, and this remains true today. McElroy (1979) noted what he called an “anti-agricultural policy,” enacted by letting prime agriculture tracts go fallow after 1966 and indirectly promoting rampant suburban sprawl by sponsoring labor-intensive tourism, federal highway construction, and less-than-optimal finance and realty practices. The decline in the number of operational farms and cultivated acreage was substantial.

In 1980, the Department of Agriculture’s efforts to revitalize agriculture intensified due to a noticeable increase in dependence on imported foods, concerns over energy conservation, and a realization that agriculture is an essential component of the territory’s economic development. Mills (1979) reported that 91% of Virgin Islanders surveyed felt that it was “important” or “very important” for government to exert efforts to expand agriculture. The Department of Agri-

culture also reported that very few young people were currently involved in or entering farm production (Padda, 1979). Obstacles included inadequate availability of land, capital, and the lack of technological assistance. Padda (1972) pointed out other obstacles, including a lack of trained personnel, labor shortages, inadequate water supplies, and insufficient marketing.

Still, to the government's credit, it put in place several pro-agricultural policies during this time to encourage farming activities. These included (a) direct subsidy payments of US\$40.00 per acre to farmers who cultivated sorghum; (b) a 95% exemption from real property taxes for land officially certified for agricultural use; (c) a 90% reduction of tax on income derived from agriculture to any certified applicant; (d) the provision of a number of direct services to small farms (e.g., land preparation, fertilizer, seeds, and slips); (e) the enforcement of zoning and building regulations to minimize residential and commercial encroachment pressure; and (f) the acquisition of land purposed for farming. Still, even according to Mills (1984) the tax incentives and subsidies were not enough to suppress the continual infringement on agrarian land.

There have been multiple programs, often led by the extension service in the USVI, to reduce barriers to farming and sustaining agricultural businesses (e.g., "Virgin Fresh" Apiculture Project, Operation Breadbasket). The goal of these programs was to reduce the risks incumbent to farming, increase production, maintain permanent employment in agriculture, and spur the economy to improve residents' quality of life (Crossman et al., 2011). These projects, and others, promote the recovery of the agricultural industry by teaching farmers sustainable agriculture, financial planning and management, income tax preparation, and how to turn a profit. Despite these efforts, starting and sustaining farm businesses continue to challenge islanders due to factors beyond farmers' control, for example, the lack of markets for local goods and distribution pathways, the exorbitant cost of fertilizer and other inputs, and the cost of electricity (Crossman et al., 2010; Iowa State University Food Systems Team, 2020; Laurencin, 2017).

Key Informant Interview Results

Fourteen key informant interviews were conducted across all three islands and included natural resources agencies, government personnel, native and transplanted farmers, UVI faculty, kindergarten through twelfth-grade (K-12) educators, and a chef. Results were divided among four main challenges, or themes, facing USVI's food system (cultural, environmental, infrastructural, and political) and steps toward resiliency.

Cultural Challenges

The lack of interest in farming came up in several interviews. For native islanders, this reluctance was linked to painful memories associated with working the land and slavery. One native farmer in St. Thomas put it this way: "we are still associating farming with slavery. A farmer is a businessman. We need to treat it as such." An agronomist from UVI offered the following remarks:

Agriculture for people didn't improve when slavery ended. It got worse. Here in particular, just like in the deep south, they went from slavery to indentured servitude. In some cases, more extreme poverty/hardship and the race relations were the same... nothing changed.

Native farmers also reflected on how farming appears to kids growing up in the islands. Much of the agricultural land on St. Thomas is steep and there is not much machinery or automation to make the physical labor easier, so children see their parents or families doing back-breaking work. A native farmer said it this way "Our agriculture is so manual and labor intensive. [Kids] just see their grandfather out there hoeing weeds. That's the ag they know, and it brings back some of those bad memories."

Another issue that emerged from the data linked farmers, particularly native farmers, to a "lifestyle" of farming rather than the business of farming. This was especially true in the Bordeaux region of St. Thomas, where the terrain is steep and most farmers centered there are Rastafarian. This is related to the painful memories of slavery. The Bordeaux region, also known as Estate Bordeaux, was once a thriving sugar plantation.

The farmers still working there do so on their own terms. This promotes a sense of freedom, rather than an obligation to work; they can now farm as they please, when they please. For NRCS this creates some challenges in terms of supporting farmers' efforts. "Rasta" farmers do not think of farming as a business; to them it is a way of life. "The cucumber comes when it comes," an NRCS employee stated about the farmers' point of view. They showed little interest in systemizing their business, moving toward regularity, making consistent profits, and building a sustainable business.

A lot of them consider [farming] more like a lifestyle than a business. So, they don't think of it like having to keep track of paperwork and all. ... Extension offers record keeping workshops and other workshops, but they don't open their mail, they find out about things last minute ... so they don't enroll in programs, they can't claim benefits. (Natural Resources Conservation Service employee)

There was a sense of frustration among agency personnel whose jobs are to provide outreach and education, financial literacy, and help farmers qualify for benefits and incentives. However, their guidance is shunned and stymied by the perceived indifference of their target audience.

Environmental challenges

Participants often spoke of hurricanes as being both a curse and a blessing. As a curse, hurricanes are ripping off what small amount of topsoil is left, particularly on St. Thomas and St. John. Both islands have little topsoil due mostly to decades of cultivation for sugar plantations, steep slopes, and the resultant soil erosion.

Friends of ours, they came up here and helped rebuild the farm. They came day after day. ... We started replanting ... then the second storm came and then we lost the momentum, I said no way... Hurricanes are the hardest things. Land wiped clean. The soil. The soil is the hardest part ... so now you have to start all over again. (Transplant Farmer 1)

Some participants spoke of losing their livelihood once the plants were ripped from the soil and the topsoil was washed or blown away. A transplant farmer on St. Thomas remarked about this after visiting the Rasta farmers in the Bordeaux region after the hurricanes:

We went out [to Bordeaux] after the storms. And they are very positive, energetic people who fend for themselves. I've never seen them sadder. They lost what was most important to them, their livelihood. Their plants ... they're wiped out. They got nothing. (Transplant Farmer 3)

Conversely, many participants spoke of the positives that accompany the hurricanes. For example, they contended the extension service and NRCS were listening and being more responsive to farmers' needs after the storm. Hurricane relief funds seemed to help agricultural professionals respond more quickly and frequently to farmers' needs.

Before the storms [the Department of Agriculture] were a lot more out of touch. We couldn't reach them. They couldn't get the budget for it. The St. Croix office ... since the storm they've got more money to travel more and are a little more accessible. So that's positive. After the storm they're more accessible so it's positive. (Transplant Farmer 1)

On a more personal level, one farmer referred to the hurricanes as a blessing because they helped them prioritize and become more organized.

The hurricanes were a blessing. Uh huh. Because ... it's an opportunity, to get your head out of your ass. Yeah. Get out of the mud. Reinvent into something better, sharper, and more organized. It's like we had things that were able to shed that we couldn't before. (Transplant Farmer 2)

Infrastructural challenges

There were other significant infrastructural challenges, such as the cost of electric power signifi-

cantly stifling any move toward cold storage and refrigeration, that no one can afford. The lack of value-added processing was reflected in the following comment by a university researcher: “We grow a lot of cucumbers, but we don’t see one damn pickle.” Labor is another cost-prohibitive item that keeps the labor force small. The minimum rate per hour for farm workers is US\$15/hour, but the going rate, and what is often more widely accepted, is US\$20/hour. Few farmers can afford the help.

By far the most crucial elements that emerged, particularly with the farmers we spoke with, were related to water: sources of water, but mostly water storage and distribution. The tropical island’s climate cycles between wet and dry seasons, making the ability to collect and store rainwater essential for farming during periods of limited rainfall. Water limitations have been problematic for generations and the problem continues to stymie farmers and Department of Agriculture officials.

Water is an issue. We have adequate rainfall, but it’s wet-dry-wet-dry—we need to be able to store water then use it when it is dry. I have been farming for 42 years. Nothing is changing. I am still crying for water. (Native Farmer 3)

When it rains, farmers can collect water, primarily from roofs, but the capacity to store and use it during the drier seasons has remained a challenge.

Water program storage capacity, cisterns, tanks. It sounds so simple in the States you take it for granted. But right here—water. So, something like ... 1,000-1,500 sq. foot [139 square meter] flat roof, a couple of hours of a rainstorm ... how much water can you collect. Thousands of gallons. Nowhere to put it. (Transplant Farmer 1)

The Department of Agriculture can truck water to farmers, but capacity limitations and poorly timed delivery afford very little reassurance to distressed growers.

I’ve been out of water for a week, and I called the department agriculture to tell them I was out of water. ... But they still haven’t brought my water. And that’s from last week Wednesday. And no one has called me. So that’s how serious this is because you have to have a plan A, plan B, plan C about water. (Native Farmer 1)

The Department of Agriculture recognizes this issue and has secured USDA funding to purchase large water storage tanks for the Bordeaux region of St. Thomas, but the project has yet to move forward, according to many of the farmers’ accounts. Despite government reports of successfully securing funding, no tanks have been placed yet.

Political challenges

Of all the sectors that help move life forward in the USVI—agriculture, tourism, transportation, social services, etc.—the one that encumbers the lion’s share of government funding, developmental efforts, and support is tourism. Since the late 1960s or early 1970s, the USVI’s tourism star has risen to develop the island in many ways. Better harbors, improved roads, and other infrastructural updates have bolstered the island landscape. Despite these upgrades, study participants described tourism as the dominant sector, with agricultural prioritization being nonexistent. The agriculture budget is US\$4.5 million annually, and the majority of those funds (approximately 85%) is allocated to personnel remunerations.

The USVI used to be a very agrarian-oriented community, that changed in the ’60s. It changed when we decided to close the last of our sugar plantations; it changed when we decided to convert all of those agriculture-zoned lands into industrial lands; and it changed when we decided to make tourism the hub of our economic wheel. So, all the resources went into tourism. (Previous Commissioner of Agriculture)

A seemingly greater obstacle to overcome is the ability for farmers to legally lease land. Currently, if land parcels have not been surveyed by

the government (i.e., marking boundaries), citizens are barred from cultivating or even living on the parcels. Backlogged municipal survey efforts, particularly on St. Thomas and St. Croix, limit citizens' ability to legally inhabit, produce food, or do anything else on the land. Several farmers, particularly in St. Thomas, have resorted to self-help measures that circumvent lawful expectations.

Many farmers are technically squatting. They have chosen not to wait for the government. "I have to do what I need to do. I need to farm and I'm doing it." And if it weren't for them doing that we would have less to show. The honest truth. Not waiting for the government. (Previous Commissioner of Agriculture)

Decades ago, the government instituted a homesteading program that provided land lessors (i.e., farmers) with the ability to transition into ownership, once certain labor expectations and tenure were met. Many people still think this option exists, so they cling to their land in hopes the government will oblige. Many of these farmers are older and no longer farming due to age and health-related constraints—so they sit on their land, hold it fallow, and wait. We heard from an employee in Agricultural Extension that "50% of the arable land on St. Croix is not in production due to the land survey/legal lease issues." In some instances, people are holding the land to which they have secured rights, but not actively farming, because of financial, age and/or health limitations.

Some of the people who have leases, some of them are not even able to farm anymore. They don't want to give up the land. ... From way, way back, there was a situation where persons ended up with land in a homesteading program that the government had a long time ago. But still, in the minds of some of these people, they think that maybe they will be able to own the land. So even though they're not interested in farming anymore, not able to farm anymore. They don't want to give it up because they think they're going to lose an opportunity to own it. I would say it's about 50% of the farmland here in St. Croix. (UVI Researcher)

Part of the deeply embedded misfortune for farmers awaiting land surveys is the lack of true ownership, without which they are not eligible for financial and technical assistance. Things like cost-share programs for seeds and plants, water storage and transport, pest control and disease mitigation, or general managerial support (like book-keeping and other small business skills) are inaccessible. These are responsibilities of the USVI Agriculture Extension and NRCS, and the very reason these agencies exist. An NRCS employee said, "[The] majority of farmers on St. Thomas are squatters. Farmland needs to be surveyed, marked boundaries. ... If they don't have legality, they can't be eligible for help."

Steps toward resiliency

Extension efforts aim to reframe agriculture in the islands and show youth that growing food is not just full of onerous tasks like hoeing weeds and digging trenches. Extension is actively developing programs to reintroduce youth to agriculture and tethering it to health and technology, such as the science of nutrition and soil quality. Other examples include exposing young people to new farming technologies like the use of drones and geographic information systems (GIS) and certain elements of precision agriculture.

We want to nurture a new generation of farmers. ... We have an ag discovery program here. Funded by the USDA. It is a residential program. Youth stay on campus—class activities, class lab, get a feel of what university is about. We're also working with young adults on St. Croix. July and August—ag enrichment summer camp ... nurturing young adults who can step up. (Previous Commissioner of Agriculture)

Our participants recognized the power of the tourism sector for farmers and other related jobs. We spoke with several transplant farmers who were actively selling products to tourist venues, such as high-end restaurants and the private-chef industry on yachts. Crate Crops, an agriculture start-up with produce grown hydroponically in shipping containers, devised solutions to combat food issues in St. Croix but found no infrastructure to sell the pro-

duce on the island. Other farmers mastered growing microgreens indoors, but likewise found only limited distribution options. Transplant farmers worked to introduce tourists and locals to the hyperlocal food movement, and the craftwork of up-and-coming native chefs in the area.

Related to this, a government official put it this way:

We need to pull tourists from the overburdened downtown shops to a local farm or farmers market so they can experience what a Caribbean mango tastes like, so they can purchase the local made mango jelly. ... Give them an experience to take home and remember.

Discussion

Our data, drawn from semi-structured interviews and observations at agricultural and food-related events and framed by the historical context of slavery, sugar, and the rise of tourism, revealed many challenges to growing and distributing food in the USVI. These challenges encompass the infrastructural (e.g., capturing and storing water); the biophysical (escalating severe weather); the sociocultural (e.g., farming as a lifestyle rather than as a business, painful histories involving slavery and indentured servitude, and current land ownership issues); in addition to the political (e.g., small funding allocations for agriculture and issues related to the legal lease to land).

Navigating Water Woes

Many of our participants complained about the lack of water storage capacity on the islands. There is little natural water on the islands, so most water comes from the capture rain in cisterns and barrels (Iowa State University Food Systems Team, 2020). The islands' average rainfall is 39"–47" (100–120 cm) per year (National Weather Service, n.d.), with more precipitation falling on each island's northern slopes. The islands operate on a wet/dry seasonal cycle; dry times can stretch from January to August, while wetter months are September to November. Water storage could alleviate the shortages, but tanks cost money and require consistent cleaning and upkeep. Funds to purchase and main-

tain water storage containers were found to be in short supply among small-scale farmers, who were already fiscally strained.

Mills (1984) identified inadequate supplies of water and other issues (e.g., tourism development, labor shortages, and the unavailability of land) as the explanation for the decreasing performance in agriculture in USVI. This is not a new issue. Key informants identified the commissioner of agriculture and the government, in general, as those who should apply for grants to fund water-storage projects. A former commissioner of agriculture discussed a USDA grant secured to fund a water storage project on the east side of St. Thomas, which led to construction of a US\$60,000 cistern under the parking area for the farmers market. Still, the commissioner admitted that the investment in infrastructure, particularly water storage and distribution systems, continued to be lacking.

The Virgin Islands Community Food System Assessment (2020) also identified the need for resilient water practices in preparation for shifts in climate and the water-holding capacity of soil. Permaculture and agroforestry practices could benefit the maintenance of soil health and crop diversity (Iowa State University Food Systems Team, 2020). In 2021, Act 8404 was signed into law by Governor Albert Bryan mandating development of a comprehensive agricultural plan for the USVI to make increased agricultural productivity, food security, and food sovereignty a reality for residents. Toward this goal, a task force convened to develop and address mandates granted by Act 8404 (VI Agricultural Plan Task Force 2021, 2021). Of the five high-priority projects proposed, comprehensive irrigation systems and water supply were at the top on the list (VI Agricultural Plan Task Force 2021, 2021).

Climate Threats to Island Ecosystems

Climate models predict increasing frequency and intensity of hurricanes in the Caribbean in the coming decades, emphasizing the importance of small-scale farmers adapting to these shifting weather patterns (McGinley et al., 2022). Since the double 2017 category 5 storms swept through the USVI, there have been 20 severe storms, and eight have been category 3–5 hurricanes (World Data,

n.d.). None caused as much damage as Irma and Maria, but several caused power outages, property destruction (particularly along the shoreline), and inhibited cargo ships from docking to deliver food and water supplies. Island nations are often the hardest hit by intense weather events and have the most difficulty rebounding due to supply chain issues and inadequate relief assistance (Betzold, 2015; Thomas et al., 2020). The ability for farmers to grow food on the island is essential to long-term sustainability and resilience. There are operations on St. John (e.g., Josephine's Greens) and on St. Croix (e.g., Ridge to Reef Farms) supplying leafy greens (lettuces, kale, and herbs) and other salad bar items to local schools, restaurants, and grocery stores. Although these operations were small, they continued to function despite weather setbacks. In addition, new transplant farmers on St. Thomas and Love City Fresh on St. John grew food indoors (microgreens in a basement and shipping containers used as grow rooms), which captured some tourist dollars. Those products were sold to several high-end restaurants and personal chefs who cater to the yachting industry. Despite the severe weather, small-scale farmers continued finding ways to grow and distribute fresh foods. Like other small island nations in the Caribbean, farming and food production have fueled the dichotomy as mechanisms of oppression pitted against community empowerment. Navigating food insecurity and food sovereignty in this modern day requires small-scale agriculture and autonomy (Conzo, 2022).

When asked about how Irma and Maria affected them, many farmer interview participants chronicled restarting their farms from scratch; some even rebuilt soil. Several farmers, however, responded in a way that suggested they were taking things in stride. Yes, the hurricanes were terrible, but afterward they moved forward in a new, albeit stronger, way. The storms wiped the slate clean and afforded new opportunities. They restarted, discarded old failing practices, and devised new ones. Participants hoped for more attention from the government, with potential support that was previously nonexistent. Rarely do island residents have economic and infrastructural support to rebound without governmental subsidies, so national and international backing is crucial during the rebuild-

ing stages (Pernetta, 1992). In the USVI, land masses are small, populations are large, and supplies are limited because of costly and restrictive import practices, making storm recovery efforts challenging for all, but particularly those with limited financial means (Platenberg & Harvey, 2010).

Resilience Among USVI Farmers

The history and culture of farming in the USVI is multilayered. We have discussed the impacts of the slave trade and people who "settled" there, the crops that motivated the colonist mindset of "valuable," and the cultural influences that persist today. Examining the historical context magnifies both the resiliency of the contemporary island food system and the obstacles that affect current strategies.

The USVI farmscape is dominated by Black Americans working within (and against) a system that was not built for them, and one that pays little homage to the African diaspora (Edwards, 2022; Oboler & Dzidzienyo, 2005). They compete with corporate entities that prioritize tourism expansion and development over subsistence farming. Campbell et al. (2022) suggest that local governments, food policy councils, cooperative extension, and other food and agriculture stakeholders struggle to enact policy or programming that helps them achieve their goals of equitable food system change because they do not know what policy or program models exist to help. Despite the inherent racism, classism, and socioeconomic stratification that persist, the culture of Blackness is a key element that influences resilience of the islanders, still today (Edwards, 2022). The intersection of race, ethnicity, class, geography, and social hierarchy must not be overlooked.

African Influence on Global Agriculture: Resistance and Resilience

Many agricultural contributions and practices originated in Africa, including crop origination, farming and domestication techniques, and the bulk of the labor force in the form of chattel slavery and indentured servitude (Carter & Alexander, 2020; Moon, 2007; Sousa & Raizada, 2020). Despite the significant contributions to agronomy and the foundational framework put into place by Black people, farming technology, innovation, and work

ethics are often equated with whiteness. Historical narratives rarely depict the role of African culture in shaping contemporary food systems (Hoover, 2013).

“Freedom” in the form of legislative measures and widespread liberation movements ultimately led to hopes of amelioration, food sovereignty, and optimism among previously enslaved peoples. However, strategic disputes over land ownership rights, limited economic opportunities and performative replacements for slavery, like sharecropping and land leasing, allowed systemic oppression to persist (Johnson, 1984; Merem, 2006; White, 2018). Post-liberation movements further shaped Caribbean communities and exacerbated economic imbalances that perpetuated a socioeconomic segregation between racial and ethnic island groups.

Several key informants in our study recognized that native farmers, particularly the Rastafarians on St. Thomas, treated farming as a lifestyle rather than a business. This dramatically limited the kinds of governmental support they could be eligible for were they to attend agriculture extension programs, for example. The birth of Rastafarian culture was a direct response to historical (European) colonization. Afro-Jamaicans of the early 20th century sought ways to defy governance and rebel against the oppression and loss of autonomy of Black people that resulted from British colonial rule (Campbell, 1980). They strived for an identity that would thwart the expectations of conformity to Eurocentric culture and supremacy. Rasta traditions, once established, significantly influenced other Caribbean Island populations, including inhabitants of the USVI (Edmonds, 2012).

The VI Agricultural Plan Task Force 2021 (2021) recommends developing an Agriculture Business Center to aid farmers in increasing production and developing skills around the business of farming (e.g., book-keeping and grant-writing). These programs would have to be open to farmers who may not have legal title to their land and address the cultural and economic diversity of participants, particularly Rasta traditions. Still, how do we incentivize farmers to take advantage of this kind of programming? That problem will still exist despite the addition of an Agriculture Business Center.

Historical Issues Driving Contemporary Problems

In the Caribbean, relic systems of governance, geographical isolation, and supply chain limitations reinforce mechanisms of widespread corruption or general negligence. Colonial legacies, nativist discourse, and an island-influenced racial divide serve as additional obstacles that U.S. citizens of the Virgin Islands continue to face (Austin, 2018; Capetillo-Ponce & Galanes, 2013). Food systems plagued by socioeconomic stratification and geographic barriers that limit oversight present unique challenges to small island states. Many islanders associate agriculture and physical labor with slavery and indentured servitude. This is a global phenomenon not linked exclusively to USVI. Historically, the labor force was rooted in mechanisms of colonialism worldwide (Barry et al., 2020; Williams, 2013).

Still, there is growing awareness that food-related policies and programs can address issues of equity and resilience (Campbell et al., 2022). There are specific national policy platforms aimed at building food justice in the U.S. (Beyranevand & Broad Leib, 2023; Valliant & Freedgood, 2020). Recent legislative indicators signal movements to attract, directly support, and engage people of color in agriculture. The Emergency Relief for Farmers of Color Act and the Justice for Black Farmers Act were passed to identify and address the needs of BIPOC farmers. A burgeoning local food movement across the U.S. over the last decade inspired many BIPOC farmers to engage in growing food. Multiple programs have encouraged BIPOC farmers on the U.S. mainland; the Rodale Institute and the Organic Farmers Association gave mini-grants for BIPOC farmers; several training programs specifically for BIPOC farmers exist; and the USDA Local Food Purchasing Assistance program (LFPA) has funded state, tribal, and territorial governmental local food purchases that support underserved producers. Thus far, the food sourced through these programs bolsters food banks and pantries, schools, and other emergency outlets in underserved neighborhoods. Despite these programs’ growing success, there is a significant issue related to agricultural land access.

Land Rights to Whom

Land to practice agriculture on is scarce and expensive in the USVI. Perhaps one of the more significant barriers facing agriculture in the USVI currently is a farmer's ability to gain legal title to the land (VI Agricultural Plan Task Force 2021, 2021; Southern Region of the Sustainable Agriculture Research and Education [SARE], 2018). According to multiple sources, people were simply squatting on the land they hoped to one day own; but without parcel surveys, potential owners were prevented from pioneering legal business ventures. Since the 1970s, squatting residents often lived on the land without ever capitalizing on its potential. There were cases (on St. Thomas) of people using the land without legal rights to grow food. They were, therefore, ineligible to participate in financially incentivized educational programming that provided support in the forms of soil mitigation, water storage, small-business classes, book-keeping, etc. Surveying these parcels could unlock significant arable acreage for growing food and provide pathways to legal farm ownership. This would take significant political will on the part of the USVI government, which depends on who is in office (particularly in the Commissioner of Agriculture role), their goals, and their power to make change.

We recognize that many Caribbean islands experience widespread political corruption with limited governmental or global humanitarian oversight. The land-grant framework struggles to identify or acknowledge clear and distinct minority rights, for example (Afro & Michelini, 1997; Klopff, 2004). In addition, laws and policies are often developed by leaders with conflicts of interests, who for example may benefit directly or indirectly from esoteric and abstruse language. Lack of focused leadership and governance like this certainly affects cohesive forward momentum that could lead to sweeping positive change.

Small-scale subsistence farming and land leases among smallholders and rural residents rarely compete with global stakeholders (Ávila-García & Sánchez, 2012; Vásquez-León, 2010). Globalization does not favor small-scale farming. Revenue from tourism dollars generates more money than maintaining sustainable food systems.

Therefore, political, cultural, and legislative consensus rarely shapes a socioeconomic framework of governance that effectively prioritizes all USVI citizens equitably.

Future Directions and Recommendations for Further Exploration

Opportunities linking agriculture and tourism could incentivize people to farm. Tourism continues to be the premier economic engine in the USVI. Key informants discussed novel programs that would vitalize local food systems and yield positive impacts: (a) develop value-added products; (b) redirect cruise-ship tourists away from the over-run port shopping districts toward farms and food adventures farther inland; and (c) increase farmers markets and food-focused events on the islands. In a post-pandemic world, these innovative strategies aimed at linking agriculture-related ventures and tourism could empower strong partnerships. In this way, tourists would gain a more meaningful island experience, and residents would benefit from increased exposure and income. In terms of future research, we see value in better understanding how to incentivize farmers and would-be farmers to participate in agriculture and business education programming offered by USDA NRCS, UVI Extension, and/or a new Agriculture Business Center. Perhaps as a precursor to this, working toward forming farmer networks and/or peer-to-peer training opportunities to share knowledge and expertise related to farming, technical and business skills, would be time and funding well spent.

Conclusion

Our research has illuminated the complex barriers affecting accessibility, affordability and sustainability within the US Virgin Islands' food system while also uncovering promising pathways to enhance agricultural and food system resilience. Understanding the historical context of forced labor in sugarcane agriculture, driven by global trade, is essential for developing a more sustainable and resilient food system in the USVI. This history underscores the significance of transforming agricultural work from a burdensome legacy to a source of pride and empowerment. The Rasta farmers in the Bordeaux region on St. Thomas,

who operate farm businesses on land where their ancestors once toiled, epitomize this shift.

Efforts to make agriculture more appealing to younger generations—through technology, tourism, and health-related fields—are gaining momentum in the USVI. The resilience of the local population and the emergence of a dynamic entrepreneurial spirit are evident in initiatives like Ridge to Reef Farm dinners on St. Croix, which elevate regional foods. This, coupled with a rise in documentary films, speaking panels, farmers markets, and educational events, highlights a growing interest in sustainable food systems and food security.

Challenges revealed by this study point to the need for a dual-focused approach: sustaining local agriculture while fostering meaningful connections with the tourism industry. The islands' food system is vulnerable to external factors such as hurricanes and economic fluctuations, which necessitates a strategy that strengthens local agriculture and enhances the tourism experience with authentic, locally sourced products.

The vibrant and ambitious spirit among islanders and newcomers presents a unique opportunity to bridge agriculture and tourism. This integration can safeguard the islands' food sovereignty while providing a more immersive and sustainable tourism experience. As policymakers move forward, aligning strategies to support local agriculture will be crucial in developing a resilient and integrated framework that nurtures both the land and the economy of the United States Virgin Islands.

Acknowledgments

The authors would like to thank our study participants, who gave willingly of their time and expertise and for trusting us with their ideas and insights. A special thank-you to our hosts while conducting research in the U.S. Virgin Islands, The Honorable Geoffrey and Ann Barnard. We thank the three anonymous JAFSCD reviewers who offered detailed and helpful feedback that certainly made the manuscript stronger. Any remaining errors belong to the authors.

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Formative assessment of community health center Food is Medicine programs during COVID-19 in Northern California

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Submitted May 16, 2024 / Revised September 3 and September 20, 2024 /
Accepted September 24, 2024 / Published online December 18, 2024

Citation: Moraga Franco, C., Kuyper, E., Engle-Stone, R. (2025). Formative assessment of community health center Food is Medicine programs during COVID-19 in Northern California. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 371–392.
<https://doi.org/10.5304/jafscd.2024.141.014>

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Abstract

The COVID-19 pandemic disrupted implementation of Food is Medicine (FIM) programs and imposed food security and healthcare-related hard-

ships. Understanding access to and experiences with FIM programs during crises and among diverse populations can help build resilience of

Disclosures

Edye Kuyper is employed as the Food and Wellness Manager at CommuniCare+Ole, the health center network where this research took place. All other authors have no disclosures to declare.

Funding Disclosure

This research was funded by the Henry A Jastro Research Award and the University of California Davis Clinical and Translational Science Center.

Acknowledgments

The authors would like to thank Alejandro Espinoza, Humberto Felix, and Alana Hroziencik for their time assisting with data collection, transcription, and coding. We would also like to thank Dr. Lauren Au for feedback and guidance on the interview guide. Lastly, we are deeply grateful to all the research participants for generously sharing their insights and experience.

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programs to future shocks. This formative, mixed-methods study aimed to (1) assess potential barriers and facilitators to access to health services during the COVID-19 pandemic, with emphasis on Food is Medicine (FIM) programs; and (2) understand the effects of the pandemic on healthcare access, food security, and related coping strategies among Federally Qualified Health Center (FQHC) clients. From December 2021 to September 2022, 19 interviews (10 in English, 9 in Spanish) were conducted with clients in Yolo County, CA, with close-ended and open-ended questions about their experiences for a pre-pandemic period (before March 2020) and a pandemic period (last 12 months). Qualitative analysis was conducted in NVivo and using the Framework Method. Major themes identified for Objective 1 were: (1) perceived benefits of FIM programs, including increased knowledge and skills and increased access to produce; (2) barriers to program participation, including client time constraints and limited program awareness; and (3) satisfaction with FQHC services. Themes identified for Objective 2 were: (1) changes in healthcare access, such as increased difficulty with access and healthcare cost, and the use of telehealth; (2) changes in food security, including economic barriers to purchasing quality food and the decreased quantity of food; and (3) use of federal and community resources to cope with difficulties. Our results suggest potential avenues to strengthen Food is Medicine programs, and highlight the role of FQHC programs, community resources, and social networks as coping strategies for food insecurity and decreased access to care.

Keywords

COVID-19, pandemic, food security, Food is Medicine, food systems, mixed-methods research, nutrition programs

Introduction and Literature Review

Non-communicable disease (NCD) is the leading cause of death worldwide; in 2019, over 2,500,000 deaths in the U.S. were due to NCDs (Hambleton et al., 2023); the four leading contributors were ischemic heart disease, lung cancer, chronic obstructive pulmonary disease, and stroke (GBD 2019 Diseases and Injuries Collaborators, 2020). In

the U.S., the NCD burden is greatest among food-insecure and low-income populations (French et al., 2019; Gundersen & Ziliak, 2015; Ritte et al., 2020). Food is Medicine (FIM) programs work to integrate food and nutrition interventions into the healthcare system for prevention and management of NCDs (Downer et al., 2020). Such programs include medically tailored meals and groceries, produce prescription programs, nutrition education, and culinary education. Several studies, including research involving randomized trials, have found that these programs are associated with positive behavior change, improved health outcomes, reduced healthcare costs, and improved food security (Berkowitz et al., 2019; Berkowitz et al., 2018; Cavanagh et al., 2017; Community Preventive Services Task Force, 2023; Ferrer et al., 2019; Gao et al., 2023; Palar et al., 2017; Seligman et al., 2015; Sharma et al., 2021; Trapl et al., 2018).

Federally Qualified Health Centers (FQHCs) are community-based healthcare providers that are uniquely situated to play a vital role in health and local food systems by implementing FIM programs that serve low-income groups. FQHCs receive funds from the Health Resources & Services Administration (HRSA) Health Center Program to provide comprehensive primary care services in underserved areas, offering services on a sliding fee scale for uninsured patients (HRSA, 2024). Previous literature on FIM programs implemented through FQHCs, including farmers' markets, financial incentives for fruits and vegetables, and produce prescriptions, has shown a positive effect on outcomes such as fruit and vegetable consumption and hemoglobin A1c among participants (Aiyer et al., 2019; Bryce et al., 2017; Freedman et al., 2013).

The COVID-19 pandemic imposed a dynamic succession of challenges, both on individuals and the healthcare sector, which may influence the implementation and impacts of FIM programs. These programs face an ongoing need to adapt to the needs and constraints of clients, which changed dramatically during the pandemic (Saxe-Custack et al., 2022; Stotz et al., 2022). In general, during the pandemic, households and individuals faced job loss, fear of exposure to the virus, reduced healthcare services, increased demand for food at home,

unavailability of food at stores, and increased concern and worries related to food access (Leddy et al., 2020; Niles et al., 2020; Wolfson & Leung, 2020). Coping strategies for such challenges included utilizing government programs and the charitable food sector, relying on friends and families, or making tradeoffs, such as eating less food or cutting back on other spending categories (Halverson & Karpyn, 2022; Kinsey et al., 2020; Leddy et al., 2020; Loth et al., 2023; Niles et al., 2020). Some of these strategies succeeded in buffering low food access among low-income and food-insecure people (Harper et al., 2022; Lee et al., 2022; Reimold et al., 2021). However, few studies have documented pandemic-related experiences of access to FIM programs, which theoretically could have mitigated pandemic effects on food insecurity and nutrition outcomes. One qualitative study, focused on families with children and conducted with a clinic-based, community-supported agriculture program, found that clients faced several challenges, including financial and shopping related difficulties, and that federal food assistance programs facilitated food access (Cullen et al., 2023). A study of a produce prescription program set in a large pediatric clinic during the pandemic (April–June 2020) reported that participants had several food access constraints, such as rising food costs and shortages, had to make food shopping adjustments, and experienced stress regarding food insecurity (Saxe-Custack et al., 2022).

Healthcare utilization data from FQHCs across the U.S. demonstrated precipitous drop in service volumes during March–May 2020 (Simon et al., 2021). FQHCs faced additional hardships, such as decreased resources and supplies and increases in client food insecurity (Abrams et al., 2020). The disruptions to health center operations, such as fluctuations in staffing and difficulty with predicting patient volume and participation in programs, also made it difficult to implement FIM programs. (Brown et al., 2020). Previous studies assessing impacts of the pandemic on FIM programs found that barriers to participation included fear of exposure to infection (Saxe-Custack et al., 2022), and that benefits from participation included promotion of healthy dietary habits, improved access to

high-quality foods, and alleviation of some barriers to accessing food and cooking (Zimmer et al., 2022).

While previous studies help to understand how the pandemic impacted individuals participating in FIM programs as well as FIM program operations, the available literature does not fully capture the breadth of program models or client populations. Most of the studies were conducted in partnership with or were set in large medical centers (Brown et al., 2020; Cullen et al., 2023; Saxe-Custack et al., 2022; Zimmer et al., 2022) and focused on families with children (Brown et al., 2020; Cullen et al., 2023; Saxe-Custack et al.). Studying FIM programs in different populations and settings, such as adults in FQHCs, allows researchers and practitioners to assess the generalizability of FIM programs across populations with different needs and priorities. It is important to understand how FIM programs implemented in FQHCs can meet the needs of those experiencing reduced food security and access to healthcare during crises, and to guide efforts to build resilience of these programs to future economic or social shocks. This formative, mixed-methods study aimed to 1) assess potential barriers and facilitators to access to FQHC services, with emphasis on FQHC FIM programs; and 2) understand the effects of the pandemic on healthcare access, food security, and coping strategies among FQHC clients.

Research Methods

Study Site

CommuniCare+OLE (CC+OLE) is a network of community health centers designated as both FQHCs and Migrant Health Centers in Yolo, Napa, and Solano counties, California (CommuniCare Health Centers [CCHC], n.d.). CC+OLE operates FIM activities in Yolo County that emphasize growing, sharing, cooking and enjoying local food to address diet-related disease and loneliness. FIM programs include managing an onsite garden where staff and clients produce food and which also serves as an outdoor space for appointments and classes. Program activities include produce distribution from the garden, and other sources such as local farms, and culinary

education. In 2019, CC+OLE conducted a total of 132,632 patient visits and served 24,187 patients across their three comprehensive health centers; during the first year of the pandemic (2020), totals dropped to 118,274 visits and 22,196 patients (CCHC, 2020; CCHC, 2021). The health centers were able to quickly transfer to telehealth services, and also shifted operations of their FIM programs. Group Medical Visits for patients with diabetes that included produce distribution were paused from the onset of the pandemic. Group visits resumed in 2022, but garden produce continued to be available in clinic waiting areas during the pandemic, distributed in accordance with health and safety recommendations on a table in one clinic waiting room. Culinary education was offered virtually; patients retrieved ingredients prior to classes from their respective clinics and cooked along with instructors via Zoom.

Participant Selection

We used a mixed-methods approach to capture experiences and perspectives from a convenience sample of clients accessing services at CC+OLE. Advertising was conducted through flyers posted in the clinic, as well as by program staff administering other services. Interested individuals shared their contact information with study personnel, who reached out to schedule interviews. Participants were eligible if they were at least 18 years old, accessing services at CC+OLE, residing in California, provided oral consent, and were able to respond to questions in English or Spanish. Ethical approval was obtained from the UC Davis Institutional Review Board.

Data Collection

This cross-sectional study was conducted using a semi-structured interview script, which included a pre-coded survey questionnaire as well as open-ended questions. Data collection for each participant was conducted in a single session of approximately one hour. Recruitment and interviews took place December 2021–September 2022. The interview script was developed using a combination of previously validated questionnaires and questions developed for this study in coordination with CC+OLE.

At the beginning of the interview, participants answered questions about the types of services (e.g., produce distribution, culinary education) and the frequency with which they had accessed these services through the clinic. Participants were asked to rate their satisfaction with the programs on a scale of 1–5, 1 being “not satisfied at all” and 5 being “extremely satisfied.” These were followed by open-ended questions regarding perceived potential benefits of the program and barriers to participation. Prompts were program-specific; for example, patients who participated in produce distribution were asked open-ended questions about whether and how the types of foods they ate had changed, and culinary education participants were asked to reflect on new skills or knowledge they may have gained. If clients participated in a different type of program, identified as “other,” they were also asked about perceived benefits and barriers, and about connections with other participants. “Other” programs included substance use/behavioral health programs and one-on-one diabetes education. While these programs are not part of traditionally recognized FIM approaches, the patients in diabetes education programs are a target population for FIM program activities and patients in the substance use/behavioral health programs received access to garden produce in behavioral health clinics; however, they primarily attended the clinic for behavioral health programs. All participants responded to a demographics questionnaire and answered questions related to food security, access to healthcare, coping strategies, employment, transportation, food and nutrition related behaviors, social isolation and social networks, as well as a medical questionnaire. These questions were intended to provide descriptive information about the participants and their pandemic experiences.

Food security was assessed for two 1-year time periods: a pre-pandemic period and a pandemic period. The pandemic period was assessed using the USDA Six-item Short Form Food Security Survey Module, which asks participants to reflect on the past 12 months (U.S. Department of Agriculture Economic Research Service [USDA ERS], 2022). Interviews occurred during a nine-month period, so the calendar months corresponding to

the pandemic period (“the last 12 months”) ranged from December 2020–December 2021 to September 2021–September 2022, depending on the date on which the interview occurred. The questionnaire included identical questions for the pre-pandemic period, in which the reference time frame was “in the year before the COVID-19 outbreak” (before March 2020); for example: “In the year before the COVID-19 Outbreak (from April 2019 to March 2020), the food that my household bought just didn’t last and I/we didn’t have money to get more.” Participants were also asked open-ended questions about food security, prompting them to reflect on changes in the quantity and quality of food that they were able to obtain during the specified time period.

Healthcare access was also queried separately for the two time periods (e.g., “In the year before the COVID-19 outbreak [from April 2019 to March 2020], when did you have health insurance?”), in addition to questions on the use of food assistance (charitable food sector, CalFresh, WIC, school meal program, unemployment, or other), or other food security-related coping mechanisms (reliance on friends, family outside the household, church or faith group, CC+OLE or other clinic, or other). Questions on employment status, which assessed participant current employment and income and wage status, also assessed the number of months employed and number of employers for the two time periods. Each of these sections also included open-ended questions to explore participant experiences not captured by the close-ended questions. Participants were asked to report nutrition-related behaviors using the Food Behavior Checklist (e.g., typical beverage consumption, typical fruit and vegetable consumption) (Townsend et al., 2006), and a health and medical history section (e.g., any previous diagnoses, medications used, health coverage).

Because one potential additional benefit of FIM programs is to address social isolation (Wright et al., 2015), which is associated with poor health outcomes and increased food insecurity (Barnes et al., 2022; Burris et al., 2019; Wang & Bishop, 2019), we also assessed social isolation and social networks. The Berkman-Syme Social Network Index (SNI) was used to measure social connected-

ness (e.g., contacts with friends and relatives, memberships in groups) (Berkman & Syme, 1979), and the PROMIS Social Isolation Short Form 8a was used to measure social isolation (e.g., feelings of loneliness, feelings of connectedness) (Cella et al., 2010).

The interview was piloted with three FQHC clients, two in English and one in Spanish, then refined and updated before data collection began. A bilingual interviewer (CMF), who also served as the study coordinator and had no previous relationship with participants, conducted the interviews (ten in English, nine in Spanish). Interviews were conducted remotely by phone or Zoom and lasted 45–60 min. Before data collection began, the study procedures were described and the consent form was read to the participant who was given a chance to ask any questions before giving oral consent.

Audio recordings of the interviews were translated when appropriate and transcribed by the study coordinator and three research assistants. The study coordinator reviewed all translations and transcriptions, and the audio recordings were used to resolve any discrepancies. The transcribed interviews and interview guide were used to develop an initial codebook.

Data Analysis

Descriptive statistics were calculated for pre-coded survey questions. Due to the small sample size, we did not perform hypothesis testing on the quantitative data. Thematic analysis of open-ended questions was conducted with the Framework Method, a common methodology in health-related qualitative research to analyze data from semi-structured interviews (Gale et al., 2013). The Framework Method allows for themes and codes to be derived before analysis, utilizing the interview script, as well as throughout the analytic process, as new themes emerge from the interviews. The data were coded and reduced through a data matrix. Two researchers (the study coordinator and a trained undergraduate assistant) read the first five interview transcripts in their entirety and then used the codebook to independently code each one. An intercoder reliability score (ICR) was calculated for each segment of the transcript. Segments with poor agreement

(less than 80% agreement, or Kappa < 0.7) were discussed and revised to reach consistency in the codebook. The remaining 14 transcripts that were not coded in tandem were coded by the study coordinator, using the codebook that was developed by the initial two coders. Data saturation was assessed by comparing the number of codes developed in the initial five interviews to the number of additional codes generated from each set of two additional interviews; thematic analysis was halted once saturation was reached (i.e., no new meaningful codes were generated). All coding and subsequent thematic analysis was conducted using NVivo.

Results

Participant Characteristics

Twenty-six clinic clients shared contact information with the research team. One declined to participate, 3 could not be reached after several attempts, and 3 scheduled a data collection appointment but later could not be reached or declined to participate. For the remaining 19 participants, all data collection was completed with the exception of 1 participant who was not able to complete the full session and had missing data for the food behavior checklist, social isolation/ networks, and medical history.

A majority of the participants were female (14, 74%) and Hispanic (14, 74%), with an average age of 47.8 ± 13.1 years; just over half (10, 53%) had education beyond high school (Table 1). Diabetes was self-reported in 9 (50%) of the participants who answered the medical history section, and hypertension and high blood cholesterol were also commonly reported (Appendix, Table A1). Ten participants (56%) participants self-reported “Fair” health and eight (44%) scored low on the Social Network Index score, indicating high levels of social isolation. Participants self-reported an average of 2 servings per day for fruits and 2 servings per day for vegetables (Appendix, Table A2), close to the 4.5 cup equivalents per day of fruit and vegetable recommendations for a 2,000-calorie diet (USDA & U.S. Department of Health and Human Services, 2020). On the

Food Behavior Checklist, 13 (72%) reported consuming fruit drinks, sport drinks, or punch never or less than 1 time a week and 9 (50%) reported consuming regular soda or energy drinks never or less than 1 time a week. At the time of analysis, 16 participants (84%) were classified as food insecure.

Thematic Analysis

Table 2 summarizes the major themes identified for each of the two objectives, along with their corresponding subthemes and with exemplary quotes. Each theme is further discussed in the following sections.

Table 1. Participant Demographic and Socioeconomic Characteristics

Participant Characteristics (N = 19)	Mean $\pm$ SD
Age (year)	47.8 $\pm$ 13.1 (range: 32-80)
Household Size (number of people)	3.1 $\pm$ 1.5
N (%)	
Gender	
Male	5 (26%)
Female	14 (74%)
Interview Language	
English	10 (53%)
Spanish	9 (47%)
Ethnicity	
Hispanic	14 (74%)
Non-Hispanic	5 (26%)
Education	
Less than high school	5 (26%)
High school equivalent	4 (21%)
Some college	6 (32%)
4 year college degree or more	4 (21%)
Income (Yearly; US\$)	
\$10,000–\$20,000	7 (37%)
\$20,000–\$30,000	5 (26%)
\$30,000–\$40,000	3 (16%)
More than \$40,000	3 (16%)
Refused/I don't know	1 (5%)

Table 2. Interview Themes, Subthemes, and Exemplary Quotes, by Study Objective

Themes	Subthemes	Exemplary Quotes
Experiences with Food is Medicine programs		
Satisfaction and benefits with FIM program activities	Increase in knowledge and skills from participation in culinary education	“The cooking classes ... teach you how to cook, without so much fat, with more natural things, like olive oil and everything, which isn’t as harmful for you. And the people that do the cooking classes are kind and you can tell that they know what they are doing and teaching us.” – Female, 56, Produce distribution and culinary education participant “I really liked them very a lot, I felt that we learned a lot, and also that they gave us fruits there and I had something in my garden, and got to share with others, or things that helped us. We were always sharing recipes or things that we did not know if they were good, or not good but not harmful for our health, and because the person who helped us would tell us things like it’s okay but it has a lot of this, this has too many carbohydrates or things like that, and that made it a good program for me.” – Female, 49, Produce distribution participant
	Positive interactions with staff	“The people from the group medical visits, the doctors...explain to you, what benefits you and helps you, how to eat, how to measure your glucose and all that. And the doctors speak the language that we speak, which is better for my mother, she speaks Spanish.” – Female, 56, Produce distribution and culinary education participant “[The educator] is pretty organized, she has different...resources available...starting with fundamental education around diabetes and really being able to adapt to whatever my questions are and my gaps in learning are to help me contextualize it to make the necessary changes to be healthier. “ – Male, 43, 1–1 Diabetes education participant
	Increased access to quality food	“I watch people out there gardening. You see them out there working just enjoying what they’re doing and they’re giving you food and it’s good food and it’s healthy, it’s not sprayed with pesticides and stuff. You can actually pick it off the vine and eat it and not be worried that you’re going to get sick from something that they sprayed on a crop.” – Female, 51, Produce distribution participant “I’ve gotten more products from here locally, such as more organic [foods]” – Female, 37, Produce distribution participant
Barriers to FIM program participation	Client time constraints	“Right now, I don’t go even though I like the classes very much, but it’s complicated since I have work during the week. I couldn’t take my mom nor go myself anymore, well since it benefits both of us.” – Female, 56, Produce distribution and culinary education participant
	Limited program awareness among clients	“The thing about it was that they have it like in a little table and they advertise the garden program on the little piece of paper so I wasn’t sure if that was just like for the advertisement or that we can actually grab the produce and so that wasn’t clarified and then I saw other people grab it and I was like oh okay it’s okay to take it.” – Female, 51, Produce distribution participant

		“Oh well if there was more information...because sometimes you don’t know what programs exist or which programs you could do, and then sometimes you find out and the program has already passed. ... It would be good to publish them a little more, on Facebook, or sometimes in the community clinic, so that we can have access to more of this, more of the things that could help us in the community.” –Female, 37, Produce distribution and culinary education participant
Satisfaction with FQHC	The FQHC was a well-received source of care	“I feel that when I have needed them, they have always helped, and during the pandemic I understand that sometimes things couldn’t be done, unless they were urgent.” –Female, 49, Produce distribution participant
		“I don’t think they could do any better than what they’re doing. I honestly don’t. I mean I’ve seen them and I know that there’s some challenges for them, with the covid.” –Female, 51, Produce distribution participant
Impact of the COVID-19 pandemic and related coping strategies		
Pandemic related changes with healthcare access	Decreased access to healthcare services	“Before I was able to access health services whenever I wanted, for whatever reason I wanted...but afterwards it was like pulling teeth to get an appointment. Oh, it’s not that serious, it’s not life-threatening, it can wait. I felt like I was used to a certain standard of living, where like I if I had issues, I could ... have them seen, but I didn’t feel like that was the same.” – Female, 36, Produce distribution participant
	Experiences with the shift to telehealth	“The good thing is that they had this tele-health thing, we were able to do zoom calls and telephone. So that was good and that increased so with my doctor, the behavioral therapist, and somebody else [sic].” –Male, 67, Produce distribution participant
		“Well I had to get Wi-Fi, so ... I just got into some situation where they’re cutting down price, but I had to pay for that, that was an extra expense. I had to keep going ‘this is too much’ so sometimes they would give me a coupon but now it’s getting better.” –Male, 67, Produce distribution participant
Pandemic related changes with food security	Economic barriers to purchasing quality food	“Well, you can no longer eat what you want, you eat what you can afford.” –Female, 64, Produce distribution participant
		“The truth is that one would like to eat better but everything is expensive, expensive, expensive. You can’t buy what you really should to be able to be healthy. ... You go with [whatever is] cheaper because you have to eat.” –Female, 56, Produce distribution and culinary education participant
	Decreased quantity of food	“I would have to just eat [smaller], eat small portions of food to make it last during the week or during the month so I have extra. Or usually sometimes I only eat like two meals a day.” –Male, 57, Culinary education participant
Use of federal and community resources as	Greater utilization of the charitable food sector	“We’re getting food from the food bank, a lot more of it too...and it’s good food and it’s fresh food and it’s you know, a blessing.” –Female, 51, Produce distribution participant

coping strategies	Greater use of federal programs (WIC, school food programs)	"If it weren't for CalFresh or WIC, then we would not have that extra funds to buy the meals. So CalFresh is helping us to buy food and with WIC, that helps with milk, juices, things like that. WIC offers cheese ... well everything, it's all been a big help." –Female, 37, Produce distribution and culinary education participant
	Higher reliance on social networks	"Among the family, we all support each other and if one is out of work well, the others help him, and so, right. And if someone gets sick and doesn't work, then we all cooperate. In our family I don't think there was that much...since we are together, I don't think we were short of food, right. And since we all pay the bills and everything, I think it benefits us. But if we had been alone...oy, no, we would have been on the street I think." –Female, 64, Produce distribution participant "Church and my friends help emotionally, when I don't have [money or food], I feel bad, I feel stressed, and I feel nervous about what's going to happen. Well, I try to talk about it and they listen to me, and that makes me feel good." –Female, 39, Culinary education and produce distribution participant
	Difficulty managing chronic disease with foodbank food	"Some of the stuff at the food bank, they're not diabetic friendly...so whatever I could use from the food bank I would use it but I gotta stay away from carbs...a lot of the bread and pasta and the stuff that will make my sugar go up." –Male, 57, Culinary education Participant

Experiences with FQHC Food is Medicine Programs

Satisfaction and benefits with Food is Medicine programs

The interviews focused on FIM programs such as produce distribution (used by nine participants) and culinary education (used by six), but five participants reported use of “other programs.” Five participants were involved in more than one program, including two participants in “other programs.” Average program scores ranged 4.2–4.7 on a 1–5 scale (Table 3).

Table 3. Use and Rating of CC+OLE Programs

Use of CC+OLE Programs	Mean ± SD
CC+OLE Program Participants ^a	N (%)
Produce Distribution	9 (47%)
Culinary education	6 (32%)
Other	5 (26%)
Program Rating (0-5) ^b	
Produce Distribution	4.2 ± 1.1
Culinary education	4.6 ± 0.5
Other	4.7 ± 0.7

^a. Participants may use more than one program

^b. Participants were asked: “If you are/were involved with any of the previously mentioned programs: how satisfied are you with them, on a scale from 1 to 5, with 1 being ‘not satisfied at all’ and 5 being ‘extremely satisfied?’” and were then asked to rate each program they participated in.

Reported benefits of FIM programs that emerged through the qualitative analysis included increase in knowledge and skills from participation in culinary education, such as learning how to cook with different types of vegetables or learning about nutritional qualities of foods, as well as positive interactions with staff, such as working with kind and knowledgeable staff. Through food distribution programs, participants shared that they had increased access to quality food, such as organic, locally grown produce. Several participants described the food they obtained with terminology such as “fresh,” “natural,” “organic,” “healthy,” and “pesticide free,” suggesting confidence that the food was of high quality.

Barriers to Food is Medicine program participation

Two main barriers to program participation emerged from thematic analysis: client time constraints and limited program awareness among clients. Some clients share that the times when programs and classes were offered did not work for them, or that it was hard to participate in programs while working. A few participants commented on not having enough information about programs, or not being aware of programs in general.

Satisfaction with Federally Qualified Health Center services

Another theme that emerged is that in times of need, the FQHC was an overall well-received source of care, apart from the FIM programs. Patients understood that resources and time were limited during the pandemic, and they were happy with the care they received.

Impact of the COVID-19 Pandemic and Related Coping Strategies

Changes with healthcare access

While we did not conduct statistical testing, due to the small sample size, survey responses on healthcare access were consistent with the general problem of reduced healthcare access and utilization during the pandemic. For example, 16 participants reported being able to access healthcare “whenever I needed to” pre-pandemic, whereas nine reported the same response for the pandemic period (Appendix, Table A3). Similarly, for the pre-pandemic period, 12 participants reported having health insurance “all of the time” and 3 participants reported that it was “difficult or very difficult” to pay for medical bills; however, in the pandemic period, 8 participants reported having health insurance “all of the time” and 7 participants reported that it was “difficult or very difficult” to pay for medical bills. Subthemes that emerged involving changes in healthcare access include decreased access to healthcare services and experiences with the shift to telehealth. Participants recalled putting off healthcare for economic reasons or due to fear of exposure to the virus. Some participants mentioned issues with medication and supply chain shortages, and others mentioned reduced staff and services at

the clinic as a barrier to healthcare. However, participants also acknowledged telemedicine as a form of healthcare continuation. While most participants shared that telemedicine was an accessible way to receive care, some mentioned having to pay for internet as a barrier.

Changes with food security

Descriptive results were consistent with less food security in the pandemic period compared to the pre-pandemic period, with 3 participants classified as food secure in the pandemic period, compared to 8 in the pre-pandemic period (Table 4). Sub-themes related to changes in food security during COVID-19 included economic barriers to purchasing quality food and decreased quantity of food. Economic barriers cited often included high food prices, although participants also shared experiences related to job loss and food shortages. Several participants shared that they sought cheaper foods, or foods available through special deals.

Use of federal and community resources

Accompanying challenges to healthcare access and food security, participants also reported using more federal and community resources and relying more on social networks as coping strategies. Participants responses were consistent with greater utilization overall of federal programs, such as WIC and school meal programs, during the pandemic period, both in the close-ended questions (Table 4) and in open-ended questions, although program utilization varied by participant. Use of the charitable food sector was reported by 4 participants pre-pandemic and 9 participants during the pandemic (Table 4), and many participants described receiving food from the charitable food sector, predominantly the Yolo Food Bank. However, of 5 diabetic participants who received food from the food bank, 2 commented on the quality

of the food, such as too much packaged and canned food or high glycemic foods, which made it difficult to manage diabetes.

Reliance on all forms of social networks assessed, including friends, family outside of the household, church or faith group, or the CC+OLE clinic, appeared to be greater in the pandemic period than pre-pandemic (Table 4). While a few participants mentioned receiving food or financial assistance from their social networks, several also indicated relying on their friends/family/faith groups for emotional support.

Information on changes that could affect access to food and healthcare, such as in transportation and employment from the pre-pandemic period to pandemic was also sought. Participant responses were consistent with reduced employment during the pandemic (an average of six months of employment in the pre-pandemic year and four

Table 4. Reported Experiences with Food Security and Related Coping Strategies in Pre-Pandemic and Pandemic Periods^a

N = 19	Pre-Pandemic	Pandemic
	N (%)	N (%)
Food Security		
Food secure	8 (42%)	3 (16%)
Low food security (Food insecure)	9 (47%)	11 (58%)
Very low food security (Food insecure)	2 (11%)	5 (26%)
Resources Used		
Charitable food sector (Food bank/pantry)	4 (21%)	9 (47%)
CalFresh/food stamps	5 (26%)	3 (16%)
WIC	1 (5%)	3 (16%)
School meal program ^b	3 (16%)	6 (32%)
Unemployment benefits	1 (5%)	1 (5%)
None	12 (63%)	6 (32%)
Social Networks Used		
Friends	3 (16%)	6 (32%)
Family outside the household	3 (16%)	6 (32%)
Church or faith group	2 (11%)	5 (26%)
CC+OLE clinic	5 (26%)	8 (42%)
None	9 (47%)	5 (26%)

^a All numbers are presented for descriptive purposes; no statistical testing was done.

^b Two participants considered P-EBT, a pandemic EBT for school-age children, as a "school meal program," aside from meals given from schools.

months in the pandemic year), but reported methods of transportation were similar in the two time periods (Appendix, Table A4). Some participants described using their car less because of economic reasons, such as high gasoline prices or putting their car at risk of damage/need of repair. Participants also described decreased income, decreased work hours, and job loss during the pandemic, or having to implement social distancing and COVID-19 safety procedures at work.

Discussion

With this formative study, we sought to assess barriers and facilitators to participating in FIM programs among participants at a Federally Qualified Health Center. Additionally, we described participant experiences with healthcare access, food security, and related coping strategies during the pandemic. In the context of expanding the literature on FIM programs and on effects of the pandemic, this study is unique in exploring these themes together among FIM clients in a Federally Qualified Health Center. Major themes identified as barriers or facilitators to FIM program participation included satisfaction and perceived benefits of programs, including knowledge and skills and increased access to produce; and specific barriers to program participation, such as lack of information about the program and participant time constraints. Additionally, individuals expressed satisfaction with FQHC services generally, suggesting the importance of the institutional environment in which the program operates and the opportunity for connecting individuals to local food systems and additional resources in a trusted setting. Major themes related to the pandemic included changes in healthcare access, such as decreased access to healthcare and experiences with shifting to telehealth; changes in food security, including economic barriers to purchasing quality food and decreased quantity of food; and greater use of federal and community resources. In a time of increased food insecurity and decreased access to care during the pandemic, individuals relied on an intricate network of coping strategies, including federal and community resources, personal strategies and networks, and, for this client population, FIM programs. Recognizing how FIM programs

are nested within this complex network is crucial for optimizing their effectiveness: a broader understanding of participant experiences, needs, and resources can guide efforts to provide more comprehensive support that complements other resources.

Our findings support previous literature on potential benefits of FIM programs, including increased access to fresh produce for participants (Aiyer et al., 2019; Freedman et al., 2013; Tester & Leak, 2021; Trapl et al., 2018) and improved knowledge and skills through culinary education (Sharma et al., 2021). Additionally, participants perceived the food that they received to be of high quality, important to fostering positive behavior change and trust in the organization. Another potential benefit of FIM programs is providing outlets to alleviate social isolation through group engagement and community-building efforts such as community gardens. While some participants commented on the social aspects, social interaction as a benefit did not arise as a theme in our analysis, possibly because many program operations were conducted online during the time period examined. However, 8 of the 18 participants who answered the social network section had a Social Network Score of 0 or 1, the most isolated groups, suggesting that social isolation is an important consideration for this population.

Our findings regarding barriers to program participation also highlight potential avenues for improving FIM programs, such as increased outreach and advertising, and more flexible program offerings, particularly with regard to scheduling. Other studies have suggested that more health information and more culturally diverse recipes should be included in produce prescription programs (Zimmer et al., 2022). Additionally, incorporating social determinants of health and food security screeners into standard medical care, increasing funding for piloting programs, and providing patients with resources to alleviate barriers such as transportation could further improve FIM programs (Stotz et al., 2022). Several studies have also highlighted the importance of clinician and practitioner involvement for the success of FIM programs (DePuccio et al., 2022; Mozaffarian et al., 2024; McWhorter et al., 2023; Stotz et al., 2022), to

help screen and identify patients, as well as provide referrals and promote FIM initiatives and food-related support. However, involvement requires training, support, and engagement of healthcare staff, which may be challenging in the face of competing demands.

The results of this study and related literature suggest several specific recommendations to successfully implement food-related programs in primary care settings. While these are tailored to the CC+OLE program offerings, the underlying principles are relevant for programs with similar goals and approach, even if specific activities differ.

Communication and outreach:

- Work with clinic staff to actively promote the programs during patient visits and also provide information on community and federal resources.
- For produce distribution programs, add signage next to the fresh produce offered in the waiting areas informing patients they can take the produce bags; include pamphlets such as produce "info sheets" and recipes in multiple languages and that are culturally relevant.
- For all programs, ensure visibility of flyers and pamphlets in the clinic waiting areas and promote program information and opportunities for involvement through other channels, such as email newsletters or social media.
- Explore the use of food security screeners in primary care visits and implement a resource referral program that connects patients to resources and to onsite FIM programs.

Flexible scheduling:

- Offer multiple session times or after hours options for patients with varying work hours.
- Provide recordings of virtual sessions or online resources for patients who are unable to attend in-person sessions.

The preliminary findings of this formative research were used by CC+OLE to strengthen programs and provide patients with more information on resources to further integrate FIM initiatives with primary care. CC+OLE FIM programming has expanded to include a USDA Gus Schu-

macher Nutrition Incentive Program (GusNIP)-funded Produce Prescription Program, two additional health center-based gardens, and further integration of care with FIM activities. Regular staff-focused culinary education and gardening activities engage frontline healthcare workers, supporting staff wellbeing and equipping them to promote resources for patients with whom they interact. Improved signage has been added to produce distribution locations, and tours familiarize patients with the gardens. Multiple group medical visits have been added at a variety of times and days of the week. Progress is incremental, and reflection is essential to developing the programs in ways that will lead to successful integration of care with FIM programs.

It is important to consider our findings in the context of other changes occurring within the healthcare system during the pandemic and at the FQHC where our study was conducted. During the pandemic, health centers saw decreases in supplies, materials and staff, reductions in use of services; individuals faced challenges such as fear of contagion, and economic and technological barriers (Pujolar et al., 2022). In this study, while participants indicated increased difficulty with accessing healthcare, several expressed that they acknowledged the additional barriers that the clinic was facing and were happy with the care that they received. Participants' overall positive perception of the health centers may suggest that FQHCs are trusted safety net institutions, and can therefore be valuable partners in improving access to locally grown produce.

In our study, FIM programs served individuals during a critical time of increased food insecurity and reduced access to healthcare. In accordance with previous literature, participants in this study faced challenges as job loss, reduced healthcare services, and decreases in food security (Leddy et al., 2020; Niles et al., 2020; Wolfson & Leung, 2020). Participants utilized a variety of coping strategies which have also been previously documented, including utilizing resources from the charitable food sector and government programs, relying on social networks for support, or buying different and cheaper foods (Halverson & Karpyn, 2022; Kinsey et al., 2020; Niles et al., 2020).

Consistent with previous studies, it was determined that federal expansion of food assistance programs during the pandemic, such as SNAP, WIC, and Pandemic-Electronic Benefit Transfer (P-EBT), assisted families with food attainment (Cadenhead et al., 2022). Interestingly, we observed less reported SNAP participation (not including P-EBT) during the pandemic in our sample. While this decrease in SNAP participation was observed in other studies conducted early in the pandemic among vulnerable groups (Harper et al., 2022), this was reported by only 2 participants in our study and is not necessarily indicative of trends in other healthcare settings or in the U.S. in general (Toossi et al., 2022). In our study, reported WIC participation was higher during the pandemic period, consistent with federal level estimates and other studies regarding children's participation (Fang et al., 2022; Toossi et al., 2022). Qualitative studies have reported that WIC fruit and vegetable allotments increased WIC purchasing and consumption of fruits and vegetables, increased shopping frequency, and enhanced their dietary variety (Halverson & Karpyn, 2022). While it is difficult to assess how an expansion of food benefit programs affected food security status in our population, it is possible that without the expansion there would have been more instances of very low food security. Participants shared that federal programs helped alleviate food-related needs. However, given the recent end to emergency federal food assistance allotments, intended as a temporary strategy to combat food insecurity (Rosenbaum et al., 2023), it is important to consider how community food security programs, including FIM interventions, and other resources may help fill a critical gap introduced by a decrease in benefits.

Utilization of the charitable food sector (food banks and food pantries) during the pandemic increased among our participants, as seen in other studies (Harper et al., 2022; Reimold et al., 2021). According to the USDA Economic Research Service (Coleman-Jensen & Rabbitt, 2021), 6.7% of U.S. households reported using a food pantry in 2020, an increase from 4.4% in 2019. A study conducted in Vermont found that use of food banks and food pantries helped participants maintain fruit and vegetable intake during the pandemic (Bert-

mann et al., 2021). In our study, several participants expressed being able to meet their food needs through food banks and food pantries. However, we noted that some participants with diabetes commented that the quality of food bank food made it difficult to manage their disease, with much of their food from the food bank consisting of canned and prepackaged items. Previous studies have also found lower food bank food satisfaction among those with chronic disease or desire for more fruits and vegetables among food bank participants managing chronic disease (Remley et al., 2019; Short et al., 2022).

Limitations of this research include the small sample size, which limits statistical testing of survey data, and the convenience sampling method, which limits our ability to generalize to the total client population. Recall bias or social desirability bias may have impacted responses; we aimed to mitigate social desirability bias by having interviews conducted by staff not affiliated with CC+OLE. A strength of this study is the in-depth nature of the interviews, allowing us to better understand participants' perspectives and solicit suggestions for improving programs and program access. Further research may test the effectiveness of specific program changes on participants' experiences and health outcomes, or explore resilience to other types of challenges and shocks.

Conclusion

In summary, this study provides insight into FIM programs conducted in FQHCs during the pandemic, and how program participant experiences were impacted by the COVID-19 pandemic. FIM programs have the potential to benefit participants through access to produce and culinary education, and increased advertising and flexible program offerings may increase program reach. Our study highlights the complex interplay between various sectors and resources, including personal strategies and networks, federal and community resources, and healthcare settings, that helped individuals combat pandemic-related challenges with healthcare and food security. Understanding the role of FIM programs among other resources that community members rely on may help programs to better meet the needs of clients. Continued support

and funding are needed both to pilot FIM programs and to learn how to better implement programs among diverse populations, maintain FQHC

services, and increase multi-sectoral collaboration to support health and food security in low-income populations.



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Appendix

Table A1. Participant Health Characteristics

Participant Characteristics (N = 18)	Mean ± SD
Social Isolation ^a	49.5 ± 9.4
Self-Rated Health	
Poor	0 (0%)
Fair	10 (56%)
Good	6 (33%)
Excellent	2 (11%)
Diagnosed Health Conditions (based on participant report) ^b	
Diabetes	9 (50%)
Hypertension	6 (33%)
High blood cholesterol	7 (39%)
Heart disease	0 (0%)
Stroke or cerebral vascular incident	2 (11%)
Cancer	0 (0%)
Other	9 (50%)
None	6 (33%)
Social Network Index Score	
0/1 (most isolated)	8 (44%)
2	5 (28%)
3	4 (22%)
4 (not isolated)	1 (6%)

^aA score of 50 is the average for the United States general population with a standard deviation of 10. A higher PROMIS T-score represents more of the concept being measured.

^bParticipants could have multiple conditions

Table A2. Food Behavior Checklist

Food Behavior Checklist (N = 18)		Mean ± SD
How many servings of fruit do you eat per day?		2.1 ± 1.1
How many servings of vegetables do you eat per day?		2.0 ± 0.8
How would you rate your eating habits? (with 1 being poor and 10 being excellent)		6.1 ± 2.1
		N (%)
How often do you drink fruit drinks, sport drinks, or punch?	Never or less than 1 time a week	13 (72%)
	1–3 times a week	4 (22%)
	4–6 times a week	1 (6%)
	1 time per day	0 (0%)
	2+ times per day	0 (0%)
About how much do you drink each time?	8 oz. (1 cup) or less	16 (89%)
	12 oz. (1 normal can)	2 (11%)
	20 oz. or more	0 (0%)
How often do you drink regular soda or energy drinks?	Never or less than 1 time a week	9 (50%)
	1–3 times a week	4 (22%)
	4–6 times a week	1 (6%)
	1 time per day	2 (11%)
	2+ times per day	2 (11%)
About how much do you drink each time?	8 oz. (1 cup) or less	10 (56%)
	12 oz. (1 normal can)	8 (44%)
	20 oz. or more	0 (0%)
Do you eat more than one kind of fruit per day?	No	6 (33%)
	Yes, sometimes	7 (39%)
	Yes, often	3 (17%)
	Yes, everyday	2 (11%)
Do you eat more than one kind of vegetable per day?	No	1 (6%)
	Yes, sometimes	6 (33%)
	Yes, often	7 (39%)
	Yes, everyday	4 (22%)

Table A3. Reported Experiences with Access to Healthcare in Pre-pandemic and Pandemic Periods

Access to Healthcare (N = 19)		Pre-Pandemic	Pandemic
		N (%)	N (%)
How often were you able to get healthcare when you needed it? (able to visit a clinic/physician/dentist/etc)	Not at all	0 (0%)	0 (0%)
	Only sometimes	0 (0%)	6 (32%)
	Most of the time	3 (16%)	4 (21%)
	Whenever I needed to	16 (84%)	9 (47%)
How often were you able access to services at CC+OLE Health Centers when you needed it? (able to visit a clinic/physician/dentist /etc. or participate in a program)	Not at all	0 (0%)	0 (0%)
	Only sometimes	1 (5%)	6 (32%)
	Most of the time	0 (0%)	2 (11%)
	Whenever I needed to	15 (79%)	10 (53%)
	Refused/I don't know	3 (16%)	1 (5%)
During this time period, when did you have health insurance?	All of the time	12 (63%)	8 (42%)
	Some of the time	2 (11%)	4 (21%)
	None of the time	5 (26%)	7 (37%)
How hard was it/has it been for you to pay for medical bills?	Not at all difficult	7 (37%)	6 (32%)
	Not very difficult	4 (21%)	4 (21%)
	Somewhat difficult	5 (26%)	2 (11%)
	Difficult	1 (5%)	4 (21%)
	Very difficult	2 (11%)	3 (16%)
How hard was it/has it been for you to pay for medication?	Not at all difficult	9 (47%)	7 (37%)
	Not very difficult	2 (11%)	1 (5%)
	Somewhat difficult	6 (32%)	3 (16%)
	Difficult	2 (11%)	4 (21%)
	Very difficult	0 (0%)	4 (21%)

Table A4. Reported Experiences with Employment and Transportation in Pre-pandemic and Pandemic Periods

<i>N</i> = 19	Pre-Pandemic	Pandemic
	Mean $\pm$ SD	Mean $\pm$ SD
Employment		
Months employed ^a	6.3 $\pm$ 5.8	4.2 $\pm$ 5.5
Number of employers	1.1 $\pm$ 1.3	0.9 $\pm$ 1.0
	<i>N</i> (%)	<i>N</i> (%)
Employed	11 (59%)	7 (37%)
Transportation ^b		
Bus or other public transport	2 (11%)	3 (16%)
Own vehicle	17 (89%)	16 (84%)
Ride from friend/family/neighbor	2 (11%)	4 (21%)
Ride from taxi or app like Lyft/Uber	2 (11%)	2 (11%)
Some brings food to me (delivery service or friend/family member)	1 (5%)	3 (16%)
Walk or bike	5 (26%)	7 (37%)

^a. Months employed and number of employers calculated among all participants^b Participants could elect multiple forms of transportation

Research brief: Analysis of policy responses to seed, fertilizer, food and fuel shocks in three African Regional Economic Communities

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Submitted December 7, 2023 / Revised March 27, April 26, and July 3, 2024 /

Accepted August 12, 2024 / Published online November 20, 2024

Citation: Lokosang, L. B., Kirui, L. K., Maru, J. M., Karugia, J., Bahta, S., & Enahoro, D. (2025). Research brief: Analysis of policy responses to seed, fertilizer, food and fuel shocks in three African Regional Economic Communities. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 393–401. <https://doi.org/10.5304/jafscd.2024.141.009>

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Abstract

The COVID-19 pandemic and the ongoing Russia-Ukraine war had severe implications for global

food security and nutrition. It was feared that food systems would be impacted negatively, especially food, seed, fertilizer, and fuel quantities required for agricultural production. The study aimed to ascertain the extent to which calls to action by AU policy organs, as well as recommendations by experts, to mitigate possible effects of the COVID-

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Funding Disclosure

We would like to thank all funders who supported this research through their contributions to the CGIAR Trust Fund.

19 pandemic, were implemented at the national level across three of the five regional economic communities and whether they yielded any tangible impacts. The study conducted a desk review of literature and key informant interviews in 18 African countries. We found a wide range of variations in terms of country responses to the pandemic. Countries in the East African Community focused more on expanding targeted social protection programs, Economic Community of West African States countries focused more on supporting smallholder farmers and digital agriculture, and the Southern African Development Community focused on budgetary stimulus packages. We found a lack of coherence in responding to the crisis within each region to improve the supply and distribution of food, seed, fertilizer, and fuel; thus, necessitating an immediate and aggressive implementation of strategies aligned with continental and regional policy resolutions and recommendations.

Keywords

seed, fertilizer, food, fuel, COVID-19, pandemic, Africa, national food policy, regional economic communities

Abbreviations

African Union.....	AU
African Union Commission	AUC
Economic Community of West African States	ECOWAS
Food and Agriculture Organization of the United Nations.....	FAO
Regional Economic Communities	RECs
International Fund for Agricultural Development.....	IFAD
Southern Africa Development Cooperation.....	SADC
United Nations Children Fund.....	UNICEF
United Nations Economic Commission for Africa	ECA
World Food Program.....	WFP
World Health Organization.....	WHO

Introduction

Food insecurity and malnutrition in Africa have persisted for decades despite reportedly improved

economic growth and performance of the agriculture sector. The *Africa Regional Overview of the State of Food Security and Nutrition 2021* report (FAO et al., 2021) notes that Africa is not on track to meet Sustainable Development Goal (SDG) 2 (“End hunger, achieve food security and improved nutrition and promote sustainable agriculture”) by 2030, with only 11 countries having less than 10% prevalence of undernourishment. The *State of Food Security and Nutrition in the World 2022* report (FAO et al., 2022) paints an equally worrying picture for Africa as it shows that hunger continues to rise, albeit at a slow pace.

The COVID-19 pandemic and the Russia-Ukraine war threatened food security and nutrition around the world (Ben Hassen & El Bilali, 2022; United Nations, 2020). The overlapping crises affected food, fertilizer, and fuel prices. Jaacks et al. (2021) report that the extended COVID-19 lockdown impacted Indian farmers’ ability to sell their crops and livestock products and decreased daily wages and dietary diversity. The pandemic is also reported to have negatively impacted food production systems and supply chains (Alam, 2021; Nchanji & Lutomia, 2021). It worsened the economies of countries already suffering other economic downturns such as South Africa (declining sovereign credit rating), Tanzania (significant fall in stock exchange), Angola (sharp decline in oil prices), and Zambia (facing mounting foreign debts of up to US\$11.2 billion) (Golubski & Schaeffer, 2020). The Russia-Ukraine war also is seen to have threatened economies. Its impact is being felt in dramatic consumer price hikes of major farming inputs, including fertilizer, seeds, and fuel for mechanized agriculture.

The widespread international border closures and travel restrictions following the COVID-19 outbreaks led the African Union and its partners to convene an extraordinary meeting of African Ministers of Agriculture, held virtually on April 16, 2020. The meeting came out with a declaration (AU & FAO, 2020) urging AU member states to ensure that “farmers have timely access to quality equipment and crop inputs, including seeds and planting material” (p. 5). A policy brief on input supply chains strongly recommends subsidies on inputs, among others (FAO & AUC, 2020c).

The follow-up Joint Conference of Ministers of Agriculture, Ministers of Trade, and Ministers of Finance was convened on July 27, 2020. It concluded with the “Joint Ministerial Declaration and Agenda for Action,” which made bold commitments including a call to AU member states to provide smallholder farmers with “access to quality agricultural equipment and inputs, including seeds, planting materials, breeding stocks, fertilizer, veterinary products, animal feeds, and access to pasture, while ensuring sustainable management of natural resources and conservation of biodiversity for food and agriculture” (AU & FAO, 2020, p. 5).

The goal of this study is to assess whether or not member state governments took actions on the bold, high-level commitments made nearly three years ago. Based on a comparative analysis of policy responses in food, fertilizer, and fuel in three of Africa’s Regional Economic Communities (RECs)—Eastern African Region (the East African Community and other countries in the Horn of Africa), Economic Community of West African States (ECOWAS) and Southern Africa Development Cooperation (SADC)—the study aims to establish the extent to which member states responded with policies to mitigate the effects of the COVID-19 pandemic, the Russian-Ukraine war, and other recent shocks causing hikes in prices and scarcity of food, fertilizer, and fuel. It is necessary to ascertain if the policy recommendations and calls for action by AU policy organs and experts (through policy briefs) were implemented, and if so, if they were impactful. Desired outcomes of this study are to (a) highlight important lessons learned in mitigating the crisis; (b) influence policy formulation or adjustments with regard to responding to ongoing crises or taking preventive actions ahead of the outbreak of a crisis; and (c) share experiences and lessons across countries and regions.

Methodology

The study followed a two-track approach: a desk review of literature and key informant interviews. The literature review examined how countries in the three RECs under study responded. It also looked at whether they implemented measures to mitigate the effects of the overlapping crisis of COVID-19, the Russia war on Ukraine, and recur-

rent climate-related challenges. The focus of the desk review was on inputs and food supply, imports and exports, social protection, markets, including regional spillover effects and distribution channels, and labor supply. The key informant interviews examined the differences in national and regional perceptions (Eastern Africa, Southern Africa, and Western Africa).

Twenty-five purposefully selected key informants from 22 countries were interviewed. Interviewees were senior policy-level position holders (56%) and those who played planning and monitoring roles (36%) in government, intergovernmental, parastatal, and academic and research institutions. The majority (92%) of the respondents were knowledgeable and competent to provide the needed information. However, the rest of the respondents were excluded from the sample because they indicated that they could not provide the needed information. The purpose of the key informant interviews was to corroborate the review of literature.

Key Findings and Discussion

An Overview on the Impact of the COVID-19 Pandemic and the Russia-Ukraine War and Country Responses

African countries responded in various ways to the anticipated effects of the COVID-19 pandemic and the Russia-Ukraine war (ECA, 2020). South Africa, for instance, implemented a program of cash transfer to low-income households, which was expected to provide critical support to the most vulnerable populations during the crisis imposed by the pandemic and protracted lockdown (Arndt et al., 2020). However, it is yet to be ascertained whether the program resulted in any impact at all. In Ethiopia, Geda (2021) projected that the COVID-19 pandemic was likely to stretch the macroeconomic balance of the country, which was already “in a precarious condition” (p. 23) prior to the pandemic’s onset. Among the possible socioeconomic effects are unemployment and poverty. Pape et al. (2021) concluded that the “pandemic has had a strong impact on the livelihoods of Kenyan households” (p. 2). Onsomu et al. (2021) determined that Kenya, a country in which tourism

contributes substantially to its GDP, was worst hit by the pandemic compared to other selected industries without smokestacks (IWOSS) (Onsomu et al., 2021). The tourism sector contracted by 83.3%, with total tourism revenue losses estimated at 297.2 million dollars, including at least US\$3.60 million in park entry fees alone (Onsomu et al., 2021). Other affected sectors included horticulture; information communication and telecommunication (ICT), and youth employment (Onsomu et al., 2021).

In Nigeria, the United Nations Development Program (UNDP, 2021) reports that at least two-thirds of businesses had to close down during the pandemic. The report also outlined five different impact areas: operations; production and capacity utilization; sales, revenue, and finances; workforce; and perceptions of business owners regarding the future of their enterprises. Balana et al. (2020) reported that as a result of restricted movements imposed to curb the spread of COVID-19, on-farm activities were reduced, with 24% of farmers reporting that they reduced fertilizer application, leading to low crop productivity and production, especially of staples highly dependent on fertilizer. A study conducted in Ghana and Nigeria by Ojokoh et al. (2022) reported that the extensive lockdowns caused scarcity in farming inputs such as planting materials, agrochemicals and fertilizers, badly affecting the livestock and fish farming subsectors.

In Tanzania, the impact of the COVID-19 pandemic fell heavily on smallholder farmers, with 85% experiencing an income reduction, thus increasing the vulnerabilities of affected communities (Mugabe et al., 2022). A study by Ssempebwa et al. (2022) reported that 8% of young people in Uganda had their sources of livelihoods affected due to the increase in prices of farming and business inputs. The UNDP (2020) reported disruptions in the supply of farm inputs for both crops and animals in Uganda, which are attributed to the effects of the stringent COVID-19 restrictions on the supply of agricultural labor, technical services, and the supply of inputs, such as improved seed, fertilizer, veterinary medicines, animal and fish feed, insecticides, and pesticides. Fall et al. (2022), quoting Van Hoyweghen et al. (2021) and Sánchez et al. (2020), reported that the agriculture produc-

tion sector in Uganda and Senegal experienced strains due to low access to inputs like seeds and fertilizers, as well as the availability of labor. Nolte et al. (2022) reported accessing farming inputs being a challenge to more than 10% of respondents in Burkina Faso, Ethiopia, Uganda, and Zambia.

To mitigate the effects of the COVID-19 pandemic and other economic and livelihoods shocks on poor and small-scale farming communities, a number of institutions, academics and researchers recommend policy adjustments, apart from those made by AU policy organs. Erinle et al. (2021) outline six such policy areas: (a) establishment of community-based food networks, (b) food and agriculture data collection and maintenance, (c) stabilization of food prices, (d) infrastructural development for food security, (e) increased investment in agricultural research and policies, (f) adoption of modern farming practices, and (g) reduction and management of agricultural and food waste. Some governments in Africa played their part in implementing the measures, either through their own initiative or in alignment with the universal recommendations. For instance, Nyirenda et al. (2021) report that in the 2020–2021 farming season, the government of Malawi replaced the Farm Inputs Supply Program (FISP) with the Affordable Inputs Program (AIP), with the aim of achieving food security, improving nutrition, and reducing poverty by increasing farmers' access to improved inputs (fertilizer, hybrid maize seed packs and open-pollinated variety (OPV) maize, sorghum or rice) at reduced prices. In The Gambia, the International Fund for Agricultural Development (IFAD, 2020) reported supporting rural farming communities with seed and fertilizer, among other needs, in an effort to boost the resilience of the rural populations (Ojokoh et al., 2022).

Besides the financial and material support to small-scale farmers, digital technology (mobile communication and applications), although limited in rural areas, was used to gather information. This practice became a strategy to cope with limited physical movements after the imposition of the curfew. For example, in Tanzania, 20% of smallholder farming households surveyed reported having used digital information technology (electronic

tablets and mobile phone handsets) during the peak of the pandemic to gather information since physical movements were restricted, although Tanzania did not impose a total lockdown (Mugabe et al., 2022).

Perceptions of Key Informants Regarding Country Responses to the Shocks

An overwhelming majority of respondents (84%) reported that governments made some policy responses to the crisis and initiated input supply programs to mitigate the prevailing crisis. Food crops were targeted in governments' response to the crisis, which is a laudable action due to its effect on weakening food insecurity during the crisis. However, it was also reported that this action was not taken countrywide but in specific locations or parts of each country, mainly because they were determined to be food-deficit regions.

Among the respondents interviewed about the sources of farm inputs, they identified various sources: 28% mentioned warehouses, 44% cited local markets, and 48% referred to imports (respondents could choose more than one source). A reliable strategy would be to stock a large proportion of the inputs in warehouses rather than depending on imports, which would drain foreign reserves and weaken economies. Government (80%), foreign donation (24%), and internal aid (12%) combined as the sources of the payments for the inputs and food supplied to curb the effects of the crisis. The inputs and food supplied were mostly delivered through direct public distribution systems (72%), followed by digital platforms (16%), including web-based mediums and phone-based reporting (12%), indicating that information communication infrastructure and systems were still not commonly used across the continent to reduce delays and the costs of travel. Conventional paper-based reporting was the dominant method (68%) for tracking and monitoring progress in the distribution of inputs, while phone-based and digital platforms came in a distant second (12%).

About half of the key informants (48%) reported that governments introduced market reforms to inputs in order to mitigate the crises, which was one of the calls for action by the ministers of trade of the AU in their July 27, 2020, meet-

ing. They were reported to have come in the form of price adjustments (38.5%) and subsidies (77%). This government intervention reflects the importance of market reforms for a functioning food system that guarantees both food sovereignty and food security.

Over half (56%) of the respondents reported that governments initiated food supply programs to mitigate the COVID-19 effect. Just under two-thirds (62.5%) of the respondents reported that food was supplied to specific locations or parts of the country considered to be food-deficit. Governments depended more on markets and imports to secure food for the vulnerable population in preparation for and during an emergency. According to the respondents, government food aid came from national food reserves (41.2%) and local markets/imports (58.8%). This indicates a need to build national food-reserve management institutions, capacities, and systems. It also calls for developing harmonized continental, regional, and national strategies that target increased food storage capacities and equity in developing new food reserve infrastructure, taking advantage of recent technological advances.

A majority of the respondents (60%) perceived that governments made very limited efforts, while 36% thought governments made commendable efforts. Fifty-six percent reported the existence of coordination mechanisms (institutional setups and reporting mechanisms) for governing their response to the crisis.

State Response to July 2022 Joint Declaration and Agenda for Action

About half of the respondents reported that governments responded well to the call for opening food and agriculture input markets and supply chains. The majority of respondents (ranging from 60% to 84%) agreed that governments took affirmative action toward mitigating the crisis through support to smallholders and the private sector, expanding social protection programs, and promoting innovative digital agriculture to increase productivity and production.

About half of the respondents agreed that governments took some actions to operationalize essential food trade corridors and reduce custom

duties on food products. The majority of respondents reported that they were aware of governments keeping domestic food markets operational in support of consumers and producers. ECOWAS countries equally reduced customs duties on food products and kept domestic food markets operational. The eastern Africa region more effectively operationalized food trade corridors compared to the other RECs, but all the three RECs did well in keeping domestic food markets operational to support consumers producers.

Half of the respondents (52%) reported that governments made favorable financial decisions to help their countries (especially private investors) recover from the effects of the recent crisis on food systems. These measures included mobilizing additional external resources to supplement domestic and private sector resources, increasing the share of direct sovereign wealth funding for investment in agriculture, and encouraging financial institutions to use guarantees and refinancing mechanisms. About a third of the respondents reported that governments took other appropriate financial measures.

Conclusion

Our data analysis showed that member states responded variably to the crisis. While there were some attempts by AU member states to respond to the crisis, a significant number of countries were yet to implement the AU 2020 Call for Action. Indeed, only about a third of the respondents thought that governments made a commendable effort to mitigate the potential effects of the crisis.

A key takeaway from this study is that the selected regions responded to the effects of the COVID-19 pandemic and the Russia-Ukraine war on food systems, agri-food inputs (seeds, fertilizer and fuel), and food supplies to varying degrees. The Eastern Africa region did well in expanding and improving social protection programs for income support to enable food production and market access. ECOWAS provided a range of activities to support smallholder producers, promoting innovation and digital agriculture technology and supporting the private sector in accessing investment finance. The level of response to the crises in the SADC region was generally low.

The findings show that there was no coherent intervention from RECs or the mandated continental organizations in the form of an immediate and aggressive strategy to support member states in developing action plans that would have been coherent with the continental policy recommendations and commitments, which in fact were made by the member states themselves. Overall, the findings seem to point to a relatively low level of response in the SADC region based on the recommendations of the ministers responsible for agriculture, trade, and finance. This does not mean that no responses were made, but that responses in the SADC region were weaker than those in Eastern Africa and ECOWAS.

Furthermore, our analysis indicates that key informants were dissatisfied with the responses to both the COVID-19 pandemic and the ongoing Russia-Ukraine war. Additional studies will be required to establish the impact of the responses. In this case, the ultimate beneficiaries, including smallholder farmers and vulnerable groups, will need to be the respondents.

Recommendations

Based on the findings outlined above, three recommendations can be made for continental and regional actors and members states, and also for CGIAR's National Policies and Strategies for Food, Land and Water Systems Transformation (NPS).

1. The African Union Commission and AUDA-NEPAD, working in close collaboration with RECS development partners, should:
 - Increase the capacity and develop a strategy for supporting member states to develop coherent and harmonized agri-food systems and livelihood resilience action plans. This is consistent with a recommendation in FAO and AUC policy brief (FAO & AUC, 2020b).
 - Develop and endorse an aggressive advocacy strategy for engaging with national leaders of member states to motivate the allocation of resources to implement the resolutions of the July 2020 Joint Ministerial Declaration, which point in the right direction for mitigat-

ing the effects of the crisis affecting food systems resilience on the continent. This is consistent with the policy brief on crop calendars and recommended actions during the COVID-19 period (FAO & AUC, 2020a).

2. Member states should:

- Pay special attention to strengthening the inputs and food supply subsectors as the critical area of intervention for effective mitigation of the crisis. In doing so, Africa can achieve food sovereignty, meet the goal of tripling intra-African trade in agricultural and food commodities, and reduce unnecessary food imports. This is consistent with the policy brief on safeguarding input supply chains for small-scale agricultural producers (FAO & AUC, 2020c).

3. CGIAR's NPS and other policymaking institutions should:

- Use the evidence from this study and other relevant information to develop policy briefs

that provide AU member states with policy recommendations for action.

- Use the findings of the study as a basis for conducting a larger study to establish the impact of the response interventions.



Acknowledgment

This work is part of the CGIAR Initiative on National Policies and Strategies (NPS). CGIAR launched NPS with national and international partners to build policy coherence, respond to policy demands and crises, and integrate policy tools at national and subnational levels in countries in Africa, Asia, and Latin America. CGIAR centers participating in NPS are The Alliance of Bioversity International and the International Center for Tropical Agriculture (Alliance Bioversity-CIAT), International Food Policy Research Institute (IFPRI), International Livestock Research Institute (ILRI), International Water Management Institute (IWMI), International Potato Center (CIP), International Institute of Tropical Agriculture (IITA), and WorldFish.

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Setting the table for rural food access: Models from Appalachia and the Deep South

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Submitted June 3, 2024 / Revised September 25 and October 15, 2024 / Accepted October 15, 2024 /
Published online December 31, 2024

Citation: Darwin, A. E., Nunoo, N., Lee, J. S., Borron, A., & Thompson, J. J. (2025). Setting the table for rural food access: Models from Appalachia and the Deep South. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 403–426. <https://doi.org/10.5304/jafscd.2024.141.016>

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Abstract

The Southeastern United States was built upon agriculture, but paradoxically its rural residents experience high rates of food insecurity due to

numerous intersecting socio-economic barriers. Food insecurity leads to higher rates of diet-related chronic disease in rural populations compared to their urban counterparts, further compounded by limited access to healthcare. Guided by the theoretical frameworks of assets-based community devel-

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Disclosures

The authors have no conflicts of interest to disclose.

Funding Disclosure

This project was funded by a U.S. Department of Agriculture (USDA) National Needs Fellowship (#2016-38420-25578).

Author Note

This work was presented at “Cultivating Connections,” the 2022 Agriculture, Food, & Human Values Society (AFHVS)—Association for the Study of Food and Society (ASFS) joint annual meeting. It is also part of Abigail E. Darwin’s master’s thesis (2021).

opment and the culture-centered approach, this paper investigates existing program models that guide the establishment of community-derived programs to increase the availability and accessibility of locally sourced fruit and vegetables for low-income residents of the rural Southeast. Data were collected through document analysis and semi-structured interviews with leadership from twelve community-derived food access programs in Appalachia and the Deep South. Using a framework approach, data were analyzed to identify and characterize current models based on their structures and guiding values. Four program models were identified: the Charity Model, the Support Model, the Restructure Model, and the Market Model, which range from providing emergency food to restructuring the local food system. We present characteristics of each model, the challenges faced, and lessons learned by participating programs. In addition to identifying the four models, an unexpected result of this work was uncovering subtle yet important differences between Appalachian and Deep South programs that reflect their divergent, yet parallel cultural histories of marginalization and resilience.

Keywords

food access program, food insecurity, asset-based community development, rural communities, Appalachia, Deep South

Introduction

Over the past decade, comprehensive approaches to mitigate community food insecurity have become increasingly common (Coates, 2015; High Level Panel of Experts, 2019; Iannotti et al., 2024). These community-based initiatives seek to address the root causes of hunger and break the cycle of food insecurity by addressing the needs of whole communities and families. In an increasing number of communities, produce prescription programs have decreased food insecurity and health disparities by increasing program participants' access to fresh fruits and vegetables (Aiyer et al., 2019; Marcinkevage et al., 2019; Newman et al., 2022;

Slagel et al., 2023; Zhu, 2019). Often, these programs also provide education on nutrition, kitchen skills, and recipes to maximize the benefits of the prescribed fresh food (Bookhart et al., 2019; Joshi et al., 2019; Schlosser et al., 2019; Stotz et al., 2023).

Despite their success in urban settings, produce prescription programs rarely exist in rural¹ communities (Rodriguez et al., 2021; for an exception, see Burrington et al., 2020). There are limited data on programs that aim to expand rural food access, especially in the U.S. Southeast. What does exist suggests the need for additional research on rural food access (Fleischhacker et al., 2013; Holston et al., 2020; Hossfeld & Rico Mendez, 2018). In response to the research gap, this study identifies and describes existing program models that aim to increase access to locally sourced fruit and vegetables for low-income residents of the rural Southeast. Specifically, we examine grassroots food access programs, which are diverse in structure but united by the goal of increasing rural fresh fruit and vegetable access through a community-based approach.

Background

As of 2022, the food insecurity rate was 14.7% in rural America compared to 10.5% in suburban areas; food insecurity was also higher among those experiencing poverty (36.7%) and in the U.S. South (14.5%) (Rabbitt et al., 2023). Furthermore, the proportion of U.S. residents living in poverty is higher in rural and nonmetro areas than in metro areas (Coleman-Jensen et al., 2021; Davis et al., 2023). Although poverty is the most powerful barrier to food access, it is compounded by social and geographic barriers faced by rural residents. While most rural residents live in rural clusters (i.e., denser zones of development within largely rural areas), these clusters are unevenly supported by full-scale grocery stores. More accessible food outlets, such as rural corner stores, Dollar General stores, and gas stations, have limited selection, higher prices, and few if any fresh fruits or vegetables (Larson et al., 2017). To meet nutritional

¹ The U.S. Census Bureau (2021a; 2021b) defines “rural” as any population not in an urban classification zone. “Urban” has two classifications: “urbanized” zones with more than 50,000 people or “urban areas” with more than 2,500 but fewer than 50,000 people.

needs, rural residents commute to nearby urban centers with supermarkets. However, a significant portion of this population lacks consistent access to dependable transportation, impeding their ability to undertake the journey, which can often take over an hour (Bauer & Dolan, 2011; Gantner et al., 2011; MacNell, 2018). Having managed the long commute, many low-income rural shoppers strategically purchase shelf-stable, calorically dense, nutritionally deficient foods rather than more expensive, perishable fresh fruits and vegetables (McGee et al., 2011).

Food access strongly influences food consumption patterns which, in turn, impact the risk for diet-related health conditions that are more prevalent in rural areas of the US, including obesity, hypertension, diabetes, and heart disease (Ahern et al., 2011; Wang, et al., 2014). Because rural communities experience both diet-related health disparities and additional barriers to healthcare, access to healthy food is a key social determinant of health and well-being. (Brennan Ramirez et al., 2008; Koh, et al., 2011; Raphael, 2016).

There are also significant racial and ethnic disparities in the rates of food insecurity in the U.S.; Black, Indigenous, and Hispanic households consistently experience food insecurity at twice the rate of white households (U.S. Department of Agriculture Economic Research Service [USDA ERS], 2024). In rural communities, 30.7% of Black Americans were living in poverty in 2019, compared to 13.3% of white Americans (USDA ERS, 2021). Nevertheless, despite the ongoing social and economic inequities experienced by people of color in the South, beginning with forcible removal and enslavement, these communities have long used food production as a site for creative activism and resistance, through co-operative and regenerative farming models (Franklin et al., 2011; Leslie & White, 2018; White, 2018).

The dominant strategy for addressing gaps in food access in the U.S. is a corporate food regime that relies on charity-oriented food banks and pantries to distribute free food to recipients who have limited agency within the process (Bacon & Baker, 2017; Holt Giménez & Shattuck, 2011; Poppendieck, 1999; Vansintjan, 2014). This “top down”

approach can inadvertently reinforce established power hierarchies linked to race and class, doing little to dismantle the entrenched systemic social inequities that underpin food insecurity (Guthman, 2008). In contrast, initiatives that employ a community-engaged approach offer greater potential to target intersecting barriers and bring about transformative change (Freire, 1970; Wallerstein et al., 2018).

Since the mid-1990s, community-based and participatory approaches to research and community development have gained prominence as ways to “build on the strengths and priorities of the community for multilevel strategies to improve health and social equity” (Wallerstein et al., 2018, p. 3). Nevertheless, the term “community-based” often refers to the setting or target of an intervention that is largely guided by an external organization’s agenda (McLeroy et al., 2003). In this paper, we use the term “community-derived,” which draws from the theory of asset-based community development (Kretzmann & McKnight, 1996) and the “community as an agent” model of community-based initiatives (McLeroy et al., 2003), to describe food access programs that have been developed *within* local communities, and *in response* to unique local needs and resources—including cultural resources.

Applied Research Methods

Inspired by the mobilization of unique resources and networks within rural communities, our research is framed by the theories of asset-based community development (Kretzmann & McKnight, 1996) and culture centered approach (Dutta, 2007). Both theories share common objectives, recognizing local lived experiences as a form of expertise for discerning issues and solutions, reinstating power to communities and individuals, and harnessing the influence, privilege, and capabilities of external organizations to bolster priorities derived from the community. Although these theories were developed to guide the creation of programs, we use them here to inform our criteria for selection of programs to investigate, approach to data collection, and analysis. The project was reviewed and determined not to be human subjects research by the University of Georgia Institutional Review Board.

Sample Identification and Document Review

In accordance with our theoretical framework, we initiated our study by delineating a set of inclusion priorities to guide selecting programs for our sample:

- Programs *must* aim to increase fresh fruit and vegetable access within a community; however, this does not need to be the sole focus of the program.
- Programs situated in the U.S. rural Southeast² will be prioritized.
- Programs that are community-derived will be prioritized.
- Programs that support local agricultural production will be prioritized.

We broadly defined the term “program” to include nonprofits, local governments, informal community networks, or collaborations; we use “community-derived” to refer to programs established by or with a community to address self-identified needs.

An initial web search,³ conducted in Spring 2020, yielded 24 programs that appeared to meet our inclusion priorities. Public-facing documents encompassing the values, structures, goals, purposes, and strategic partnerships as well as news articles and blog posts, were collected on the programs via online searches of their websites and social media platforms. These documents were stored and organized in ATLAS.ti, then reviewed to establish a general foundation of knowledge about these programs and to select a subset of programs that most closely fit our inclusion priorities. As a result, we identified 12 community-derived

food access programs in rural communities in south-central Appalachia and the Deep South (Figure 1).

Documents pertaining to the 12 programs were analyzed in Atlas.ti to discern their structure, values, goals, purposes, and components in support of further data collection. Then we crafted a semi-structured interview guide to delve into aspects not typically disclosed in public documents. We contacted leadership from the 12 programs and secured interviews with program directors, board members, founders, and communication specialists from 11 programs.

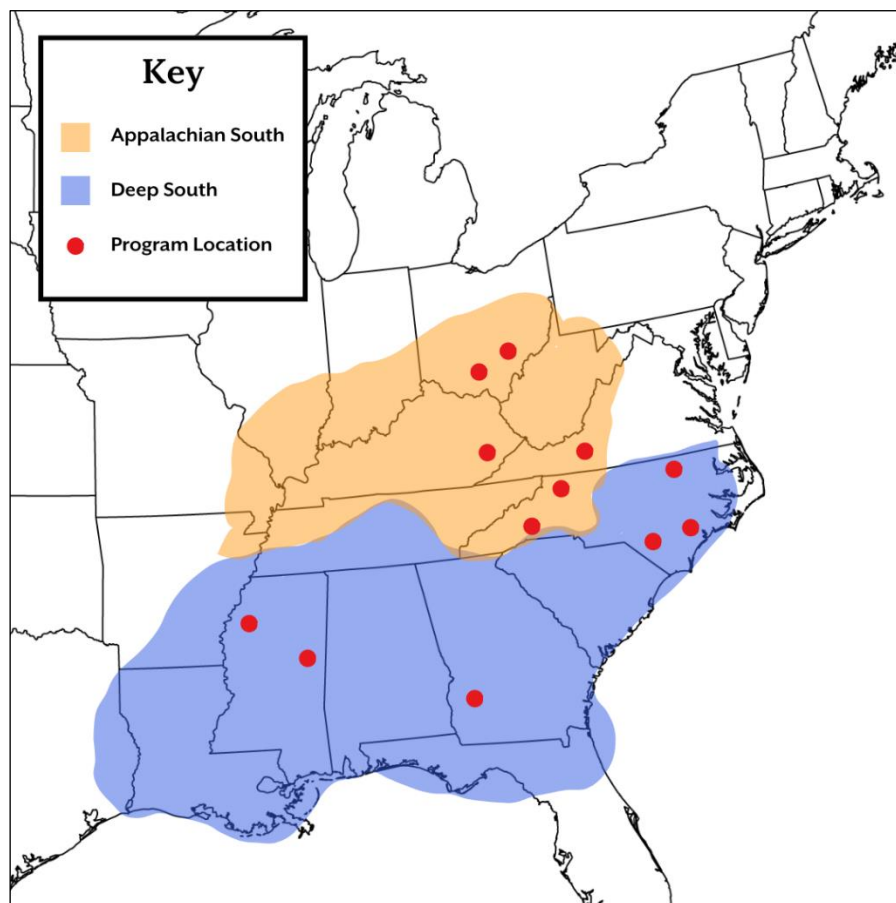
Data Collection

Fourteen representatives from 11 programs agreed to participate in a total of 12 interviews. (The one program that did not respond had publicly available interviews with the program’s founder available on their website. Since these interviews addressed many elements of our interview guide, although in less detail, and they were included in our dataset, our dataset thus includes all 12 programs.) All participants received an information letter and provided verbal informed consent at the beginning of their interview. Interviews lasted approximately an hour and a half and were conducted by Darwin via phone or Zoom. Participants were also invited to share any additional documents that would enhance our understanding of their program. Participants received a gift card to thank them for their time. Interviewees were mostly program directors but also included board members, founders, and communications specialists. Interviews were audio-recorded, transcribed, and cleaned by

² We used the U.S. Department of Agriculture definition of Southeastern states: Louisiana, Arkansas, Mississippi, Alabama, Georgia, Florida, South Carolina, North Carolina, and Tennessee (USDA Agricultural Research Service, n.d.).

³ Search terms were derived from our research objectives and included—but were not limited to—combinations of the following: rural, fresh foods, food access, food hubs, food assistance programs, and food sovereignty. With no standard terminology for community-derived programs, we left the search terms intentionally broad. Other community food systems search terms, such as “teaching gardens,” were included because the results would often link to related programs relevant to the research. Peer-reviewed content was limited, and upon review it did not result in identifying any previously unidentified programs; however, Google Scholar did yield related articles on two previously identified programs. Keywords in these articles were used as search terms for further searches, but all results were situated in urban or non-Southeastern environments. The most successful method was using search terms in the public Google search engine, yielding local news sources and websites that identified multiple programs. Instagram was an unexpected resource for program identification, mainly because Instagram accounts of programs often follow the accounts of other programs doing similar work. Lastly, two programs were identified by attending conferences where program stakeholders presented their work.

Figure 1. Map of Community-Derived Food Access Programs Included in this Study (N = 12)



hand. The interview transcripts and any additional shared documents were uploaded to ATLAS.ti for analysis.

Analysis

Analysis was guided by the Framework approach, a qualitative research method designed to describe and interpret data generated in practical, real-world contexts (Gale et al., 2013; Ritchie & Spencer, 1994). Encompassing five sequential stages, the approach includes: 1) becoming acquainted with the data, 2) discerning thematic patterns, 3) indexing key concepts, 4) creating charts or matrices, and 5) interpreting the data to derive meaningful insights (Smith & Firth, 2011). The Framework approach is a robust approach to organizing and comprehensively understanding the intricacies inherent in qualitative data within applied settings.

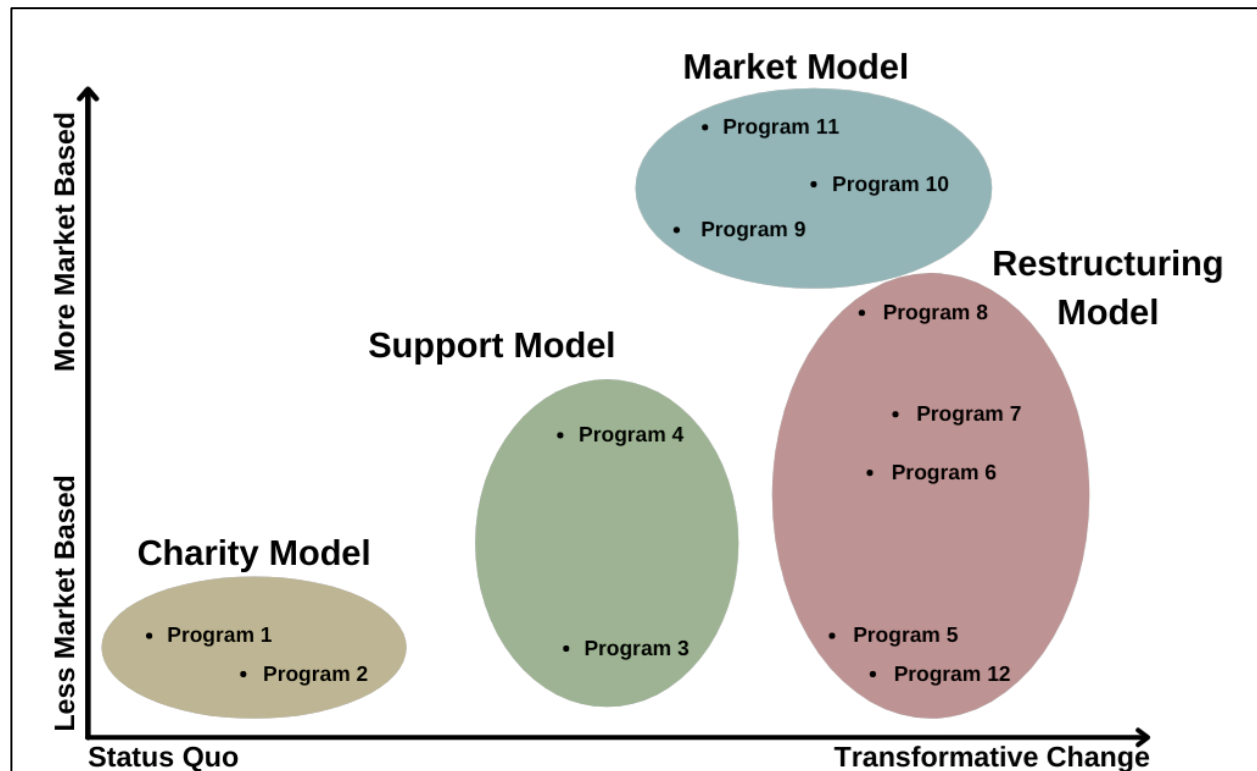
Data analysis was led by Darwin, in constant

consultation with Thompson. During data collection and transcription, Darwin familiarized herself with the data, identified preliminary themes, and expanded the codebook established during the document review to include elements specific to the interviews, such as program structures and characteristics, as well as challenges faced, keys to success, and insights shared by program leadership. Based on this codebook, Darwin systematically indexed the interviews and documents in ATLAS.ti and met with Thompson on a weekly basis to discuss coding decisions. Nunoo further reviewed the data and coding during the writing process. Following coding, Darwin organized the data with a charting process

that allowed the research team to compare program characteristics to identify generalizable models based on patterns in the data.

We mapped the programs based on two dimensions of interest: adherence to a market-based approach and intention to transform the local food system (Figure 2). These dimensions were selected because several programs explicitly self-identified in these terms. A market-based approach (Figure 2, Y-axis) involves strategies or programs that utilize market mechanisms like supply and demand, pricing, and competition to achieve their objectives (Wang et al., 2017). Programs that ranked low on the market-based dimension generally did not rely on exchange of money for food, and did not seek profitability as a program goal. In contrast, programs that ranked high on this dimension employed a business model that focused on the economic success of the initiative

Figure 2. Identification of Program Models



Distribution of community-derived food access programs across two dimensions of interest: adherence to a market-based approach (Y-axis) and intention to transform the local food system (X-axis).

as a primary goal.

The second dimension refers to program alignment with existing structures and practices that shape the contemporary food regime (Figure 2, X-axis). Programs that rank low on this dimension are content to work within the status quo, to focus on broadening access for those underserved within the current system without challenging the fundamental ways in which the food system operates. In contrast, programs that rank high aim to fundamentally transform the system through which food is produced, distributed, and consumed. This dimension parallels the hierarchy of food movements described by Holt Giménez and Shattuck (2011), ranging from neoliberal to radical.

Programs closer to the axis intersection (i.e., low on both dimensions) primarily provide emergency food, and programs furthest from the intersection (i.e., high on both dimensions) aim to transform local food systems by addressing the root causes of hunger, while also drawing on

market-based approaches. Programs were located on the grid according to their relationship to each dimension and in reference to one another. Once plotted, spatially proximate models were grouped together. We drew upon our qualitative understanding of these programs to develop generalizable descriptions for each program model, which we named according to their principal attributes.

Results and Discussion

Sample

All programs in this study were community-derived efforts to increase access to fresh food distributed across Appalachia and the Deep South (Figure 1). At the time of the interviews, ten of the 12 programs sourced locally grown food, and seven had gardens on-site to supplement distributed food or to serve as a teaching garden. Eight programs had educational components, with two more in developmental phases. All programs defined their com

munity by county boundaries; therefore, our use of “community” refers to the county in which the program is situated. Nevertheless, as one interviewee reminded us during data collection, we recognize that such a broad definition of community oversimplifies complex relationships between overlapping and independent sets of social relations that co-exist in a single space. Table 1 provides an overview of community demographics and a brief synopsis of significant characteristics of each program, including its formation, structure, guiding values, and keys to success. In the sections below, everything in quotes represents direct quotes from participants.

Four Models of Community-Derived Rural Food Access Programs

Our analysis identified four different community-derived food access program models: the Charity Model, Support Model, Restructuring Model, and Market Model (Figure 2). The Charity Model provides emergency food assistance, sourcing from food banks. The Support Model also provides emergency food assistance but sources locally within the community. The Restructuring Model increases food access for the whole community by redefining local food systems. The Market Model also increases food access for whole communities by increasing availability within the market. We discuss each model in detail below.

Charity Model

Programs aligned with the Charity Model (Programs 1 and 2) temporarily increase food security by providing emergency food, with limited effort to addressing the root causes of food insecurity and the circumstances that directly or indirectly influence it. Such programs source food through food banks, and may or may not screen clientele for income, although those that screen do so to track impact and qualify for additional funding. These programs are well-received and supported by their communities, as demonstrated by community financial and volunteer support, and testimonies from clientele as shared by the interviewees. Nevertheless, this model is characterized by a distinct separation between those who serve and those being served.

Although the Charity Model programs in this study were not directly associated with a church, partnerships with local churches support their funding, volunteer needs, and food distribution. Notably, the interviewees from these programs were guided and motivated by their religious beliefs, participating in their programs because they saw it as their religious duty to address the needs of their communities.

Although this model resembles the dominant food bank to food pantry approach to emergency food provision, the programs were embedded in their local communities. During their founding stages, program leadership assessed community needs and resources before establishing the programs, without external assistance. Providing emergency food offers immediate assistance within communities and can produce effective short-term food security from limited assets. However, given the priority of meeting a community’s immediate need, this model’s capacity to develop a long-term strategy aimed at restructuring the food system is limited.

The lessons learned from this model reflect the challenges of a charity approach. For example, Program 1 demonstrated how efforts could be unsustainable if too “grant dependent.” The program’s attempt to establish home gardens relied solely on local grant funding, and all operations were halted once funding was depleted, illustrating the need for diversity in funding sources to sustain initiatives. The model demonstrates the importance of community engagement for program success: while Program 1 offered a creative alternative to community gardens, home gardening was not a priority of their clientele. Thus, focusing efforts on community priorities may have yielded more impactful results as well as continued funding.

Facilitating community engagement is also a challenge for Charity model programs. Program 2’s overarching goal is to provide resources to elevate its community from poverty, and the food pantry is one element of this work. Although the program offers a suite of services toward this goal, the charity approach has presented challenges surrounding community involvement. The interviewee from Program 2 explained, “We’re noticing that all our services are completely free, but it’s hard getting

Table 1. Characteristics of Community-Derived Food Access Programs Included in the Study (N = 12)

Program #	State (Region)	Formation	Year Est.	Structure	Guiding Values	Keys to Success	Model	County Population	Racial Demographics	Poverty Rate (%) ^a
U.S. (total)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	328,239,523	76.3% white 18.5% Latino 13.4% Black 5.9% Asian 1.3% Indigenous	10.5%
Program 1	North Carolina (Appalachian Region)	Created by residents to address immediate needs of a rural community.	N/A	Food pantry and soup kitchen, sourcing most of the food from a national food bank. Previously had a program that provided gardening resources for individuals and families in lieu of a central community garden.	Guided by religious belief in serving neighbors.	Local grants, core group of volunteers	Charity	27,203	95.4% white	14.6%
Program 2	North Carolina (Deep South)	Food programs were adopted to benefit youth scholastic outcomes and assist families experiencing food insecurity.	2007	Food pantry and distribution of food to network of churches. A community garden is used as a teaching tool and to supply fresh produce.	Guided by religious belief in serving neighbors	Support from regional churches	Charity	34,823	44.6% white 38.9% Black 12.8% Indigenous	28.5%
Program 3	Virginia (Appalachian Region)	Founded to provide a more formal pathway for community food sharing and support.	2011	Provides emergency food to county residents and operates a teaching garden. The food is sourced from the on-property garden, donations from gardens and local farms, and salvaging food.	Established community culture of sharing abundance between neighbors.	Landownership, large volunteer network, integrated into the community	Support	15,749	95.5% white	11.4%
Program 4	Ohio (Appalachian Region)	Founded by a regional organization to connect emergency food operations to locally grown food and provide a safety net for farmers.	2007	Purchases locally grown food through community donations. Aggregates and distributes to local emergency food operations. Additional gleaning operation.	Belief that local food should be accessible to all community members.	Robust local food system, access to wholesale prices from produce auction, community donations	Support	65,327 (stationed in an urban hub of rural area)	92.1% white 3.1% Asian 2.8% Black	26.6%
<i>continued</i>										

Program #	State (Region)	Formation	Year Est.	Structure	Guiding Values	Keys to Success	Model	County Population	Racial Demographics	Poverty Rate (%) ^a
Program 5	North Carolina (Appalachian Region)	Founded by community members to grow the produce needed for a local soup kitchen.	2009	Family style garden that distributes produce through pop-up events and local emergency food organizations.	Community tradition of sharing garden harvests with neighbors to promote food as a right for all.	Guidance available through a network of community gardens, community volunteers	Restructuring	18,069	96.4% white 5.5% Latino	14.2%
Program 6	Mississippi (Deep South)	Founded in partnership with a regional organization to improve community health and economy through food system revitalization.	2010	Youth education centered on agriculture, nutrition, and data collection; mobile market to address accessibility; resources for local farmers to support direct sales.	Values community voice and direction, provides support and resources for community to drive its own change	Long-term relationships within community, history of agriculture in the area	Restructuring	30,628	63.7% Black 34.2% white	36.6%
Program 7	Georgia (Deep South)	Established after a set of countywide goals were identified around revitalizing the food system.	2017	Operates a community garden that supplies produce for a mobile market, provides community education on growing food, and supports local farmers with direct sales.	Values increasing produce availability in an economically and environmentally sustainable manner.	Partnerships throughout the community and city government, deep agricultural history	Restructuring	87,956 (stationed in an urban hub of rural area)	71.0% Black 26.3% white	27.6%
Program 8	Kentucky (Appalachian Region)	Efforts were initiated by the collapse of the local coal economy to provide self-sufficiency through growing and selling food.	2013	A group of programs collaborating to create a localized food system. Efforts evolved from teaching individuals how to grow food to supporting economic opportunities for new growers.	The programs aligned their values of health and increased access with the community value of economic self-sufficiency.	Dedication and networking abilities of the spearheading individual, donation of a physical space	Restructuring	21,553	98.2% white	28.9%

continued

Program #	State (Region)	Formation	Year Est.	Structure	Guiding Values	Keys to Success	Model	County Population	Racial Demographics	Poverty Rate (%) ^a
Program 9	North Carolina (Deep South) Sandhills Farmers and Heritage Market ^b	Formed to preserve both land ownership and culture of the local African American community.	2006	The market provides an income opportunity for local landowners, increases access to produce, and acts as a platform for nutrition education and cultural events.	Values a system that allows community members to remain resilient, such as ownership of land and ties to traditional food ways.	The buy-in of the city council to adjust the city ordinance to allow a farmer's market	Market	335,509 (12,005 population for the city alone)	51.1% white 39.1% Black 12.1% Latino	18.0%
Program 10	Mississippi (Deep South)	Founded to create local jobs by growing produce to sell to a casino's restaurants and staff cafeteria.	2013	Uses income from casino purchases to provide affordable produce for those on reservation. Has an educational component to encourage renewed connection to foodways.	Values the wellbeing of tribal members, physically, mentally, and economically.	The support and shared values of the local casino	Market	29,118	58.8% white 21.3% Black 17.5% Indigenous	21.7%
Program 11	Ohio (Appalachian Region)	Founded as an effort to increase the clientele base and provide financial security for local farmers.	2010	Aggregates and distributes local produce to corner stores, hosts produce pop-up stands.	Values the livelihood of farmers.	Wholesale produce prices from local produce auction	Market	14,508	92.4% white 3.8% mixed race 3.1% Black	15.7%
Program 12	North Carolina (Deep South)	Founded through a local pastor's efforts to increase health and quality of living in a small community.	2007	Volunteers use church land to grow crops which are shared in the community, prioritizing those most in need.	Guided by religious beliefs and the desire to improve community health.	Available land, church that brought together the whole community	Restructuring	51,472	57.8% Black 39.7% white 5.0% Latino	21.0%

N/A = Not applicable

^a Poverty rate is the % below poverty line.

^b The founder of Program 9 (Sandhills Farmers and Heritage Market) specifically requested that their program name be included in materials resulting from this project.

the community to engage with those services. ... How do we get the people to want these services when they know they need it?" The challenge of engaging clientele with services, even when offered by community members, was unique to programs in the Charity Model. While community relationships in this model may alleviate some of the stigma of charity work, prior research has shown that recipients may perceive receiving charity as mentally and socially exhausting, as well as stigmatizing (Salonen et al., 2018). This may be further exacerbated by the lack of overlap between those served by the programs and those doing the service. Interviewees also stated that they have difficulty securing national funding, as it is challenging to set their programs apart from larger agencies doing similar work.

Support Model

Like the Charity Model, Support Model programs (3 and 4) focus on providing emergency food assistance; however, this model is characterized by deep commitment to community engagement, giving it greater transformative capacity. Both programs within this model evolved from a community tradition of growing food and sharing it between neighbors, and they continue to source food locally by purchasing directly from farmers, receiving donations from local farms and individuals, and gleaning. Local sourcing requires time and effort to build relationships and rapport, but it can extend program benefits by building the resilience of the local food economy (McEntee & Naumova, 2016; White, 2018). Support Model programs are driven by the goal of serving the community by filling gaps with local resources and capacity. They are characterized by an ethos that deeply values individuals—including clientele, volunteers, and growers—as agents in the local food system. Viewing education as a tool to increase individuals' control over their food environment and expand the impact of their efforts, these programs also incorporate gardening, nutrition, or food preparation education into their structure.

The primary challenge faced by the Support Model is the inconsistency in the amount of food available for distribution. Due to the limited shelf life of fresh food and the variability of food and

financial donations from week to week, there is constant worry that client needs may not be met. This stress is exacerbated in programs that distribute food to individuals rather than to organizations in bulk, because they want to ensure that all in need are offered the same resources. For example, the program manager from Program 3 stated that they struggle to ensure an "equal choice" for all clients, since their local donations are diverse and of limited quantities. The program addresses this by asking clients to take only what they need, such as taking a quart of strawberries but leaving a bag of plums for someone else, a solution that is only successful due to a culture of mutual respect between community members.

Lessons demonstrated by the Support Model highlight the value of maintaining trust and relationships within the community. As the program director for Program 4 emphasized, "cultivating relationships is key." Support Model interviews were filled with narratives about the programs' reliance on community relationships to address challenges and needs. For Program 4, ongoing financial donations demonstrate how the community values their local food economy in ways that align with Program 4's ideal of "local food for all." With Program 3, program headquarters has become a gathering spot for the community to receive both food and fellowship, "feeding not just their bellies, but their sense of community." The boundaries between volunteers and clientele are fluid, with many serving as both depending on their capacity and need. Offering clients and other community organizations opportunities for involvement further increases awareness of the program's services and expands its impact. The program director of Program 3 illustrates this insight: "[Our program] really is the favorite mascot of the nonprofits of the area. And I think it's because everybody gets to put their finger in it in some way at the end. And I think back to sustainability, it's about getting those tentacles out."

When asked to share guidance for other programs, Support Model interviewees emphasized the significance of formulating strategic plans that can sustain the programs and guide decision-making. For example, due to Program 4's success it faced external pressure to expand or replicate the pro-

gram in a neighboring county. While the program director was not opposed to this, they also saw the risk of exceeding capacity. Thus, the program director worked to ensure that the program could “strike a balance between growth and sustainability.” Furthermore, despite recognizing need in a neighboring community, the program director was hesitant to expand if it would divert resources from the needs of the program’s current community. Similarly, Program 3 is working to establish internal guidelines and policies to ensure their longevity as a nonprofit; nevertheless, the program director also emphasized that “true success” would be achieving an environment where their services are no longer needed: “Our goal isn’t to brag about how many people we feed; we really would like to see our numbers go down. We really would like to help people overcome their barriers and poverty, so they don’t have to go to a food bank.”

In short, while the structure of the Support Model resembles the Charity Model of food distribution, the Support Model is distinguished by its commitment to remain embedded within its community by addressing relevant needs and practicing flexibility when needs change. Despite this intention, this approach is limited in its transformative capacity as it does not address structural issues that underlie the prevalence of food insecurity.

Restructuring Model

Building on the intentional commitment to community of the Support Model, the Restructuring Model (Programs 5–8 and 12) differentiates itself by striving to recreate or restructure the local food system, rather than filling gaps within an established system. It goes beyond traditional approaches to food provisioning to address root causes of food insecurity and access inequities in access. Restructuring Model programs spend significant time—often multiple years—holding community-wide conversations to determine the (in)availability of community-based resources (Alison & Gord, 2003). Furthermore, they also work with their communities to identify feasible solutions and ways that members can contribute. A board member of Program 6 put it this way:

I believe it is a huge part of the reason that

we’ve gotten to where we’ve gotten, with very little money for seven or eight years was because it’s never been about “Oh, hey, we want to turn a great profit, making a great, shiny community food system.” It’s always been about, “We want to shift the long-term conversation in our communities.”

This in-depth understanding of community needs and assets creates a secure foundation on which programs can build. Paradoxically, however, many Restructuring programs in this study were established with external support. For example, Program 6 received support from a national-level organization piloting local approaches to programming. Still, the external organization dedicated extended time to building a relationship with the community, soliciting continuous feedback and respecting residents’ agency and experiential knowledge. This strategy has resulted in flexible programs better suited to serve the evolving community needs.

The Restructuring Model is further characterized by a comprehensive approach to the food system, which, as a founder of Program 8 explained, begins with understanding that an individual’s food environment is influenced by unique barriers and personal preferences while also “look[ing] at the local food as a common denominator and a unifier for community.” The Restructuring Model also incorporates elements of food justice (Alkon & Ageman, 2011), enacting the guiding value of “good food for all” through comprehensive efforts to strengthen the local food economy while also fostering community members’ agency in their food system. This model nurtures community agency by providing education and supplementary resources for growing food, and, as the director of Program 5 explained, it destigmatizes food access by encouraging a community culture of sharing food to “challenge the idea of [food provisioning as] a transactional relationship.”

Food sharing has a deep history within these communities, often sustained as an act of community identity, resilience, and resistance. For example, Program 5 expressed pride in their Appalachian history of neighbors sharing food, rooted in narratives about traditional practices of the

Cherokee Nation that once farmed in this region.⁴ The program drew upon this cultural tradition, even reviving cultural acts of food sharing that had lain dormant for several generations. In this context, sharing is not limited to those who cannot purchase or grow their own produce; it aims to strengthen the whole community by expanding both food access and interpersonal connection. The director of Program 5 explained, “We believe that good food is a right and that we as a community have the resources to be able to grow this food and share it generously. And that when we share there’s enough for everyone.” While programs in other models reported a culture of food sharing, it generally meant sharing abundance among friends or sharing as an act of charity. In contrast, Restructuring Model programs share food among all community members without differentiating between those who can and cannot afford local produce.

Notably, several Restructuring Model programs were in communities with the poorest health outcomes in their region or state, and, as the interviewee from Program 8 explained, had been founded to address community health “with food being at the very core starting place of that.” And although no interviewee directly said that their program goals were to improve mental health, there were many efforts to improve “wellbeing” and “community”—including through efforts to bring joy into the act of growing and sharing food. These programs utilized the tight-knit sense of community to support diet and lifestyle changes through canning classes, walking programs, and community meals. Notably, this model also includes supporting the livelihood of local farmers as an important element of community wellbeing. Programs that worked closely with community youth also include efforts to demonstrate economic opportunities in agriculture to reclaim cultural pathways and enhance community.

Several challenges of the Restructuring Model appear paradoxical. First, although successfully implementing the model requires significant time

and effort, there is pressure from both community members and external funders to see immediate results. Further, despite efforts to foster community cohesion by incorporating diverse cultural traditions, Restructuring programs experienced challenges navigating cultural differences—including those associated with race and ethnicity, political views, or even church affiliation—that can result in reluctance of some to participate in the program or interact with one another. The example below, which references the program director’s brother who works in the coal industry and attended a pickling class hosted by Program 8, illustrates this point:

He’s partnered with somebody from the Sierra Club. And that would not be his choice if you said, “Do you want to partner with somebody who wants to save the environment?” You know, he would say, “I don’t want to partner with somebody who wants to put everybody out of work.” But they’re then talking about how much spice to put in their pickles. And you know they have a good conversation and meet each other as neighbors that live beside each other, that didn’t know each other, and then meet each other. So, for me, it’s a long way of saying the local food is as much about growing community as the food aspect of it.

The challenge can be exacerbated in regions where the community is more heterogeneous and may be better represented as a set of communities with different histories and cultures sharing the same geographic space. Yet, as the episode above illustrates, this tension also presents an opportunity to bring together members of the broader community in new ways. While there can be elements of a program that appeal to shared values, to truly engage and serve diverse communities requires extended efforts.

Paradoxically, the key strength of the Restructuring Model—its rootedness in community needs

⁴ Acknowledging that this was a primarily white community, the program coordinator stated that the Cherokee Nation exemplified food sharing to the white colonizers of the area as an act of community during the initial winters. Many current residents can trace their lineage back to the colonizers, and they continue to practice the act of food sharing to pay homage to both their ancestors and the Cherokee Nation.

and assets—suggests that these programs may not be readily replicated everywhere. Restructuring programs draw heavily on their community traditions of food sharing as a resource for addressing community needs. Without shared food histories, the programs may not have formed in this way or had the same impact. When asked to share advice for other programs, the advice across this model centered on slowing efforts down in order to identify resources and absorb the lessons that come from mistakes. Leaders from Programs 6 and 8 explained:

It would not have been possible if we hadn't spent, you know, seven years building relationships ... the things that haven't worked, the things we've learned from, that's just part of being messy, but I mean, that is actually a big part of our strength. ... It's not easy. It's complicated, more complicated than anyone thinks it is. (Program 6)

Probably would have been better to go slower. And you know, working out some things beforehand, instead of after the fact. Sometimes I do say that it feels like a Sudoku puzzle. ... And, you know, I've just got 5, 4, 3, 2, 1. I got this, I got this. I got this. Then you get down to the last two rows. And it's like, oh, that doesn't work. Oh, that doesn't work. Oh, that doesn't work. So, some days feel like there's way too many that doesn't work, and you wonder, what could I have done differently to make it work. (Program 8)

Finally, these communities may have been highly motivated due to their desire for self-efficacy and resilience for themselves and their neighbors, as the most radical programs developed in communities with the greatest apparent need.

Market Model

The Market Model (Programs 9–11) emphasizes working within the current market system to increase fresh produce availability within whole communities. Depending on the specific community's needs, resources, and capacities, some Market Model programs created entirely new markets, and

others buttressed systems already in place by providing aggregation and distribution services. In either case, Market programs aimed to minimize the disconnect between growers and consumers. Like the Restructuring Model, the Market Model relies upon its understanding of community culture and history to align program structures with community values. In contrast, Market programs prioritize benefits to local growers; improving the well-being of the community is a secondary goal. The interviewee from Program 9 stated, “Well, the number one goal is to have a place where the landowners, the gardeners, and the farmers will have a place where they can sell their produce. But at the same time, it gives access to locally grown foods for those people in the community.”

The focus on growers distinguishes the Market Model from the other models we identify, but it directly reflects the priorities of the historically agricultural communities where these programs are situated. For example, Program 11, located in a community that highly values supporting farmer livelihoods, aggregates and distributes local produce to corner stores and hosts pop-up produce stands. Because corner store owners already value the livelihood of local growers, Program 11 did not have to compensate or incentivize owners to carry local produce. This same value encouraged consumers to purchase the produce, making it economically viable for the store owners while expanding access to more vulnerable community members. For this model, untapped markets are a powerful community asset. Programs 9 and 11 identified locations with customer bases that would benefit their existing networks of growers. Program 10 identified a local casino as a potential buyer and developed a growing operation to create jobs and support the local economy while also subsidizing the cost of produce for residents of a nearby reservation.

The primary challenges faced by the Market Model involve pricing, marketing, and logistics, which in many ways go hand-in-hand. Market interviewees repeatedly raised the issue of price, particularly the disconnect between the value of produce to growers and its worth to consumers. For example, the Program 10 interviewee explained that “in Mississippi, organic production is not very

important to people.” The perception that organic produce is overpriced is so widespread that this program calls their produce “naturally grown” and allows consumers to “forget that it’s organic.” Similarly, despite the community’s high regard for local produce, it still directly competed with other products sold at convenience stores. The limited refrigerator space, short shelf-life of perishable goods, and customer spending habits all presented a challenge for Program 11’s partnership with corner stores:

But a corner store has “X” amount of real estate that they have to try to make money off of. ... And there really has to be some commitment from the store owner that he or she see the value that it [the fresh produce] brings to the community. And often it can be a loss leader for other products.

Every Market program also referenced the challenge of competing with the price of processed foods at partnering corner stores, and with cheaper produce from stores like Wal-Mart and Dollar General. Furthermore, it can be even more challenging for customers familiar with highly standardized products to accept, as an interviewee from Program 11 explained, “local produce that does not always look like produce from the global food system.” These challenges were addressed by providing comprehensive education about health, nutrition, and food preparation, as well as about the benefits of eating locally for both farmers and consumers. As the founder of Program 9 stated, the interwoven educational components bring consumers to the food and encourage them to engage with it:

I think by having all of these different things on the site, under that farmer’s market shelter, it keeps them focused on the area, the food, the nutrition, the growers, and then the whole process of learning about why you need to eat fresh, locally grown food. I think that helps in terms of getting them to come to the market.

Another strategy the Market model uses to combat the perception that local produce is

unattainable is by accepting SNAP and EBT. Some of these programs also incentivize SNAP purchases by, for example, doubling the first ten dollars spent.

When asked to share advice for other programs, the founder of Program 9 described an unanticipated challenge they faced when setting up their market: “We thought we could just go in if we owned the property, just set up a farmer’s market. But you can’t do that. You do have to get approval from the town, and you have to get a business permit in order to operate.” Although this was overcome by working with the town to amend policy and permit the market, their founder advocated “engaging every segment of the community at the very beginning to get them to buy in.”

Regional Differences and Racial Healing

In addition to identifying four models of community-derived food access programs, an unexpected result of this work was uncovering subtle but important differences between programs located in the Appalachian Region and the Deep South—reflecting their divergent, yet parallel cultural histories of marginalization and resilience.

The six Appalachian programs are organized by and serve majority low-income white communities that bear the weight of historical marginalization and exploitation by extractive industries and governmental policies (Biggers, 2007; Ivancic, 2021; Peine et al., 2020). This enduring legacy has left the region with limited employment opportunities and gaps in social services, exacerbating the challenge of accessing healthy and affordable food. According to Pine and colleagues (2024), food insecurity is deeply intertwined with political and economic marginalization within these communities, where local geography, environmental factors, and economic structures intersect to shape the landscape of hunger. The director of Program 4, for example, underscored this history:

[Our] county has one of the highest poverty rates and highest food insecurity rates in the state of Ohio. So, it’s just, it’s a major issue locally, related to systemic things ... with a long history—like our reliance in this region

on extractive industries, for example, and a downturn in the economy related to that. So, we have especially high rates of poverty and food insecurity here.

Leadership from Program 11 also drew the connection between the region's social and economic history and the community's relationship to food: "So, we're situated, you know, in like Appalachian Ohio, the poorest region in the state, pretty rural, high hunger incidents, like old coal mining towns...[and] we're thinking about serving populations that didn't grow up cooking or maybe only have a microwave."

Despite the backdrop of historical exploitation, economic hardship, and widespread food insecurity, Appalachia harbors a robust tradition of community resilience and creativity, exemplified by vibrant local food movements that include small-scale farms, year-round farmers markets, independent restaurants, food trucks, and artisanal businesses producing an array of local foods (Batey et al., 2023; Chapman & Perkins, 2020; Engle, 2019; Purnell & Paulanka, 2008; Zgonc, 2021). Accordingly, the programs from this region present their histories of small-scale, subsistence gardening and food sharing as "synonymous...with community care" (Program 5). The director of Program 5 further explains:

The garden was started in a tradition in this part of the country called 'a garden that gives,' [where] everything that is grown [here] is then shared with the community without cost. It was started as a kind of a family style garden, so that there weren't individual plots where people were rented garden spots, that it was kind of communally-tended, and at that point with a volunteer manager. And then the food was shared to the soup kitchen and a food pantry in the county. So, that's the origin story...and we've kind of continued from that origin story. By uplifting the importance of people's dignity, when in fact they are in a food crisis, and then also bringing together community resources to address food insecurity.

Although the Appalachian programs were spread across the four models of food access programs, a common feature was their ethic of care, embodied in a commitment to "neighbors helping neighbors" (Program 3) as a means of also sustaining small-scale farming. Scholars such as Biggers (2007) and Catte (2018) have shed light on the region's rich history of grassroots activism as a beacon of hope, driving efforts to "build up community resources" (Program 5) in the face of systemic inequities. Appalachia serves as a microcosm of broader socio-economic struggles, where the pursuit of food security intersects with narratives of resilience that demonstrate the transformative potential of place-based approaches to addressing food insecurity (Pine et al., 2024). This point is illustrated by the founder of Program 8:

So, you know, gardening, it's always been a part of life. My mom was the youngest of nine children. ... Her dad died in '43 in a coal mining accident and my grandmother had nine children at home to raise and maybe she got \$149 a month social security benefits or something from them. But there wasn't a grocery store. I mean, they really grew everything that they ate. There was one little community store that maybe they would get soup, beans, and some things at. But, from just hearing those stories, I know the value of food and farming and gardening. And from being a child, and going to her house, and everything on the table coming out of their garden, meal after meal, after meal, after meal, you know. That was what was natural. So, I know that it can be done. And I know that it was done here. So, the community understood what our limitations were and what we needed to keep the program going successfully and they honor that.

In comparison, all six programs in the Deep South are organized by and serve majority non-white communities, specifically Black and Indigenous communities shaped by racialized social and agricultural histories that involve removal, enslavement, sharecropping, and land loss (Alkon, & Agyeman, 2011; Asch, 2011; Chang, 2010;

Hinson, 2018), as well as what White calls “collective agency and community resilience” (2018, p. 6). Several interviewees described the ways that these brutal histories have led people of color to associate farming with being “back in the ways of labor work” (Program 10). A board member from Program 6 further explained that “in the Delta, farming is the last thing that any Black parent would want their child to even have an interest in.”

Nevertheless, these programs—five of which align with either the Restructuring or Market models—have embraced small-scale farming as a source of resilience-as-resistance and self-determination (Penniman, 2018; Reese, 2019; White, 2018). The founder of Program 12 describes this tension between positive and negative perspectives on farming in a published interview (Toner, 2016):

I didn't have a good experience with the soil growing up. My family, we were sharecroppers. We grew up eating from the garden. But it was more of a process of pain. I can literally see this guy getting out of this pickup truck, telling my father that he didn't make any money for the year. It was so painful to watch my father be oppressed, to watch him walk away with nothing. That's why I did not like the land.

When I came back to the land, I had to deal with my anger. And I'm still coming through that process. But for me, working in the garden has been a healing place.

Responding to the violent legacy of agriculture in the Deep South, these programs seek to address and heal the collective trauma experienced by program members themselves and across generations in the community (Penniman, 2018). This is commonly addressed through youth education, because “kids teach the parents” (Program 7). Several Deep South programs, particularly Restructuring Model programs, include educational components that not only teach growing skills but encourage youth to embrace the opportunity to “make a living growing food” and emphasize the “dignity in it and the way that it improves the community” (Program 6). These programs work to rewrite the narrative and redefine youths' relationship with growing food as

a component of food justice (Leslie & White, 2018; Reynolds & Cohen, 2016). In teaching the history of suppression and resilience of Black growers in their region, Program 6 aims to ignite youth to reclaim agriculture, evidenced by their increased participation in program events. The founder of Program 9 discusses the multidimensional benefits of its educational component:

And these are middle and high school teenagers who learn to go out on the farm and they learn to start with the seed. They actually plant the seeds, they grow the food, they harvest it, and then they bring it to the farmer's market. ... So we tried to go through that whole gamut to teach them how to grow food. And at the same time, keep their connection to the land so that they know this is where your food comes from. And this is what goes into the process of getting that food from the field to the table.

A notable theme of the Deep South programs involves imparting agricultural knowledge and cultivating a sustainable livelihood among youth. Implicitly woven into the fabric of these initiatives is a profound acknowledgment: to ensure the longevity of agricultural traditions and cultural practices, there must be a concurrent commitment to economic sustainability. This recognition is particularly vital for communities grappling with enduring cycles of economic inequality. Embracing White's concept of economic autonomy (2018), these programs underscore the interconnectedness of agricultural education, cultural preservation, and economic empowerment as integral components for fostering resilience and prosperity within BIPOC communities. Notably, while several programs mention the necessity of healing collective racial trauma, this history is not framed as a deficit or a “barrier” (Leslie & White, 2018). Rather, the cultural history and experiential knowledge of Black growers as teachers and elders are reclaimed and embraced as important resources, as the founder of Program 9 discusses:

And then we also have what we call our African heritage diet, which goes all the way

back to Africa to show the healthy way to prepare those same foods. ... So these are certified instructors that prepare foods in their church cafeteria or different places to promote healthy eating and still eat your heritage foods. Because to me, there are certain things that I like. I'm not a fancy eater. I've always loved my collard greens, my sweet potatoes, black eyed peas, stuff like that. I eat several, but these are the things that I love. And I just learned how to prepare them in a more healthier way.

Program 6 builds upon the values of Black farmers in the region who "actually [farm] because they love the whole process of, that farming process, and then helping their community get their product." This exemplifies farming as an act of love for both the land and the community. Similarly, the founder of Program 9, which is established on a former plantation site, stated that many local farmers grow entire fields of produce to give away to the community—specifically, produce with cultural value, such as sweet potatoes, which many growers distribute around the holidays. The theme of embracing self-sufficiency and resilience as a form of resistance embodied by BIPOC growers is woven throughout all Deep South programs included in our sample.

Operating within a tribal nation presented additional challenges for Program 10. Although founded by tribal members, the program was not initially accepted by the local Indigenous community. Societal dependence on industrial farming over multiple generations had severed the community's relationship with traditional agriculture and, thus, the program's focus on organic practices made the community skeptical of its potential for success. Early on, farm operations were led by a non-Indigenous staff member who did not have the capacity to address the community perceptions while also managing a farm. Due to the lack of community engagement, our interviewee was hired "to create a better relationship within the tribal community so that people can know and see what they have right here under their nose." As a tribal member who could speak with the community's elders in their own language, they have been able to

cultivate a deeper connection via cultural identity and language: "We've noticed a lot of tribal members in general feel like they relate more to another tribal member. But we're hoping with me and some of the others, my coworkers that are tribal members, we can break that barrier feeling and bridge the gap."

With increased community engagement, Program 10 was motivated to create an educational component that embraced growing food on the reservation as "returning to our ancestral roots" and bringing "back the ability to do everything from scratch...make everything homemade." This is an example of how education is framed as "re-learning" and "re-education" within the Market Model; these programs tie their support for local growers together with a specific support for traditional/culturally appropriate/heritage foods and foodways.

To summarize, while both Appalachian and Deep South food access programs reflect the resilience of their communities in the face of marginalization and exploitation, they also manifest differences that reflect their unique cultural and social histories. Although the Appalachian programs aligned with all four program models, they draw collectively on a rich regional history of grassroots activism and resist the dominant corporate food regime (Holt Giménez & Shattuck, 2011) by decoupling local food from monetary value. In building on longstanding traditions of food sharing among neighbors, they are carving out a radical niche (Avelino, 2017) that works to sustain agriculture and address food security in the region. In comparison, the Deep South programs exhibit resilience as a form of resistance, particularly within communities of color (Reese, 2019; White, 2018). Broadly aligned with food justice movements (Alkon & Agyeman, 2011; Holt Giménez & Shattuck, 2011), most Deep South programs are enacting a kind of transformative power to "renew" and "reconfigure" the relationships between communities and their agricultural heritage (Avelino, 2017, p. 509) in ways that replace racial trauma with agricultural reclamation, youth involvement, and an emphasis on heritage and traditional foods.

Conclusion and Recommendations

Drawing on examples of community-derived food access programs across the Deep South and Appalachia, this study identifies and presents four models of rural food access programs, aiming to serve as a resource for communities interested in establishing similar initiatives. The Charity Model focuses on emergency food sourced from food banks, the Support Model utilizes local assets for emergency food, the Restructuring Model redefines or creates a new local food system, and the Market Model enhances community food access through established markets. As the first study of its kind, this research builds upon and extends the food system typologies presented by Holt Giménez and Shattuck (2011), offering a qualitative framework to evaluate and understand community-derived food access programs. While intended to inspire, these models are sufficiently flexible to accommodate communities' unique needs, goals, and cultural considerations.

Recommendations derived from this study are intended for two audiences: for community-based stakeholders who are developing or running food access programs, and for external stakeholders, such as food systems researchers, policymakers, and funders. Our interviewees shared several recommendations for program practitioners. They emphasized the importance of starting by identifying and leveraging community resources, particularly the time and knowledge of residents, which enables the community to identify additional resources, solutions, and cultural practices essential for a program's success. While community involvement is crucial, the interviewees also noted that external organizations could play a complementary role by filling resource gaps that the community cannot address alone. However, it is important for community stakeholders to define the extent and nature of external involvement. Our interviewees suggest approaching this work as an investment in uplifting the entire community, blurring the lines between those being served and those providing service, with equity as a guiding principle. Finally, our interviewees frequently highlighted the importance of patience, noting that meaningful and sustainable change takes time. Allowing space for learning and growth, even if it seems to slow pro-

gress, is vital for long-term impact.

We recommend that external stakeholders focus on ways to “reinforce” the work of community-derived programs (Avelino, 2017, p. 508). First, we advise continued research into the strengths and limitations of community-derived food systems programming and planning. Additionally, increasing attention to effects of community-derived programming in domains beyond the food system can help to normalize the approach and redefine the support of external organizations—redistributing power back to communities and lightening the burden when communities need to “push back” against top-down interventions. Taking this a step further, particularly as we argue that community members can be their own resources, we recommend that external organizations prioritize funding to compensate community-based stakeholders for their time and contributions to synergistic work. This alleviates financial burdens—a barrier identified in every interview—and allows community leaders to invest more of their resources in local work and programming.

Our final recommendation is for internal and external stakeholders to collaborate to address the research gap and increase the scalability of community-derived work. Future efforts would create resources to facilitate the exchange of knowledge among rural communities and assess the effectiveness of community-derived programs in contrast to traditional top-down approaches to food access. The barriers affecting rural communities' access to fresh foods also includes a gap in cross-community knowledge exchange, suggesting that some rural communities might be addressing challenges that have been resolved in neighboring communities. Hence knowledge sharing is vital to addressing those challenges.

Each model we identified has strengths and limitations, but collectively they offer a robust strategy for addressing the intersecting barriers to accessing fresh produce in rural America. Despite the cultural and historical differences between the Deep South and Appalachian region, by embracing food as a “common denominator,” “unifier,” and “starting place,” these models have the potential to reach beyond food access and contribute to broader improvement in economic and health inequali-

ties. Additionally, they can serve as adaptable frameworks for fostering community-derived efforts that endorse creative solutions and empower communities through decision-making autonomy.



Acknowledgments

We are deeply grateful for the time, trust, and stories shared by our interviewees, whose work blazes an inspiring path to follow.

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What scale for local food system planning? Insights from French case studies

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Submitted May 7, 2024 / Revised September 1 and September 26, 2024 / Accepted September 26, 2024 /
Published online January 2, 2025

Citation: Liu, T. (2025). What scale for local food system planning? Insights from French case studies.
Journal of Agriculture, Food Systems, and Community Development, 14(1), 427–447.
<https://doi.org/10.5304/jafscd.2025.141.015>

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Abstract

This paper explores the critical role of scale in food system planning. Although there is growing awareness of the importance of considering the city-region scale in food system planning, a comprehensive understanding of the scale of planning is lacking in this evolving policy field. This study addresses this gap by analyzing a series of food system planning projects developed at different scales in France. Drawing on document analysis and semi-structured interviews with officials, the paper explores three key dimensions of scale: administrative, action, and governance scales. Findings reveal that there is no relevant one-size-fits-all administrative scale for all food system planning projects. Instead, each administrative scale has its own

strengths and limitations. Smaller-scale planning is often more efficient for rapid implementation but may fall into the local trap, whereas larger-scale planning offers a more appropriate scale to meet the food supply-demand balance at a city-region scale but risks a long process of coordination and inefficient implementation. The study identifies local political willingness, legal competences, and spatial appropriateness as significant factors when determining at which scale to develop food system planning. Moreover, the study investigates how localities define “local” within their food system planning practices. They vary from the ambiguous “as close as possible,” administrative units, to

Funding Disclosure

This work was a part of the author’s PhD work supported by China Scholarship Council (grant numbers 201908310135) during 2019–2022.

Author Note

I conducted the research as a PhD candidate at INRAE, Université Paris-Saclay (France), and wrote, submitted, and revised the paper as a postdoctoral researcher at the University of Bern (Switzerland).

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quantified distances, but most action scales extend administrative boundaries. Finally, the study identifies locally designed governance strategies to match action scales and administrative scales, with empirical evidence from food system planning experiments applying cross-scalar and cross-local governance models. It also highlights challenges such as unclear distribution of responsibilities among jurisdictions, which hinders local implementation of actions. By providing empirical evidence, the paper contributes to a nuanced understanding of the scale issue in food system planning and emphasizes the importance of governance strategies and institutional design. The paper offers practitioners guidance on identifying and determining the scale of planning and governance strategies, while also providing scholars with directions for future research.

Keywords

agriculture, food planning, food policy, food security, food strategies, multilevel governance, public policy analysis, sustainable food system, regional planning, urban planning

Introduction

Local food systems are increasingly recognized for their potential to address challenges such as climate change, food insecurity, and social segregation (Allen, 2010; Baldy & Kruse, 2019; Feagan, 2007; Sherriff, 2009; Stein & Santini, 2022). In an era dominated by global food systems, public policies are critical in facilitating a transition towards local food systems. Public policies on food systems have long been a concern at international and national levels, addressing food insecurity through increasing productivity and the global food trade (Barling et al., 2002; Sonnino, 2016). However, this productivist approach has shown its deficiency, as it falls short in addressing localized issues regarding unequal access to healthy food and the ecological consequences of food systems (Morgan & Sonnino, 2010; Sonnino, 2016). Recognizing this shortcoming, practitioners and scholars have searched for solutions at the local level, thereby making food systems an issue in the local political agenda.

Over the past two decades, an increasing number of local authorities have initiated measures to support various aspects of food systems, ranging

from production to consumption. While many authorities have adopted segmented actions, others have embraced integrated policies to systematically support local food systems (Candel, 2020; Karetny et al., 2022; Liu, Korthals Altes, et al., 2024; Mattioni et al., 2022; Robert & Mullinix, 2018; Sibbing et al., 2021). These integrated policies, referred to here as *food system planning*, outline goals and actions for developing more sustainable local food systems (Sonnino, 2016). Such policies are also known by other terms, such as *food planning* (Horst, 2017; Liu, 2024) and *urban food policy* (Morley & Morgan, 2021). The content of food system planning may address different aspects of food systems—such as allocating land, organizing food distribution facilities, and locally sourcing for public catering—depending on the different targets to be achieved (Candel, 2020; Liu, 2024). Food system planning is a burgeoning field with numerous unanswered questions, one of which pertains to the appropriate scale of planning.

The scale of food system planning is inherently linked to the *local* scale of food systems. Researchers have argued that “local” encompasses multiple dimensions of proximity, with geographical proximity being the most essential (Enthoven & Van den Broeck, 2021). However, “local” is not a fixed geographical distance. In food studies, the concept of “local” food systems is often operationalized through the lens of “city-region,” which emphasizes connecting urban areas with their surrounding peri-urban and rural hinterlands (Carey, 2013; Fei et al., 2023; Jennings et al., 2015; Moragues-Faus & Marsden, 2017). These hinterlands are also referred to as a foodshed, or a geographic region that produces food for a particular population (Kloppenburg et al., 1996; Freedgood et al., 2011). In food system planning practices, the spatial boundary of “local” or “city-region” varies. It may span distances of 80 to 100 km (50 to 62 mi) or encompass a county, a subregion, or a whole country (Battersby & Watson, 2019; Carey, 2013; Morgan & Sonnino, 2010; Sonnino, 2016). Most food system planning projects do not rigidly delimit the local food system but rather describe it through the expected benefits (Mendes, 2007; Sonnino, 2016). Researchers have suggested that the boundary of city-region food systems should consider various

factors, such as foodshed, geographical appropriateness, jurisdictional boundaries, social coherence, and cultural identity (Borrelli & Marsden, 2018; Cavallo & Olivieri, 2022; Dubbeling et al., 2017).

Despite the emphasis on the city-region scale, planning mainly operates within jurisdictions. Most studies focus on food strategies adopted by municipalities (e.g., Mendes, 2007; Cretella & Buenger, 2016; Doernberg et al., 2019; Sibbing et al., 2021; Candel, 2020) or regional authorities (Ben-Othmen & Kavouras, 2022; Horst, 2017; Parsons et al., 2021). Some studies have shown that different food system issues correspond to different relevant scales (Battersby & Watson, 2019; Mendes, 2007). Born and Purcell (2006) have warned that scale is socially constructed and a given scalar strategy brings a certain direction of outcomes; they have alerted planners to the “local trap,” noting that not all local activities result in positive outcomes.

Further, studies have highlighted the need to match *the planning scale* with *the scope of local food systems it addresses*. Zasada et al. (2019) suggested that a challenge for food system planning is the mismatch between administrative boundaries and the spatial extent of the local food systems that the planning addresses. This mismatch leads to planning inefficiencies because the competence of an administrative body is linked to the actions it can undertake within its jurisdiction (Hayhurst et al., 2013; Prové et al., 2019). Governance strategies have been proposed to address this mismatch. For instance, some have advocated fostering collaboration between neighboring localities to jointly develop actions covering foodshed (Calori et al., 2017; Wascher & Jeurissen, 2017). Drawing from empirical studies on Vancouver’s planning, Mendes (2007) argued that municipalities can serve as effective “brokering institutions” that coordinate multilevel governance strategies.

The abovementioned literature outlines three dimensions of scale within food system planning:

1. The administration scale, which delineates the scope of the administrative jurisdiction within which planning authorities wield their power.

2. The action scale, which pertains to the spatial area that planning aims to cover.
3. The governance scale, which indicates the spatial scope wherein planning actions can be implemented through collaboration with partners.

However, several scale-related inquiries need *empirical* investigations for a deeper understanding. Concerning the administrative scale, although a recent study has shown how administrative scales affect the policy focuses of planning (Karetny et al., 2022), it remains unclear how the scales affect planning outcomes. Regarding the action scale, ambiguity exists surrounding how planning conceptualizes local food systems. In terms of the governance scale, although multilevel governance is increasingly acknowledged, it remains underdeveloped in planning practices (Fattibene et al., 2023; Sonnino, 2023). A comprehensive understanding of governance strategies, including their motivations and mechanisms, is lacking.

Thus, this paper aims to enhance the understanding of scale in food system planning by empirically examining a series of food system planning projects at various scales. This understanding will benefit both practitioners and scholars in the field of food system planning. For practitioners, a comprehensive grasp of scales will enhance the efficiency and effectiveness of implementation by identifying the appropriate actors to mobilize, setting suitable goals, designing achievable actions, and establishing governance strategies to manage cross-scalar matters. For scholars, the concept of scale presents a compelling framework to analyze and reflect on local governance within this emerging area of public policy. The research is guided by three questions and corresponding hypotheses derived from the literature:

1. Administrative scale: How do leaders at administrative levels of food system planning affect planning approaches?

Hypothesis: Food system planning project leaders¹ possess distinct competencies. These

¹ “Project leaders” in this paper refer to entities that develop food system planning projects.

competencies shape their roles and the policy instruments they employ across different administrative tiers.

2. Action scale: How is “local” conceptualized in food system planning?

Hypothesis: Food system planning projects define “local” based on geographic, cultural, and administrative factors, aligned with their objectives. This action scale often transcends administrative boundaries.

3. Governance scale: What strategies does food system planning employ to bridge the gap when the action scale differs from the administrative scale?

Hypothesis: Food system planning leaders establish partnerships with other stakeholders to create governance structures that extend beyond administrative boundaries to match the action scale. These strategies are based on the complementarity between stakeholders.

The empirical studies are based in France and focus on French local food system planning projects (*Projet Alimentaire Territorial*, or territorial food project). France offers an ideal test case because, unlike many other countries where food system planning is dependent on local initiatives, it has seen the widespread development of local food planning projects driven by a national scheme that actively encourages these efforts. These planning projects operate across various scales, offering a diverse array of samples for this study (Lamine et al., 2023). Despite the existence of the French Agriculture Act enacted in 2014,² which provides a nationwide framework for food system planning, food planning remains flexible, allowing ample room for local territories to explore different scales and experiment with locally adapted approaches to policymaking (Liu, Melot, et al., 2024). This institutional context is detailed in the methods section, together with case study areas and methods. Following this, the third section presents the results, aligning with the three dimensions of scale. The

paper concludes by discussing the results and providing implications for policymaking and for researchers regarding fostering sustainable local food systems.

Methods and Case Study Areas

Institutional Contexts

French food system planning, officially established by the 2014 Agriculture Act, aims “to bring producers, processors, distributors, public authorities and consumers closer together and to develop local agriculture and improve food quality” (Article 1). The state encourages local stakeholders to develop food system planning through annual financial programs managed by the Ministry of Agriculture. A call for projects has been issued annually to finance projects that meet the requirements of the call. Food system planning is not a statutory responsibility for any public authority, and the law does not define any responsible entity for launching and managing food system planning projects. Both public and private stakeholders are eligible to apply for funding through the call for projects. Private stakeholders serving as food system planning leaders must be nonprofit or for-profit entities with collective interests.

France has three tiers of local authorities: municipality (*commune*), *département*, and *région*. A group of municipalities form an intermunicipal structure (*intercommunalité*), which receives increasing power delegated by municipalities. Additionally, territories of projects are other forms of public entities, including territorial clusters (*pôles d'équilibre de territoires ruraux*, or rural clusters, and *pôles métropolitain*, or urban clusters) and regional natural parks (*parcs naturels régionaux*). Territories of projects contain multiple municipalities or intermunicipalities and ensure regional coherence. Existing food system planning projects operate at the scales of municipality, intermunicipal structure, *département*, territorial clusters, and regional natural parks. They are led mostly by public entities but occasionally by associations, cooperatives, or Chambers of Agriculture (farmers' support organizations). Food system planning leadership can involve a combina-

² Agriculture Act: Loi n° 2014-1170 du 13 octobre 2014 d'avenir pour l'agriculture, l'alimentation et la forêt.

tion of entities, such as two neighboring inter-municipal structures (France PAT, n.d.; Lamine et al., 2023).

Food system planning is not an embedded responsibility for any public authority but relies on leveraging diverse local capabilities, including land management, spatial planning, school catering, mobility, and territorial development (Bodiguel, 2018). No clear responsibility is defined by law. The major agrifood-related roles of public entities vary:

- Département councils manage canteen catering in high schools, own land, provide nonbinding advice on regulatory land-use planning, and have the capacity to establish perimeters for farmland and natural resources preemption rights.
- Municipalities and intermunicipal structures³ have land-use planning capabilities, manage primary schools and their canteens, and have the capacity to own and sell or bestow publicly owned land.
- Territorial clusters facilitate (inter-)municipal structures, particularly in rural areas, and may establish master plans, which are binding supradocuments for local land-use plans.
- Regional natural parks develop regional natural park charters, in which urbanization control and environment protection are included to guide territorial development.

Case Study Areas

Case study areas were located in two French regions, Occitania and Normandy. I identified them in the framework of a PhD project on land and food policies relating to the reterritorialization of agricultural activities. Their distinct agricultural characteristics offer a solid foundation for exploring a broad range of conditions and gaining a more

generalizable understanding of the consequences of scale. Normandy has the highest proportion of utilized agricultural areas and larger average farm sizes, whereas Occitania has a larger number of farms, a higher proportion of organic farming, and greater agricultural diversity (Chambre d'Agriculture Normandie, 2024; Chambre d'Agriculture Occitanie, 2022). These case studies included food system planning projects at diverse scales (Figures 1 and 2): municipality ($n = 1$), intermunicipal structure ($n = 16$), two neighboring intermunicipal structures ($n = 2$), département ($n = 3$), territorial cluster⁴ ($n = 12$), regional natural park ($n = 5$), and one regional natural park plus one rural cluster ($n = 1$). These planning projects exhibited complex spatial relations such as adjacency, overlap, or containment (Figure 3). Not all project leaders were public entities. The studied cases included three projects led by associations or a cooperative.

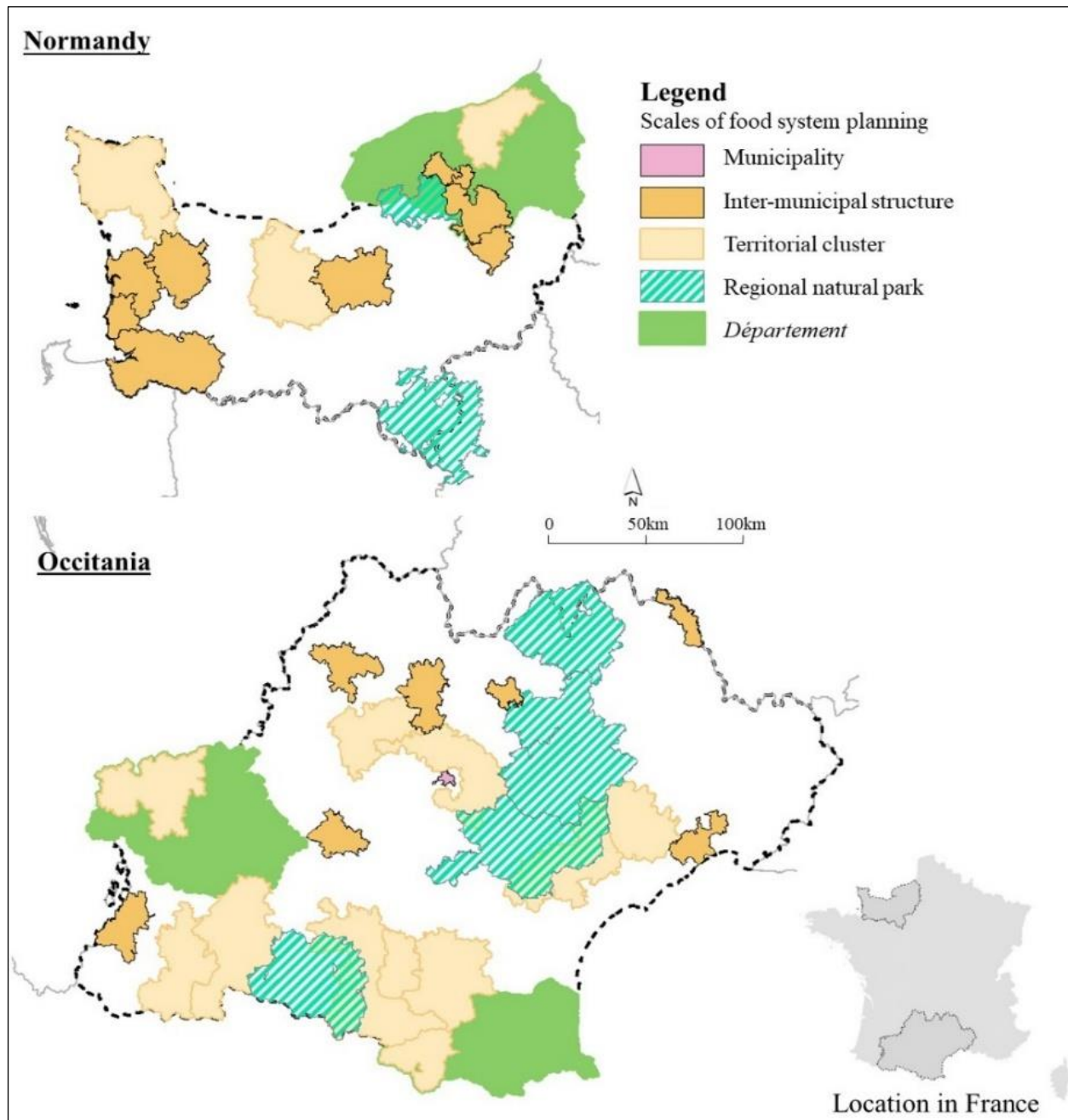
Data Collection and Analysis

I conducted data collection and analysis through semi-structured interviews and document analysis. These methods aimed to address the three research questions concerning administrative, action, and governance scales. For the administrative scale, data collection and analysis were conducted to understand the role of project leaders and the factors influencing their decisions in developing food system planning at its current scale. I used document analysis to compare policy instruments adopted by different levels of public entities. For the action scale, I focused on understanding the local conception of local food systems. For the governance scale, I collected and analyzed data to identify strategies and challenges for project leaders to take action beyond their administrative boundaries.

Semi-structured interviews took place between January and October 2021 as part of the aforementioned PhD thesis. Relevant interviews included principally project managers responsible for food

³ Municipalities and intermunicipal structures have similar rights. Municipalities can choose to or are obliged to delegate some of their capabilities to intermunicipal structures. This is also because municipalities in France are extremely small.

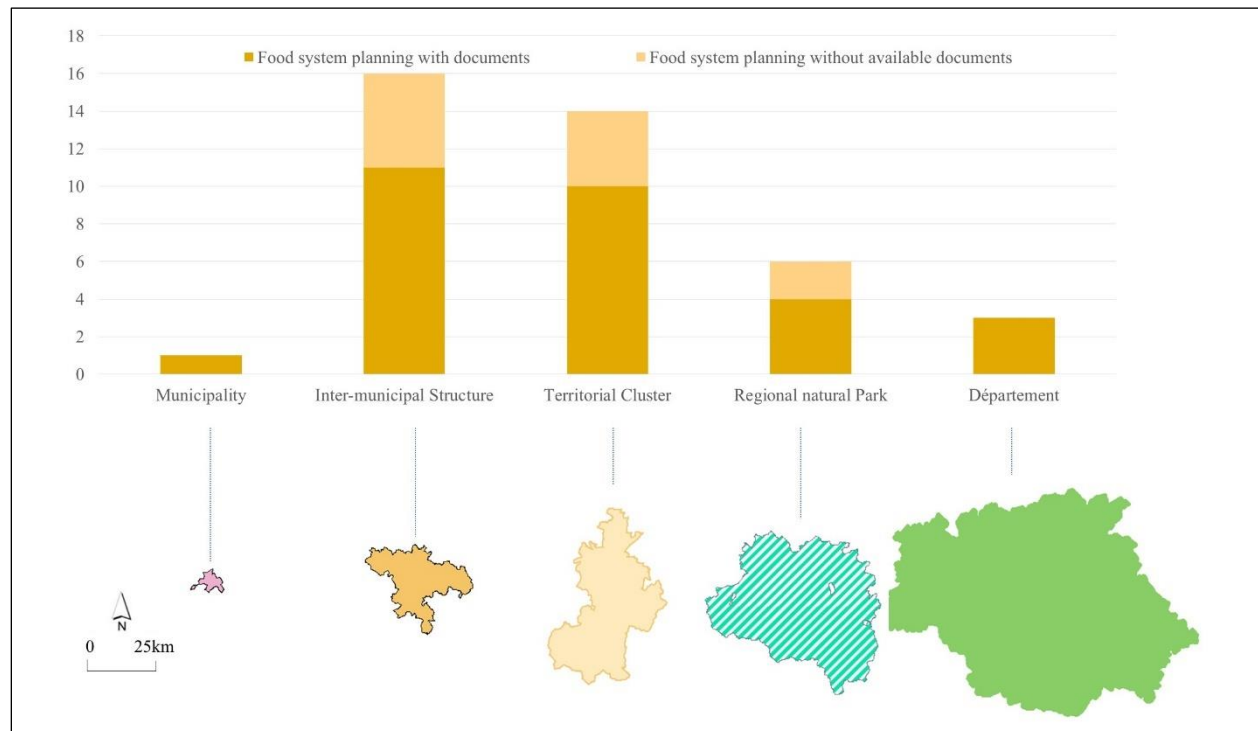
⁴ The territorial clusters apply to urban or rural areas (in the studied cases, mainly in rural areas). They are composed of a group of intermunicipal structures. The common major objective of these clusters is reinforcing the collaboration between local authorities (municipalities or intermunicipal structures).

Figure 1. Studied Food System Planning Projects

system planning. I identified them as principal interviewees because of their comprehensive knowledge of the entire process and their relatively neutral political positions. I also interviewed additional stakeholders, including staff from the Chamber of Agriculture and elected officials. They were invited either by the project managers for their local knowledge or by the author to provide

complementary information at the regional level. Interview questions related to this study covered (1) the role of project leaders, (2) the definition of “local” in food system planning, (3) the rationale for launching the food system planning at its current scale, and (4) strategies for collaborating with neighboring, supra-, or infraterritories in food system planning development and implementation. I

Figure 2. Dataset of Food System Planning Case Studies by Spatial Scale



Note. (a) Food system planning at the scale of two intermunicipal structures was categorized as a “rural cluster” considering the spatial scale. They were both at the scale of the pre-existing rural cluster. (b) Food system planning at the scale of a regional natural park plus one rural cluster was categorized as a “regional natural park.”

recorded all the interviews with the interviewees’ permission and transcribed them. I used the qualitative analysis software Atlas.ti to code the interview transcripts based on these four topics. I conducted the original interviews in French and translated them into English for all quotes included in this paper.

I collected food system planning documents from official websites and those provided by interviewees, including working documents. To address the question of administrative scale, I analyzed documents to compare the policy instruments adopted for food system planning at different administrative scales. I compared 10 policy instruments across four topics: land, collective catering, environment protection, and local food facilities. I grouped administrative levels with similar legal capabilities to facilitate comparison. The single municipality was combined with intermunicipal structures, and territorial clusters were combined with regional natural parks. I also reviewed docu

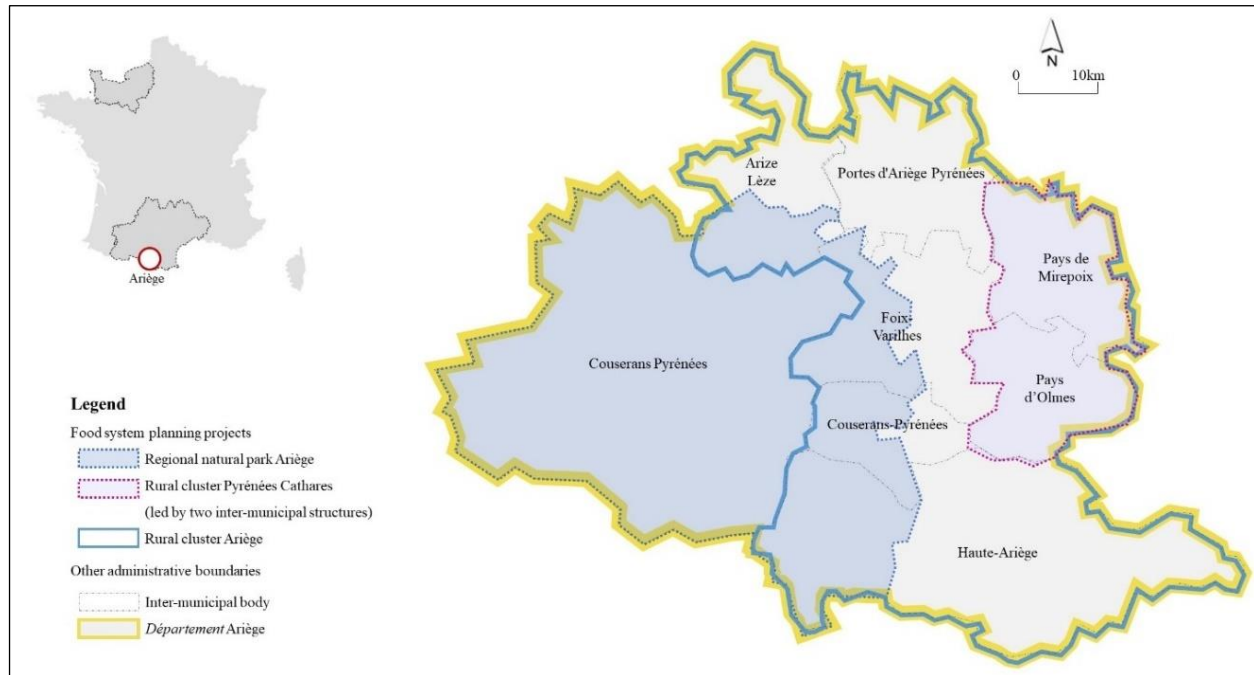
ments to identify the definition of local food systems and governance strategies.

Results

Administrative Scale: Compare Planning Approaches and Roles of Project Leaders

Planning approaches and roles of project leaders across scales

I identified the prevalence of selected policy instruments used by administration scales of food system planning through document analysis (Table 1). These policy instruments reflect the specific planning efforts involved in each project. Across all administrative scales, planning projects consistently addressed some topics and applied policy instruments to achieve them, such as collective catering and farm incubator development. Other instruments showed significant differences. For example, intermunicipal structures were particularly active in

Figure 3. Overlap of Food System Planning Projects at Different Scales: Example in Ariège

leveraging publicly owned land, whereas regional natural parks and territorial clusters were more inclined toward facilitating product diversification than other structures by providing analysis and strategies to improve product diversification and offering information, communication, and advice to facilitate farmers' transitions to being more eco-friendly (Table 1).

The roles played by project leaders further illustrated these disparities in policy instrument usage. Interviews reported that most food system planning project leaders play roles as project coordinators (including overseeing the plan, coordinating actions, organizing committees, monitoring agendas and budget, and applying for funding) and project managers (acting as project owners when implementing actions). However, their dominant roles vary depending on the scale of food system planning.

Municipalities and intermunicipal structures played a more significant role as *project managers* compared to other structures. They actively engaged in actions related to dispensing publicly owned land and buildings to facilitate local farming activities and food facilities (Table 1). Moreover, according to interviewees, (inter-)municipal struc-

tures often directly intervene in facility investments, such as managing logistics platforms or allocating publicly owned land for vegetable centers.

In contrast, territories of projects, that is, territorial clusters and regional natural parks, fulfilled more roles as *coordinators* and *facilitators*. These structures primarily coordinated partners due to their limited capacity to implement actions requiring substantial material or financial investment. These territories were active in developing food facilities (farm incubators, local processing facilities, and distribution facilities; Table 1). However, interviewees confirmed that they did not execute concrete projects themselves but rather coordinated partners involved in projects. Additionally, territories of projects played a specific role as *facilitators*, aligning with their responsibility to facilitate very local-scale authorities (intermunicipal structures and municipalities). For instance, these structures were the most active in training local authorities on land preservation tools (Table 1). As well, although collective catering is not an official responsibility of territories of projects, they actively supported school canteens through providing analysis, advice, and communication activities (Table 1).

Table 1. Comparison Between Policy Instruments Leveraged in Food System Planning Across Administrative Scales

Administrative scale of food system planning	Collective Catering	Facilities			Land				Environment	
	Provide analysis, advice, and communication to improve collective catering	Create farm incubators	Create local processing facilities	Create local food distribution facilities, e.g., food hubs, logistics, storage facilities	Use publicly owned land and buildings for local farming	Leverage land-use planning & associated instruments	Fallow land reclamation	Train local authorities on land preservation tools	Provide analysis and strategies to improve product diversification	Provide information, communication, and advice to facilitate farmers' ecological transition
(Inter-) Municipality (<i>N</i> = 13)	92.3% (12)	30.8% (4)	46.2% (6)	46.2% (6)	69.2% (9)	23.1% (3)	7.7% (1)	7.7% (1)	23.1% (3)	30.8% (4)
Territorial cluster/ regional natural park (<i>N</i> = 11)	81.8% (9)	63.7% (7)	54.5% (6)	36.4% (4)	18.2% (2)	36.4% (4)	18.2% (2)	63.7% (7)	54.5% (6)	63.7% (7)
Département council (<i>N</i> = 2)	100% (2)	50% (1)	-	-	50% (1)	-	-	-	-	-

Note. Food system planning project of Pyrénées Cathares was categorized under (inter-)municipality because the project was led by two intermunicipal structures; food system planning projects of Haute Vallée de l'Aude, of Pyrénées Catalanes, and of Pyrénées Orientales were not included in this comparison because their project leaders were not public entities.

Département councils mainly functioned as *coordinators*, with a dual role of coordinating both intradepartmental planning projects and numerous intermunicipal structures. According to the interviewees, however, this coordinating responsibility was still evolving:

This is a real question that the département is wondering: How it should be positioned? Should it encourage sharing and pooling? Can it be a support to help territories that do not necessarily have the means to develop food system planning or that have not thought about it too much; should it be positioned as a support? Should it take charge of certain actions on particular competences? So the question of the articulation of the positioning ... and the legitimacy of the actors to intervene in the different territories, it necessarily arises. (Staff, Chamber of Agriculture of the region of Normandy, June 11, 2021)

Département councils were only involved in a few concrete actions among the analyzed instruments (Table 1), one of which was collective catering in high schools, a core legal responsibility of département councils. Additionally, they may approach food system planning differently than other authorities, as reported by one interviewee who described their planning as a “road map”

rather than a regular “action plan.” As such, food system planning serves as a framework guiding food policies for future years, with detailed actions developed progressively.

Advantages and disadvantages of food system planning at different scales

According to the interviewees, scale was often not a primary consideration when launching food system planning projects. Most interviewees reported that localities typically initiated these projects as an extension of existing local agrifood initiatives, combined with incentives from the national initiative for developing food system planning. For example, rural clusters that had already implemented measures to enhance local supply chain activities frequently developed food system planning projects in response to national encouragement. However, scale emerged as an influencing factor in the initiation and evolution of certain planning projects. Evidence from five projects shed light on the advantages and disadvantages of small and large planning scales (Table 2).

The first two cases in Table 2 demonstrate the development of small-scale food system planning to seek implementation efficiency. The municipality of Albi intentionally developed planning at the municipal scale to guarantee implementation of measures to improve local agriculture and social justice, despite recognizing potential constraints

Table 2. Five Cases in Which Scale Played a Role in Food System Planning Processes

Food system planning project leader	Size (population; area)	Scale-related action and rationales
Municipality: Albi	48,526 p; 44 km ² (17 mi ²)	Developing food system planning at the municipal scale: Seeking efficiency
Rural cluster: Dieppe Pays Normand	109,821 p; 855 km ² (330 mi ²)	Down-scaling of rural cluster scale food system planning to intermunicipal structure scale: Seeking efficiency
Rural cluster: Armagnac	43,387 p; 1,700 km ² (656 mi ²)	Developing food system planning at the rural cluster scale due to failure at the intermunicipal scale: Political willingness
Rural cluster: Pyrénées Comminges	77,435 p; 2,137 km ² (825 mi ²)	Developing food system planning at the rural cluster scale because of an intermunicipal proposal: Territorial coherence
Intermunicipal structure: Tarbes-Lourdes-Pyrénées	127,086 p; 614 km ² (237 mi ²)	Wishing to upscale food system planning from intermunicipal to departmental scale: Balancing food supply-demand

Sources: Population and surface area data: Insee (2024), data in 2021; rationales: interviews.

related to administrative boundaries. Similarly, the rural cluster-scale food system planning in Dieppe faced obstacles due to the unequal political engagement of intermunicipal structures within the cluster. Consequently, one intermunicipal structure where stronger political interest existed developed its own food system plan.

However, small-scale food system planning also encountered challenges due to resource constraints. For example, although the municipality of Albi established a steering committee to develop actions beyond municipal boundaries to make use of other partners' capabilities, implementing certain actions proved challenging. These challenges were exemplified by restrictions on land use intervention:

When I set up market gardeners, for the moment, I do it on the scale of Albi. On this type of action, it is difficult to go elsewhere because each municipality is responsible for its own land; we will not “steal” land from our neighbors. (Civil servant, municipality Albi, Occitania, September 27, 2021)

Conversely, three other territories (Table 2) experienced the upscaling of food system planning, driven by either political or spatial considerations. In the rural cluster of Armagnac, initial attempts to develop intermunicipal scale planning were hindered by a lack of political interest in the intermunicipal structure. Consequently, the rural cluster took over responsibility. The two other projects were developed (or aimed to extend) beyond the spatial area under the initiating structures' administration. They sought to encompass both consumer and producer areas or to ensure territorial coherence across mountainous landscapes.

Action Scale: Diverse Interpretations of “Local” Beyond Administrative Boundaries

I examined the action scales of planning by analyzing the interpretation of “local” in food system planning. Interestingly, none of the food system planning documents explicitly defined “local.” I obtained insights into the interpretation of “local” from interviews, uncovering a diverse range of understandings across territories (Figure 4).

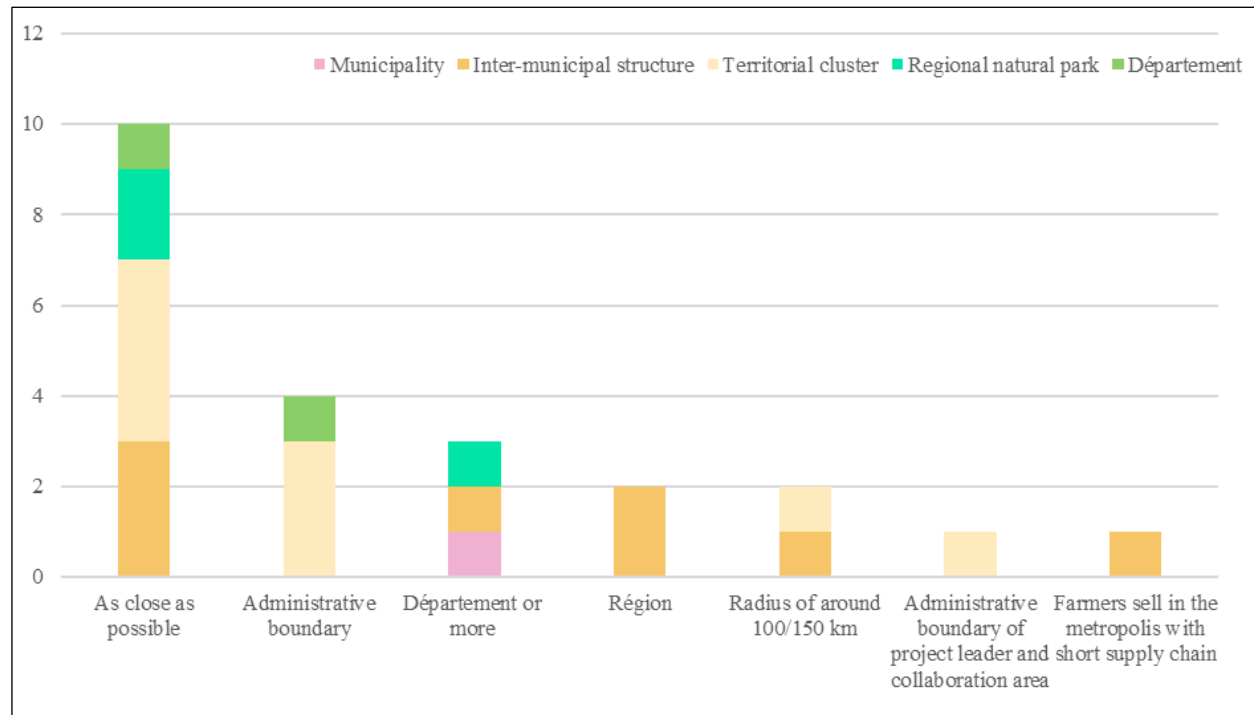
“As close as possible” was the most frequent interpretation of “local,” acknowledging the varying distances needed for sourcing different types of food due to physical constraints. Through a local food hub example, an interviewee illustrated how this notion would be implemented through different grades of proximity:

It will be done by priority. ... The first suppliers will be the shareholders of the cooperative with collective interest ... Then, if the necessary products are not available among these shareholders, the platform can buy from producers in the Pyrénées-Orientales département. Then, if the necessary products are not available from producers in the Pyrénées-Orientales, it will go to neighboring départements and then to the Occitania region, but really each time by strata. (Staff, Chamber of Agriculture Pyrénées-Orientales, September 24, 2021)

Interviewees of four food system planning projects, all managed at relatively large scales (rural administrative boundaries. In rural cluster Haute Vallée de l'Aude, “local” was linked to planning goals. The boundary was limited administratively because the central goal of the planning was to cluster and département), reported “local” as the support local producers rather than improve local supply chains. This interviewee also emphasized that “local” would go beyond the administrative boundary if planning goals changed.

In three territories, interviewees indicated that “local” food would be within the département or neighboring départements, considering food supply capacity. In Normandy, two intermunicipal structures defined “local food” as regional products, reflecting both spatial feasibility and cultural identity considerations.

Two territories defined “local” with physical distances. One suggested a radius of approximately 100 km (62 mi), reflecting consumers' living areas and local producers' capacity to reach consumers without intermediaries. In another territory, the definition referred to a radius of 150 km (93 mi), aligning with the concept of a production basin or academically termed “foodshed” (Kloppenburg et al., 1996).

Figure 4. Interpretation of “Local” in the Framework of Food System Planning

Note. (a) Data included 23 food system planning projects. (b) For the category “administrative boundary,” interviewees emphasized the administrative boundary but also mentioned food from neighboring territories or neighboring département might also be recognized as local.

Two other territories adopted unique interpretations of “local.” In the rural cluster of Haut Languedoc et Vignobles, the concept extended to a governance scale involving neighboring partners (the neighboring regional natural park, which has overlapping areas with the rural cluster). For example, their digital map for local food information encompassed the area of the rural cluster and the regional natural park. For the Metropolis of Montpellier, “local” addressed the logic of a short supply chain: “we stick to farmers who can sell through short supply chains in the metropolis, who can sell directly without going through wholesalers” (civil servant, intermunicipal structure Metropolis Montpellier, October 7, 2021).

Moreover, *none* of the food system planning projects identified self-sufficiency as an operational objective. Although the municipality of Albi initially aimed for self-sufficiency, it later abandoned the idea “because otherwise, we would not succeed; it would be discouraging after a while” (civil servant, municipality Albi, September 27, 2021).

The other two projects in rural areas engaged with the concept of “self-sufficiency,” interpreting it as improving local high-quality food production and distribution outlets.

Governance Scale: Overcome Administrative Boundaries Through Multilevel Governance

When the definition of “local” extends beyond administrative boundaries, food system planning needs to seek support from neighboring or supraterritorial entities to match the action and administrative scales. Case studies offered insights into strategies and challenges in transcending boundaries through multilevel governance. This governance approach entails both horizontal collaboration across localities and vertical collaboration between public entities at different administrative levels.

Cross-local collaboration

I identified four types of cross-local collaboration in food system planning. The first type of collab-

oration involved *formalized organizational relationships*. For example, two urban metropolises established collaborative partnerships with neighboring rural areas through conventions or reciprocal contracts (Comité interministériel aux ruralités, 2015). These agreements were based on the limited capacity of metropolises to support their own food supply and included coherent agrifood policy directions for the surrounding rural territories to follow.

The second type of cross-local collaboration was the *co-development of food system planning strategies between neighboring areas*. Although exchanges between most food system planning projects remained at the stage of technical communication and experience learning, some territories went further by collaboratively developing strategies. For instance, an “interplanning” document was developed to guide the food system planning projects of the Haute Vallée de l’Aude rural cluster (led by a cooperative, Maison Paysanne de l’Aude) and Castelnaudary (led by a municipality; Figure 5a). This collaboration aimed to ensure coherence, avoid competitive actions, and, most essentially, help each area complement each other due to the specialization of resources. The two collaborated projects valued this complementarity because livestock farmed in mountainous areas could be fed by crops provided from the plains, while public canteens in the municipality of Castelnaudary could be supplied by livestock from rural mountainous areas (Figure 5b). The two projects developed shared strategies in the field of food education, structuring supply chains, raising awareness among elected officials of farmers’ setups, and supporting food system planning management. The planning document also included budget estimates and responsibilities.

The third collaboration pattern involved *leveraging civil society organizations or private-sector actors* to overcome administrative boundaries, as these actors are not restricted by jurisdictional limitations. Interviewees reported that partnerships with entities such as farmers’ associations at département levels naturally extend actions to a larger scale beyond the administrative boundaries of food system planning.

Fourthly, *economic projects* provided opportuni-

ties to connect neighboring localities. Initiatives such as processing centers, transport and logistic platforms, food hubs, and producers’ shops were reported to facilitate collaboration between adjacent areas. While these initiatives prioritized proximity in sourcing suppliers or members, they were not constrained by the administrative boundaries of food system planning.

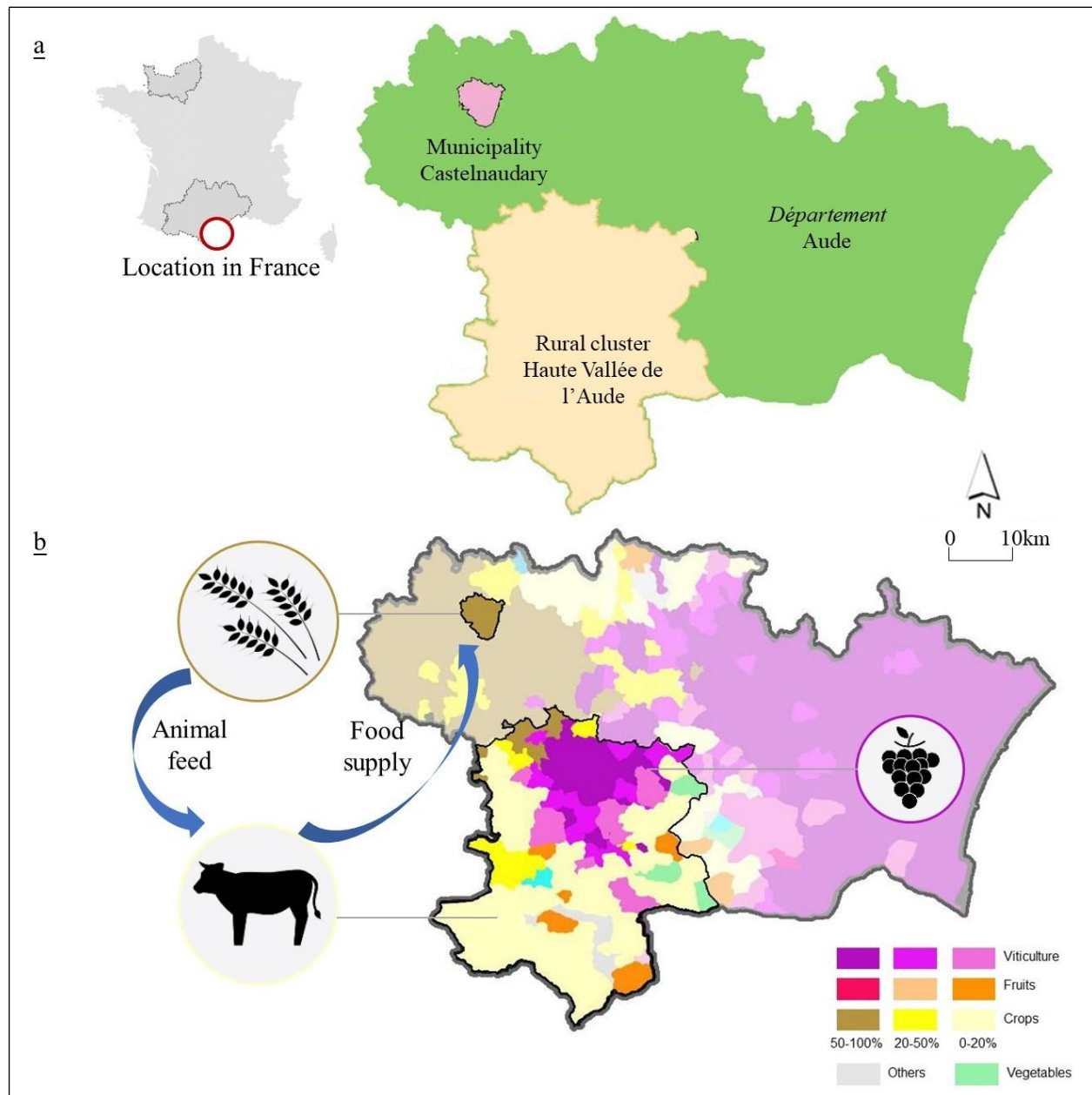
Cross-scalar governance

Governance involving entities at different levels was examined among overlapping food system planning projects, for example, in the case when a département and intra-département territories simultaneously developed their own food system planning projects (see, for example, Figure 3). Interviewees emphasized key collaboration issues such as coordinating actions on a global scale, avoiding vicious competition, and fostering synergies. For example, an interviewee from a département council highlighted the need to coordinate intra-département food system planning (i.e., planning developed within a département but at a level below the entire département area) to optimize the arrangement of collective food infrastructure:

Not all the food system planning projects are going to have their own vegetable centers or logistics platforms, even though this is an ambition in every food system planning [project]. It is clear that we cannot all have our own vegetable centers throughout the territory. So, the objective of the département’s food system planning is rather to enable exchanges between project leaders to see if pooling and sharing is possible. (Civil servant, département council Seine-Maritime, May 11, 2021)

Major challenges emerged in cross-scalar collaboration among overlapping food system planning projects due to the unclear distribution of responsibilities among administrative levels. This lack of clarity made project leaders cautious when exercising their power in planning processes. For example, département councils have the capacity to establish perimeters for farmland and natural resources pre-emption rights and integrate them into food

Figure 5. Collaboration Between Food System Planning Projects of Haute Vallée de l'Aude and of Castelnaudary



Note. 5a. Location relationship of food system planning projects. 5b. Major food production types and complementarity. 5b is adapted from a map of the dominant agriculture of municipalities in Occitania (DRAAF Occitanie, 2022).

system planning. However, none of the studied cases showed a willingness to do so. An interviewee explained that *département* councils tended to be hesitant in linking their prerogative with agriculture, in order not to offend other authorities or oppose their legal capabilities:

The relationship [between pre-emption perimeters and agriculture] could be made, there is no problem. ... The problem is really the politics of the *département* [council]. ... The agricultural competence was withdrawn from the Gers *département* within the framework of the

New Organization Act.⁵ ... So, there is an interplay of actors in the territory for which we have to be careful; we should not carry out an agricultural policy within the *département* in order not to offend other players in the territory. That is also why the *département* decided to go for food system planning, because it was politically easier. (Civil servant, *département* council Gers, June 17, 2021)

Due to these challenges, collaboration between different levels of food system planning mainly involved technical communication between project managers. I observed an exception in the *département* of Aude, where cross-scalar food system planning collaboration occurred. The action plan of an intra-*département* food system planning project, led at the scale of a rural cluster, integrated the actions of the *département* food system planning (Table 3). The rural cluster scale food system planning took into consideration the departmental actions to ensure complementarity and avoid repetition. However, it should be noted that the rural cluster-scale food system planning was led by Maison Paysanne de l'Aude, a cooperative operating at the *département* scale.

Discussion

This study examined the scales of local food system planning in the French context across administrative, action, and governance dimensions. Findings indicate that planning at different administrative scales plays different roles but does not have clear-cut characteristics in applying policy instruments. Moreover, there is no single relevant scale for food system planning; each scale presents advantages and disadvantages. The action scale, however, tends to transcend administrative boundaries, offering opportunities and challenges for governance structures to implement planning effectively. Although innovative governance structures were identified to implement actions beyond administrative boundaries, they encounter challenges in navigating multilevel governance within this evolving policy field. These challenges suggest the necessity of appropriate institutional design in food system planning.

The hypothesis regarding the administrative scale of food system planning assumed that project leaders' capabilities influence their roles and planning instruments. The results only partially support this hypothesis. Although project leaders' roles are indeed shaped by their legal capabilities, distinct

Table 3. Example of an Action Plan Integrated with Supra-Scale Food Planning

Main Topic	Subtopic	Action	Corresponding food system planning project
Collective catering	Supporting out-of-home catering projects to be sustainable and local, favoring introducing local and organic products in collective catering	Collective catering assessment of the rural cluster	Food system planning of the rural cluster: Funding from the recovery plan
		Locating the territorial offer in collective catering	
		Supporting voluntary municipalities to regain the re-municipalization of their canteens	
		[...]	
	Awareness-raising in collective catering	Animal- and plant-based protein: Finding a balance	Food system planning of the rural cluster: Other funding
		Promoting local and organic products in the institutions	Food system planning of the <i>département</i>
		Developing activities for schools "taste the world around me"	

Source: Translated and adapted by the author based on the food system plan of Haute-Vallée de l'Aude, 2021.

⁵ The *département* councils' capability for agricultural oversight was removed according to the New Organization Act 2015: LOI n° 2015-991 du 7 août 2015 portant nouvelle organisation territoriale de la République (1).

differences in policy instruments used by different administrative structures were not evident.

Municipal and intermunicipal structures function as both project managers and coordinators, often undertaking direct actions and managing concrete projects that require material investment. In contrast, territorial clusters and regional natural parks primarily act as coordinators and facilitators, supporting lower local authorities. Département councils play a role in coordinating actions as well as intra-département food system planning projects. It is worth noting that the limited number of projects led by départements in this research restricts the ability to draw general conclusions. Nevertheless, the findings reveal no clear distinction between policy instruments adopted by different administrative scales of food system planning. Three reasons likely explain this. Firstly, agrifood policies do not clearly distribute responsibilities across government scales, leading project leaders to reinforce their legitimacy by trying different possibilities. Secondly, many policy instruments are not coercive or are reliant on nongovernmental partners. These instruments are not associated with any embedded legal competence and can be managed by any scale of food system planning. Thirdly, the codevelopment nature of food system planning allows project leaders to expand their capacity by collaborating with partners (Ben-Othmen & Kavouras, 2022). It should be noted that this codevelopment depends heavily on coordination and communication work and may hinder efficiency (Santini & Fournier, 2024).

The results also highlight that food system planning can be managed at different scales, with no single scale being the most relevant. Although agrifood matters are new for all scales of local territories, territories have the flexibility to leverage capabilities held by different public entities. This flexibility may explain why food system planning is undertaken at various scales. Each scale can mediate multiscale actions, which Mendes (2007) referred to as “brokering institutions.”

Additionally, the rationales of project leaders for developing food system planning at specific scales help explain the advantages and disadvantages associated with administrative scales. Smaller-scale planning tends to offer efficiency in

rapid implementation but may fall into the “local trap” (Born & Purcell, 2006). By contrast, larger-scale planning provides a more appropriate scale to address food supply-demand balance at a “city-region” scale (e.g., Carey, 2013; Fei et al., 2023) but risks a long coordination process and inefficient implementation. This raises the question of the pertinent scale for the coordination and mobilization of actors. These findings suggest that the choice of food system planning scale entails trade-offs between political willingness, scale appropriateness, and implementation effectiveness.

In this study, I did not systematically explore the causal relationship between motivation and planning scale, partly due to the unique context of French food system planning. The national initiative has significantly influenced local food system planning by giving localities financial support and legitimacy. Thus, French food planning projects, which are primarily initiated by public authorities, are distinct from those in other contexts (Liu, Korthals Altes, et al., 2024). This study shows that most localities developed their plans at their own scale, driven by the national initiative and based on existing agrifood initiatives. The few cases in this study where scale considerations influenced planning highlight the evolving nature of this new policy field. Future studies could investigate how driving stakeholders and the initial motivation of planning influence planning scales, especially in contexts where these factors vary significantly.

Concerning the scale of actions, I hypothesized that the definition of “local” food systems is influenced by geographic, cultural, administrative factors, and that the scope of actions often extends beyond administrative boundaries. The results reveal varied interpretations of “local,” ranging from the concept of “as close as possible” to administrative units or quantified distances. None of the interpretations perfectly align with the ideal foodshed, suggesting that the “foodshed concept is more a metaphor than an actuality” (Freedgood et al., 2011, p. 98). These interpretations also reflect the logic of geographical proximity, cultural identification, and the economy of proximities (Torre & Wallet, 2014). Furthermore, the findings support the hypothesis that most action scales extend beyond administrative boundaries, highlighting the

need for governance strategies to match the scale of action and the scale of competence.

None of the food system planning projects examined in this study explicitly defined “local” in their written documents. This finding is consistent with Sonnino’s (2016) findings from international food system planning cases. A possible explanation is that project leaders mean to keep food system planning open and to avoid limiting actors’ participation. This raises a fundamental question in planning practices: Should a clear definition of “local” within food systems be established in planning to delineate the scope of actions, or is it preferable to maintain an open and inclusive approach?

In terms of governance scale, the hypothesis proposed that when action scales and administrative scales do not match, food system planning leaders may establish partnerships with other stakeholders to ensure mutual benefit and action implementation beyond administrative boundaries. The results reveal diverse forms of governance structures that involve private entities, neighboring territories, and other levels of public bodies. However, these governance structures were locally developed through experimentation and not universally established. Cross-scalar governance appears to be particularly complex due to unclear responsibilities between different levels of authorities, highlighting a need for guidance on relevant scales for actions.

I identified cross-local collaboration as primarily driven by economic and political motivations, consistent with previous findings on French food system plans (Corade & Lemarié-Boutry, 2020). Examples include collaboration between neighboring territories based on urban–rural resource complementarity, cooperation on collective food infrastructure for economic viability, and partnerships with associations and private actors who operate beyond administrative boundaries.

Despite pioneering projects testing innovative ways of cross-scalar collaboration, the results highlight challenges for cross-scalar governance between food system planning projects developed within the same territory. What scale is appropriate for what policy instrument remains unclear. This unclarity introduces uncertainty to project leaders when they seek to implement actions that are not clearly within their legal capabilities. A previous

study has argued that different food system issues correspond to different relevant scales (Battersby & Watson, 2019). My study suggests that the design of policy instruments should consider both social-economic viability and political appropriateness (i.e., aligning with the capabilities and existing projects of project leaders at that scale).

In summary, the findings of this study on the three dimensions of scales of food system planning offer valuable insights into addressing the concern over the “local trap” proposed by Born and Purcell (2006), who have argued that local does not inherently yield benefits from environmental, social, and economic perspectives. Indeed, there can easily be a “local trap” from a technical standpoint due to limitations related to administrative boundaries and legal competences. Nevertheless, this study demonstrates that appropriate cross-scalar and cross-local governance mechanisms can overcome these barriers and avoid such a “trap.” The process of organizational institution design must be accompanied by the process of learning, as illustrated by the studies on the evolution of the London metropolis food system planning (Morgan & Sonnino, 2010; Parsons et al., 2021; Reynolds, 2009).

Conclusion

Local food system planning has emerged as a new public policy focus in many localities, with its scale remaining an underexplored question. This study breaks new ground by empirically investigating the impact of scales on food system planning through a series of French cases, analyzing three dimensions of scale: administrative, action, and governance scales. These dimensions provide a nuanced understanding of the complexity of scale, while the empirical approaches illustrate strategies and challenges in practice when operationalizing this theoretical question.

Understanding scales with these multiple dimensions provides insights to practitioners involved in food system planning, including politicians, officials, and grassroots activists. My findings indicate that there is no one-size-fits-all best planning scale for every locality. Therefore, practitioners should consider local contexts—such as political willingness, legal capacity, and spatial appropriateness—when designing food system planning

and be prepared to make necessary compromises. Practitioners at the national or regional level could establish guidelines defining which scales of localities are most appropriate for specific actions. Evidence from this study indicates that larger-scale localities might be more effective at coordinating regional facilities' spatial distribution, managing rural–urban land use, and promoting product diversification. In contrast, smaller-scale localities are better suited for concrete implementation actions, such as allocating public land and establishing test farms. These actions should, however, integrate the legal capabilities and political willingness of localities. Given that each scale presents unique strengths and limitations, localities should develop tailored governance strategies to coordinate stakeholders and ensure effective implementation. The results of this empirical study provide practical guidance for multilevel governance strategies. This guidance includes establishing formal partnerships between localities, co-developing strategies and actions, leveraging private actors to overcome administrative boundaries, and using economic projects to connect neighboring localities. However, it is crucial for localities to adapt these strategies to their specific political and social contexts.

These findings also offer valuable insights into research in food system studies when engaging issues of scale. This study highlights the challenge posed by the unclear distribution of responsibilities among different levels of authorities, which hinders effective food system planning. Further research could focus on identifying the appropriate agrifood competency at each scale to enhance collaboration and resource allocation across jurisdictions. These responsibilities might include organizing food hubs and other distribution facilities, land use, product diversification, educational activities, and school catering sourcing. Additionally, research could draw from traditional planning experiences, such as land-use planning, to explore how the coordination be-

tween different levels of authority can be improved. Future empirical studies assessing the implementation of policy instruments would also help determine which scales are most suitable for specific actions. Studies dedicated to multilevel governance models and their effectiveness could also contribute to the field of food system planning. Scholars could explore the conditions under which such models succeed or fail and develop frameworks that support effective coordination across scales, thereby minimizing conflicts and redundancies. This study also demonstrates the varied understandings of “local,” suggesting future research should be context-specific. Future research could aim to standardize definitions and develop a typology of “local” regarding food systems.

While this study addresses the question of how scales shape planning, it also raises an important question: How does planning shape the scale of local food systems? As Born and Purcell (2006) claimed, scale is socially constructed. Planning should be understood not only by the outcomes but also by the processes through which partnerships take place and stakeholders exchange information and experience. These processes enable planning to shape local food systems that it aims to develop, considering factors such as environmental sustainability, cultural identity, and the population whose quality of it aims to improve. Only by considering these elements together can we contribute to the structuring and improvement of sustainable food systems.

Acknowledgments

I sincerely thank Romain Melot and Frédéric Wallet (both based at INRAE, France) for their assistance in the data collection preparation and the early draft of this paper. I am also grateful to my interviewees for the valuable information they provided, and to the three anonymous JAFSCD reviewers for their constructive comments.

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Regional food system sustainability: Using team science to develop an indicator-based assessment framework

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Submitted November 6, 2023 / Revised April 29, July 15, and August 28, 2024 / Accepted September 10, 2024 /
Published online November 20, 2024

Citation: Wiltshire, S., Beckage, B., Callahan, C., Chase, L., Conner, D., Darby, H., Kolodinsky, J., Kraft, J., Neher, D. A., Poleman, W., Ricketts, T. H., Tobin, D., von Wettberg, E. J. B., & Niles, M. T. (2025). Regional food system sustainability: Using team science to develop an indicator-based assessment framework. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 449–472. <https://doi.org/10.5304/jafscd.2024.141.011>

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Abstract

Food system sustainability, and ways of measuring it, are widely explored and discussed in academic literature. Measurement efforts are challenging because food systems are inherently complex and multifaceted, spanning diverse components, industries, sectors, and scales. Several systems of indicators and metrics have been proposed to measure sustainability; however, most existing research focuses either on narrow scales (e.g., farm level or within a single supply chain), expansive scales that can gloss over complexity (e.g., national or global assessments), or limited scopes (e.g., only considering environmental factors). A gap in the literature is a holistic local or regional approach to food system sustainability that integrates components across the system at a regional scale. In this reflective essay, we describe our development of a framework to measure and track sustainability in

such systems. We use a tiered framework that includes five sustainability dimensions and a system of indices, indicators, and metrics that allows for the measurement of important food system characteristics in a feasible and reproducible way. We employ a collaborative, transdisciplinary, facilitated team science process to first propose, and then refine, a sustainability assessment framework, using the U.S. state of Vermont as a case study. This paper details our process and progress, as well as reflections on challenges and recommendations for other team scientists. We further propose a plan to implement the framework, collect data, and engage with community members. The experiences and findings described here serve as a foundation for our own team's continued work, as well as a springboard for other similar research efforts.

Keywords

sustainability, food systems, team science, metrics, transdisciplinary, indicators, local, regional

Note: All author details are on the next page.

Introduction

Sustainable food systems (SFS) are critical for society to meet its food, fuel, and fiber needs over the coming decades (Willett et al., 2019). Yet characterizing precisely what is meant by and how to measure food system sustainability is plagued by challenges in scale, definition, variable measurement, and data acquisition. Here we present and reflect on our development of a regional food system sustainability assessment framework using a transdisciplinary team science approach (Cross et al., 2022; Feenstra, 1997). To date, our team has established

the structure of the framework, formed consensus around a set of important indicators, and grappled with many critical theoretical questions. While the work is ongoing, we believe it is important to publish at this stage to help guide other practitioners undertaking similar research efforts.

Several high-level efforts have been made to define food system sustainability. For example, the Food and Agriculture Organization of the United Nations (FAO) defines an SFS as “a food system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised” (Nguyen, 2018, p. 1). Similarly, since 1990, the U.S. Department of Agriculture has defined an SFS as:

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Author Contributions

SW, BB, and MN contributed to conceptualization and design of the study. All authors were involved with the series of meetings and actions toward framework development described in this paper. SW consolidated findings to form the current framework, performed data visualizations, and wrote the first draft of the manuscript. LC, DT, and SW collaboratively drafted the narrative document; and DN, MN, and HD reviewed it. All authors contributed to manuscript revision, read, and approved the submitted version.

Funding Disclosure

Funding for this work was provided by the UVM Food Systems Research Center via a cooperative agreement (59-8090-1-001) with the USDA Agricultural Research Service.

an integrated system of plant and animal production practices having a site-specific application that will, over the long term: satisfy human food and fiber needs; enhance environmental quality and the natural resource base upon which the agricultural economy depends; make the most efficient use of nonrenewable resources and on-farm resources, and integrate, where appropriate, natural biological cycles and controls; sustain the economic viability of farm operations; and enhance the quality of life for farmers and society as a whole. (U.S. Department of Agriculture [USDA], 2024)

As researchers within the Food Systems Research Center, a joint effort between the University of Vermont and the U.S. Department of Agriculture's Agricultural Research Service (USDA ARS), we aim to develop a framework that is rooted in current sustainability definitions yet expands upon them by adopting a regional perspective. Regional food systems stem from the geographic fixity of primary production factors like topography, climate, and natural resources (Clancy & Ruhf, 2010). The boundaries of a region can be difficult to define, but it has been suggested that an approximate 400-mile (644-km) radius is a good place to start (Clancy & Ruhf, 2010). Others conceive of a regional food system as being centered around and providing for a large urban area (Blay-Palmer et al., 2018).

More important than strict physical size, however, is the fact that regional food systems foster a shared sense of place based on common experiences of crop options, farm and food business scales, distribution networks, and consumer markets, which lead to tight-knit community connections. Regional food systems have been defined as "collaborative networks that integrate sustainable food production, processing, distribution, consumption, and waste management in order to enhance the environmental, economic and social health of a particular place" (Feenstra & Campbell, 2014, p. 1). Through this lens, a sustainable regional food system is one in which "as much food as possible to meet the population's food needs is produced, processed, distributed, and purchased at multiple levels and scales within the

region, resulting in maximum resilience, minimum importation, and significant economic and social return to all stakeholders in the region" (Clancy & Ruhf, 2010, p. 1).

Our conception of regional food system sustainability builds on existing sustainability definitions that primarily emphasize food, fuel, and fiber production; viable business models; nutrition outcomes; and environmental health. In addition to these, our framework captures co-benefits like aesthetics, recreation, and cultural values to better understand how farms and other food businesses contribute to the well-being of farm families and local communities. Following others, we also consider factors like regional self-reliance, self-organization, and resilience to outside disruptions as core tenets of regional food system sustainability (Prosperi et al., 2016; Worstell & Green, 2017). Our framework aims to improve the measurement and documentation of sustainability outcomes within local and regional food systems, which has not been a primary focus in many existing studies.

Scholars have long debated how best to conceptualize sustainability and how to break the overall concept into its components, often called "dimensions" (Vos, 2007). The most common framework is the "three pillars" model, in which sustainability is split into economic, environmental, and social dimensions (Purvis et al., 2019). However, due to the complex, interconnected nature of coupled human and natural systems (of which the food system is an example), it can be difficult to cleanly subdivide sustainability into discrete components. For example, questions remain as to whether the "overall sustainability" of a system is even measurable, because there are inherent tradeoffs between dimensions (Morrison-Saunders & Therivel, 2006). Positive movement in one dimension may lead to negative movement in another, so decisions about what to prioritize are often required, which leads to further questions about who has the power to decide and who does not.

Food systems scholarship explicitly recognizes and grapples with the complex interconnections between its various elements (Feenstra, 1997). Food system components include production on farms, distribution, marketing and sales, consump-

tion (including nutrition outcomes), as well as social factors like community vibrancy, employment opportunities, labor conditions, resource access, social justice, etc. It is critical to note that a food system is not simply a linear chain of processes, but rather a network of interacting components defined by multiple tradeoffs and feedback loops that is embedded in a broader institutional and environmental context (Chaudhary et al., 2018; Jones & Tobin, 2018; Low et al., 2015; Meadows, 1998). The inherent social-ecological nature of food systems also presents challenges for cleanly subdividing sustainability outcomes into distinct categories (Prosperi et al., 2016). Any attempt to assess food system sustainability across dimensions and components requires a wide range of expertise spanning various academic disciplines as well as other modalities of knowledge creation, that is, a truly transdisciplinary approach.

Stemming from concepts in systems thinking, the use of data-driven indicator frameworks to assess complex outcomes has been increasingly preferred (Meadows, 1998). An indicator is simply a variable describing the state of a system; a good indicator is both feasible to measure and reflects a specific desirable, yet complex, outcome within a system (Walz, 2000). Applied specifically to food system sustainability, there has been a historical shift from a focus on regulations, to standards and certifications, and finally to indicators and metrics as a mechanism to incentivize sustainable practices (Konefal et al., 2022; Ludden et al., 2018). Developing a system of indicators for a complex food system requires uniting expertise from a variety of domains, for example using a Delphi process (Allen et al., 2019; Campbell et al., 2022), or another team science approach (Cross et al., 2022; Hall et al., 2012).

The use of indicators should allow the ability to measure and reward progress toward specific outcomes, such as by establishing performance benchmarks or through payments for ecosystem services. This approach can help farmers, consumers, and policymakers make sense of agricultural sustainability by offering an apples-to-apples method of comparing different systems, as well as tracking performance of one system over time. A system of indicators also makes assessment of

tradeoffs more obvious, providing opportunities to discuss the inherent complexity of sustainability.

Project Overview and Goals

This project is among the first to develop a sustainability indicator framework focused specifically on local and regional food systems (Allen et al., 2019; Low et al., 2015). We aim to produce a reliable and repeatable method to identify, collect, and interpret sustainability data at a middle scale, and across diverse system components, to inform local and regional decisions that require robust information about the current and future state of their food systems. To do this, we began by funding concept papers proposing sustainability indicators across multiple aspects of local and regional food systems through USDA ARS funding. We then brought those diverse groups together into a team with deep expertise in all key knowledge areas. To develop the framework, we used a transdisciplinary team science process, with a core facilitator group guiding the efforts of the wider team, integrating feedback and synthesizing results (Cross et al., 2022; Hall et al., 2012). The process and progress presented in this reflective essay serve as a foundation for further work by our team and others. Although the framework itself is still undergoing development, we wish to share our team science process so that important lessons can be passed on to other research teams.

Our experience contributes to the literature on food systems sustainability in several important ways. Following others, we reiterate the importance of expanding the scope of sustainability dimensions. While the three-pillar model has been used most often (Purvis et al., 2019; Schader et al., 2014), scholars have increasingly identified additional dimensions beyond environmental, economic, and social components (Reganold & Wachter, 2016; Spiegel et al., 2022). We build on this, especially regarding the development of new types of social and human indicators, which have historically presented challenges (Bacon et al., 2012).

Additionally, this study is set apart by its unique scope and scale of analysis, specifically focusing on a holistic conception of food systems and thus incorporating farms, food businesses,

communities, and individuals at a regional scale. Existing sustainability assessment frameworks differ across their primary purposes, levels of assessment, and geographical, sectoral, and thematic scopes (Schader et al., 2014). While there is no shortage of research assessing the sustainability of food systems and/or agricultural producers, a general overview of existing studies, detailed below, indicates that they typically fall within one of three categories of scale: (1) farm, field, or household scale, (2) single-sector supply chain, or (3) national or international.

The first common type of sustainability assessment is the analysis at the farm, field, or household scale, which largely focuses on biophysical and/or microeconomic dimensions. This type of framework may assess individual agricultural production or management strategies, asking questions like “is organic agriculture more sustainable than conventional agriculture?” (Haas et al., 2001; Nemecek et al., 2011; Reganold & Wachter, 2016). Similarly, frameworks like the sustainable livelihoods approach assess how different agricultural management strategies influence livelihood outcomes at the household level (Serrat, 2017). Several efforts in this category have taken the form of computer applications with front-facing interfaces that can be used by individual farm businesses (Eichler Inwood & Dale, 2019). Examples include the Fieldprint Calculator (Gillum et al., 2016), Stewardship Index for Specialty Crops (McIntyre, 2010), and COMET-Farm (Paustian et al., 2017).

The second common style of sustainability assessment focuses on supply chains within a specific agricultural sector. These studies measure outcomes within individual food supply chains, for example, assessing the sustainability of palm oil against other cooking oils (Boons & Mendoza, 2010; Choong & McKay, 2014), or whether local supply chains necessarily confer sustainability advantages over national supply chains (Born & Purcell, 2006; Coley et al., 2009).

Finally, the third common category of sustainability assessment is the large national or international study. These projects use a global lens in which the units of analysis are typically countries, and they employ broad-scale statistical metrics (Béné et al., 2019; Chaudhary et al., 2018;

Gustafson et al., 2016; National Research Council, 2010). While useful at a macro level, this scope can wash out important regional differences and limit the utility of results for policy creation at smaller scales.

Our study goes beyond these three common assessment types to fill a gap in the existing scholarship. Developing a system of indicators to measure food system sustainability regionally is novel and nascent. While some attention has been given to community food system planning (e.g., Pothukuchi, 2004), our inclusion of diverse food system actors and consideration of complex interactions at the regional scale is a contribution to the academic literature, as suggested by Dale et al. (2013) and others. While our framework is intended to be widely applicable to multiple regional food systems, as a first step, we focus on the northeast U.S., using the state of Vermont as a case study for framework development.

Our midscale focus presents data challenges not present with the three commonly used scales described above. For example, small-scale analyses can use direct field sampling and/or farms’ or households’ economic data; supply chain analyses can employ existing industry data provided by food companies; and global analyses can leverage statistical datasets made available by governments, non-governmental organizations (NGOs), intergovernmental organizations (IGOs), and university researchers. To characterize regional sustainability, new methods for data collection and processing must be identified.

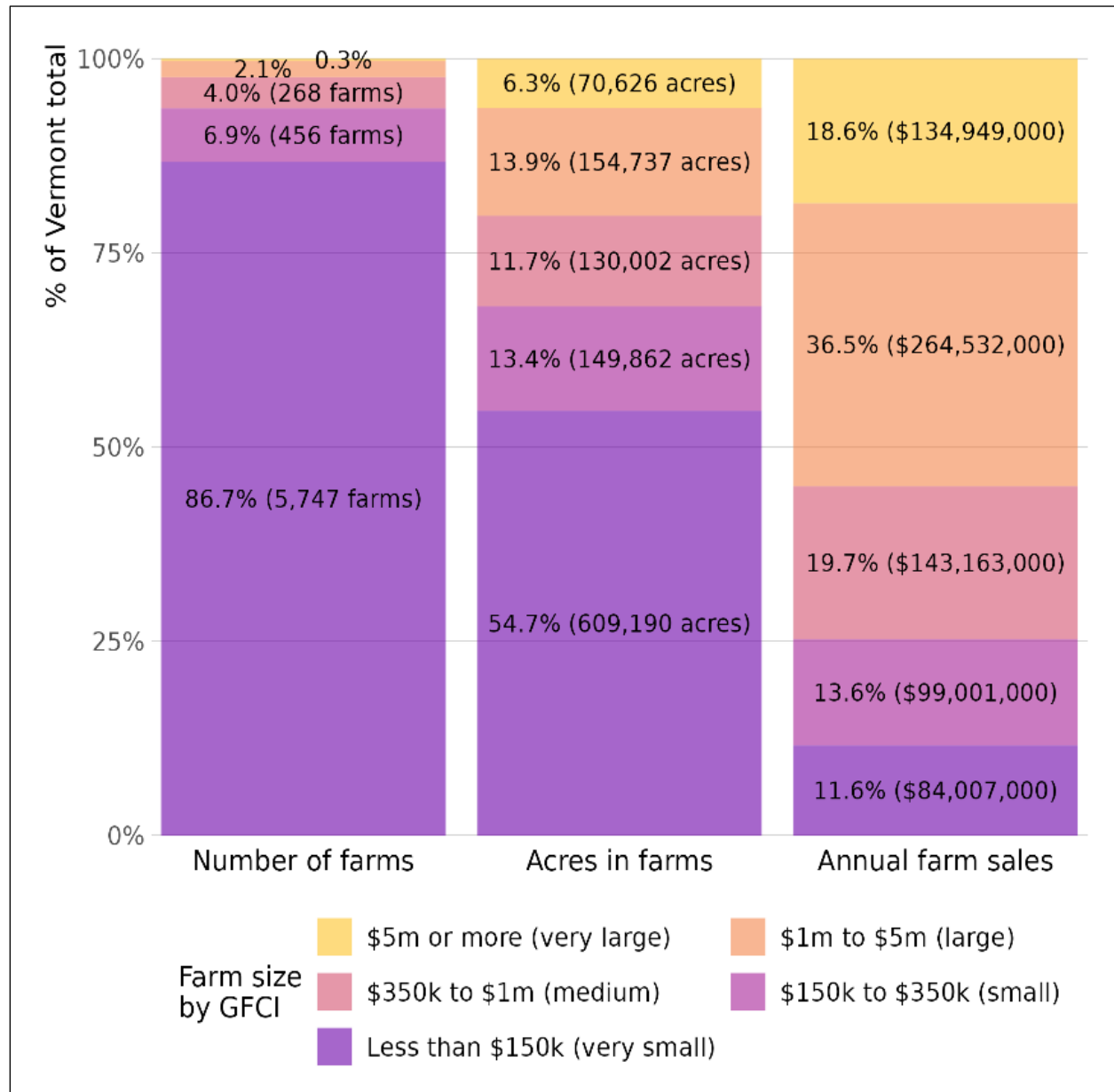
Vermont’s Food System

With the overarching goal being to develop a regional food system sustainability framework that can be applied widely, we began by utilizing our back yard. Vermont’s food system is reflective of the midscale network we are interested in. For example, Vermont is characterized by numerous small and medium farms driving production (Figure 1). Among farms in Vermont, 98% are classified as small or medium, encompassing 80% of farmland and accounting for 45% of farm sales (USDA National Agricultural Statistics Service [USDA NASS], 2017). While dairy is the primary agricultural industry (accounting for 65% of total

farm revenue), Vermont's farms are quite diverse: out of 6,627 farms, only 11% produce cow's milk (USDA NASS, 2017). The prevalence of diversified small and medium-sized farms makes assessing sustainability in smaller regions like Vermont somewhat different from studies focused on larger (e.g., U.S. national) scales, which primarily reflect large monocultural farmers selling into commodity markets.

We acknowledge that Vermont's food system differs from many other regional food systems. Our region is relatively rural, so applying our framework to regions centered around an urban center or centers will require additional consideration. Further, due to its positionality within the U.S. context, Vermont's food system differs in important ways from similar-sized regions in developing countries. However, despite these limita-

Figure 1. Key Statistics on the Vermont Agricultural System Stratified by Gross Farm Cash Income (GFCI)



Data from U.S. Census of Agriculture (USDA National Agricultural Statistics Service, 2017).

tions, an initial focus on Vermont offers a practical lens through which to begin developing an assessment framework.

A goal of this project is to focus on a holistic network of food system components, rather than narrowly on production statistics, because it is at the systems level that landscape-level benefits related to nonfood ecosystem services, community livability, and other factors emerge (Bacon et al., 2012). Vermont is characterized by strong interpersonal connections among food systems actors within the region. Many producers sell into alternative supply chains and leverage nontraditional income streams, including agritourism, direct-to-consumer marketing, regional distribution networks, and others (Chase et al., 2021). This interwoven fabric of actors across different components of the food system is important for regional food system sustainability and has been widely recognized as a strength in the Vermont context (VT Farm to Plate Network, 2019).

Materials, Methods, and Results

Here we present our process and progress toward a regional food system sustainability assessment tool. We used a transdisciplinary team science approach to develop an indicator framework that meets our goals. Our team is composed of a diverse group of researchers and extension professionals with deep experience in Vermont's food system. Areas of expertise include rural sociology, plant and soil science, watershed science, landscape ecology, agricultural and community economics, agricultural management, nutrition, data science, computational modeling, and group facilitation.

Our process followed the four phases of team-based research proposed by Hall et al. (2012): development, conceptualization, implementation, and translation. This paper focuses primarily on the development and conceptualization phases. Following the experiences of other research teams who have used similar transdisciplinary approaches to study complex food systems issues (Cross et al., 2022), we endeavored to make our process inclusive and collaborative, allowing space to step back and reflect on our progress and goals, and flexible to adapt to challenges as they arose (Figure 2). Below we provide detailed descriptions of each

research phase. While we are not suggesting that this is the only way the problem could have been resolved, we hope these descriptions and reflections will offer guidance to other practitioners. We conclude by discussing challenges, lessons learned, and recommendations for other team scientists, as well as plans for this ongoing long-term project.

Concept Papers

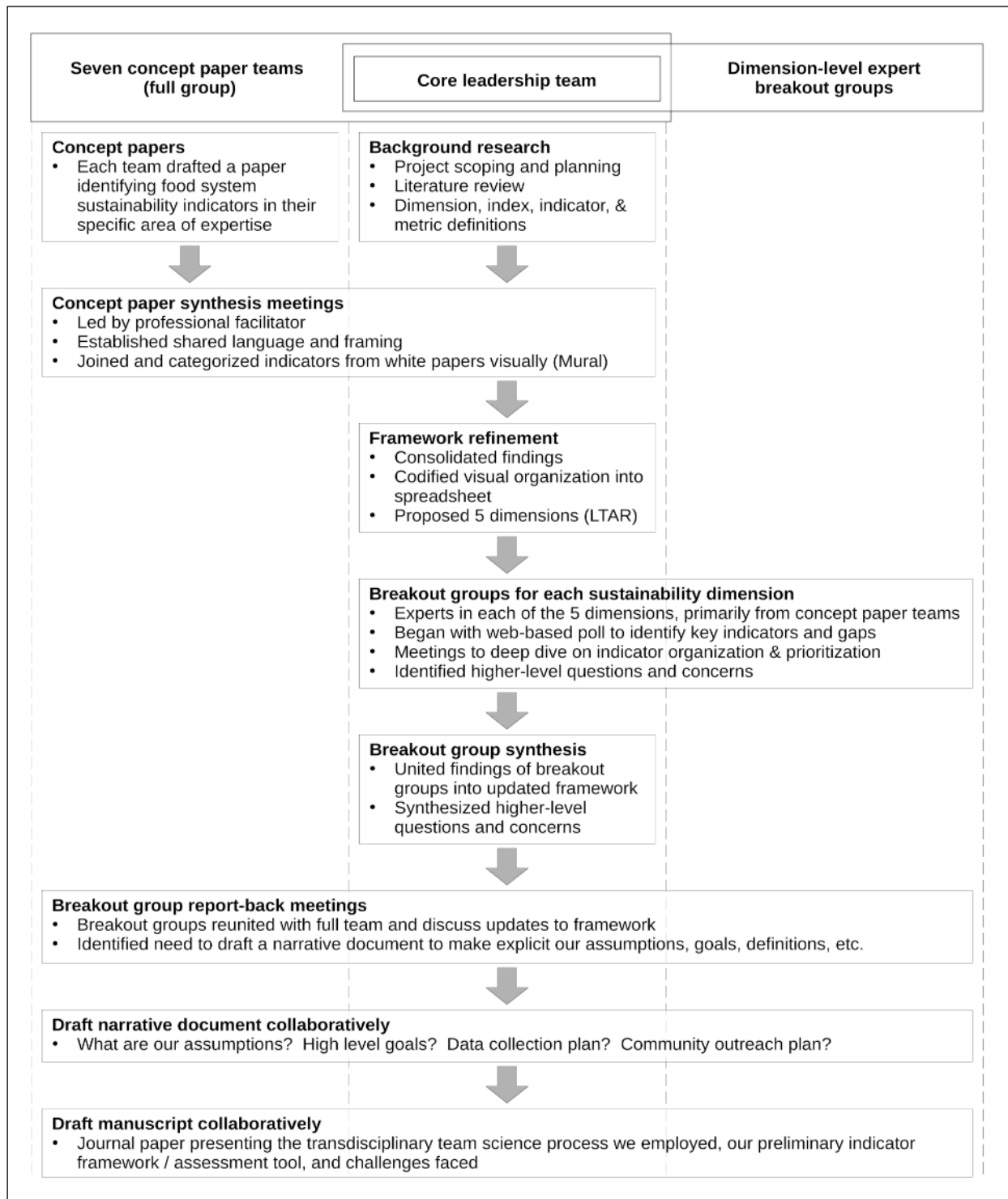
In the first stage of the process, The University of Vermont's Food Systems Research Center (FSRC) developed a request for proposals for interdisciplinary teams to generate concept papers proposing ways to measure sustainability in local and regional food systems. Seven teams were funded for their work, collectively representing more than 50 faculty, post-doctorates, students, and external collaborators. All the concept paper teams were based in the U.S. state of Vermont, although external collaborators were in other U.S. regions including Puerto Rico and Appalachia. The papers' subject areas included farm business benchmarking (Cannella et al., 2021), agroecology (Caswell et al., 2021), agritourism and direct-to-consumer sales (Chase et al., 2021), participatory research (Estrin et al., 2021), a case study on hemp production (Kolodinsky et al., 2021), soil health (Neher et al., 2021, 2022), and community embeddedness (Ament et al., 2021, 2022).

These concept papers were critical for generating a multiplicity of indicators of food systems sustainability; however, without a single unifying framework provided to teams *a priori*, their collective work represented a diverse and free-form set of potential ways to measure sustainability. As a result, the FSRC developed a facilitated process consisting of three workshops with representatives from all seven concept paper teams to aggregate the concepts into a unified framework.

Synthesis Meetings

Representatives from the seven concept paper teams came together in a series of initial meetings, led by a professional facilitator, to discuss what a combined indicator framework should look like in our specific regional context, and to synthesize findings from the concept papers. The major task of these meetings was to summarize, consolidate,

Figure 2. Team Science Process Diagram for the Collaborative Development of Our Sustainability Assessment Framework



and organize proposed indicators from the concept papers into a unified system. A core leadership team composed of a postdoctoral researcher (SW), a professor (BB), and the associate director of the FSRC (MN) undertook background research to suggest how the teams' interdisciplinary studies could be combined coherently. Based on this initial research, we used a nominal group technique (Delbecq & Van de Ven, 1971) with the full team to refine concepts and definitions iteratively, eventually landing on a sustainability framework established through a consensus process, composed of dimensions, indices, indicators, and metrics (Fiksel et al., 2012). Relationships between these components are visualized in Figure 3, and each is described in more detail below.

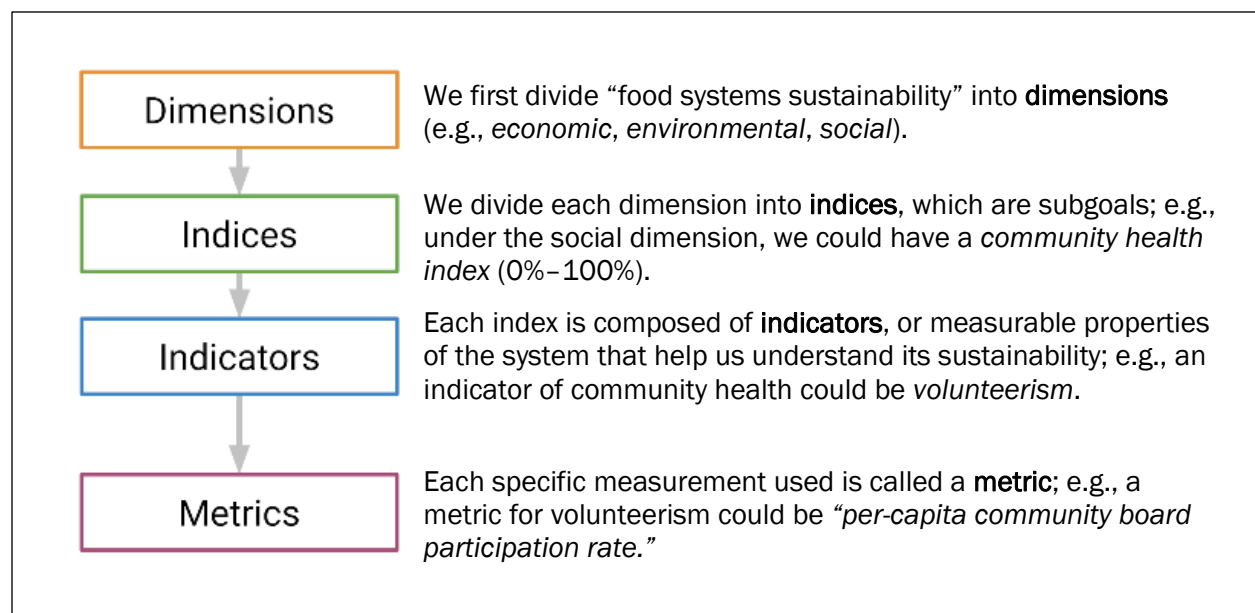
To facilitate joining indicators into a wider sustainability framework, we needed to group them thematically. Following many others, we use the term "dimensions" for the primary, high-level goals of sustainability (Fiksel et al., 2012). Historically, three dimensions of sustainability have been proposed (environmental, economic, and social), although in theory any number of dimensions are possible (Vos, 2007).

Within each dimension, one can identify important subgoals that contribute to sustainability

in that dimension. The system's performance on each of these subgoals can be represented as an "index," or a value derived by combining several key indicators within that category (Mayer, 2008). Indices are sometimes referred to as compound- or complex-indicators. We define an index as an amalgamation of multiple indicators that reflects a certain general property or goal of the system. An index is more granular than a top-level dimension, yet more generalized than an individual indicator. The index is the level at which outcomes will typically be communicated in the overall framework. For example, within the environmental dimension of sustainability, soil health is an important criterion. To quantify this, we could formulate a "soil health index" based on a set of individual indicators like soil organic matter content, CO₂ flux, and aggregate stability.

An indicator in our framework defines a specific aspect of the system we wish to measure (Walz, 2000). The sheer number of possible indicators is a notable challenge when trying to create a usable framework (Schader et al., 2014). Because the system is so complex, we sought to identify a succinct set of indicators that, together, provide an accurate picture of the state of the system across all dimensions.

Figure 3. Definitions of Dimensions, Indices, Indicators, and Metrics that Compose Our Assessment Framework



Selecting indicators is nuanced and riddled with complexity. Effective indicators should be responsive to management, affect or correlate with outcomes, and be capable of being measured precisely within feasible technical and economic constraints (Doran & Parkin, 1994). Indicators may be qualitative or quantitative, as long as a standardized method is established to unite different types of indicator data. Indicators can be neutral (a simple description) or value-laden (normatively describing progress toward a given goal) (Heink & Kowarik, 2010). In the case of sustainability, we are typically dealing with normative indicators, i.e., the indicators are helping to answer the question, “how sustainable is the system?” This means value judgments must be made about the elements of sustainability that are prioritized, which we discuss in the Recommendations section.

Whereas an indicator identifies the system characteristic to be measured, we define a metric as the specific method, procedure, dataset, or assay used to implement the measurement itself. To be useful, the sustainability assessment framework must be repeatable, both through time in the same region, and across different regions. For each indicator, one or more standardized measurement methods along with applicable units must be identified. For example, to measure soil carbon, an active-carbon POXC (ppm) test could be employed. Identifying specific metrics for each indicator will eventually be necessary as the framework is rolled out, but this is beyond the scope of the current phase of the project.

While the index is the level at which outcomes are typically reported, our assessment framework is tiered, meaning different levels of abstraction are possible. We could formulate an outcome value for each dimension, e.g., an environmental sustainability score composed of all the indices under the environment dimension. We could even unite all the dimensions into an overall sustainability score for the full system. However, it is important to maintain the ability to “drill down” into the individual indicators, because forming a compound indicator involves subjective decisions about the weighting of different components and can obscure the critical tradeoffs inherent to sustainability.

A method to report and visualize this type of tiered data is a class of plot called a radar, petal, spider, or sunburst. Figure 4 shows how we propose to use such a plot to illustrate outcomes in our sustainability assessment framework. In this case, the length of each labeled bar in the outer ring represents an index value, and colors correspond to sustainability dimensions.

Once the full team had agreed on a basic framework structure, we used an online collaboration platform called Mural to visually organize the proposed indicators from the concept papers (MURAL, 2022). This collaborative, bottom-up approach was chosen to aid in the consensus-building process using a nominal group technique (Delbecq & Van de Ven, 1971). This technique allowed for individual idea generation, idea sharing, group discussion, and consensus. The facilitator first placed indicators from each concept paper into Mural as “sticky notes,” and team members were able to reorganize them, add notes and connecting arrows, etc., individually and then through discussion. After a first pass by the full team, three subgroups convened individually, each focusing on one of the categories of environmental, economic, or social sustainability. At the end of the meeting series, we arrived at a rough visual organization of proposed indicators within a set of dimensions and indices, which was agreed upon by the participants (Figure 5).

In addition to indicator refinement, several theoretical considerations emerged from this meeting series. For example, we needed to define the boundaries of the food system more specifically. This included the spatial scale of the system (in our case regional); which elements of the food system we capture (e.g., production, distribution, retail, nutrition, human well-being, social cohesion, etc.); and by whom the assessment framework is meant to be used (Fiksel et al., 2012). We also discussed inherent complexities within the system, such as cases in which an indicator does not fit cleanly into a single dimension but instead bridges multiple dimensions. The theoretical considerations and inherent limitations we identified are discussed in the Recommendations section.

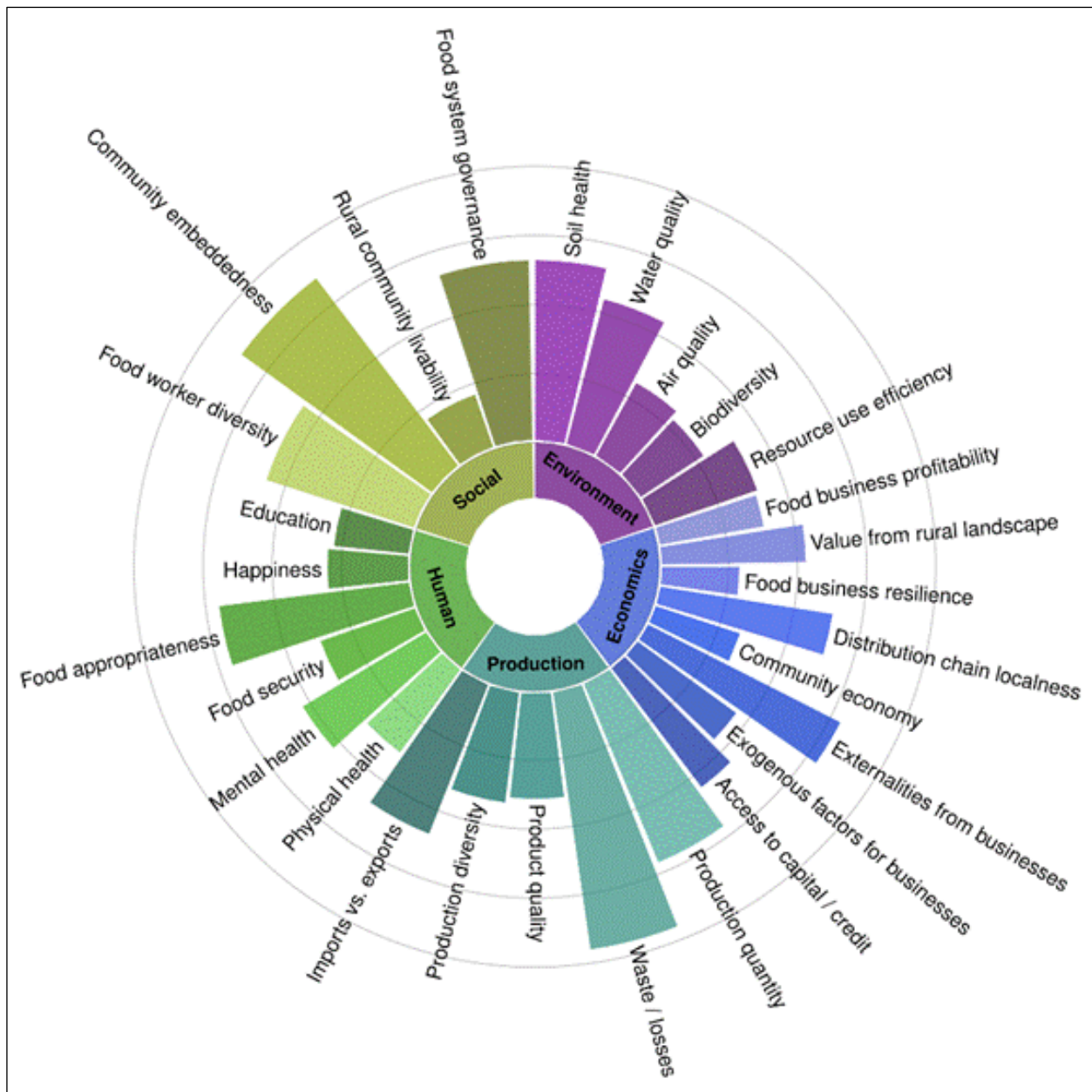
Framework Refinement

After the initial meeting series, the core team refined the visual organization of indicators into a more organized spreadsheet format. Through this process, we became aware of a sustainability indicator project currently in progress by the USDA Long-Term Agricultural Research (LTAR) group,

and the core team joined LTAR's meetings to identify synergies between our projects. While LTAR focuses on a slightly different aspect of sustainability (specifically, sustainable intensification), it has faced many similar challenges (Spiegel et al., 2022). One of these fundamental issues is the limitation imposed by the typical "three pillars" model. Fol-

Figure 4. Sunburst Plot of the Type Proposed to Communicate Sustainability Outcomes

Shows the five dimensions at the center, indices under each dimension grouped by color, and values for each index corresponding to the length of each bar. In this example plot, the dimensions and indices are taken directly from our framework, but the values are random for illustrative purposes only.



The reorganization into five dimensions was an improvement, but upon reflection we realized we still had too many overall indicators to be feasible, identified gaps where important aspects of food system sustainability were not covered, and

For the next phase of framework refinement, we collaboratively identified four fundamental criteria by which to weigh indicators for inclusion:

A) Indicators proposed in each concept paper

This section displays a collection of concept papers, each containing a set of proposed indicators. The indicators are organized into categories: Social Indicators, Economic Indicators, Environmental, and others. The indicators are presented in various formats, including tables, charts, and diagrams.

B) Indicators organized thematically

This section displays a collection of concept papers, each containing a set of proposed indicators. The indicators are organized into categories: Social Indicators, Economic Indicators, Environmental, and others. The indicators are presented in various formats, including tables, charts, and diagrams.

- **Completeness:** Adequately captures important system characteristics without emphasizing one dimension over another;
- **Parsimony:** Identifies a succinct set of indicators, as the goal is to make the tool usable and not overly burdensome;
- **Compatibility:** Ensures indicators are compatible in scale and scope; and
- **Feasibility:** Ensures indicators are theoretically possible to measure and integrate into the framework.

With these criteria in mind, our goals for the next phase were to identify redundancies and gaps in indicators, organize and prioritize indicators in the framework, ensure indicators are compatible with one another in scale and scope, and evaluate data collection feasibility.

Breakout Groups

Five teams were convened, each with deep expertise in one of the five dimensions. The overall goal

of these groups was to hone indicator selection according to the above criteria and refine thematic organization. Before convening, we conducted a preliminary online survey that allowed members to prioritize existing indicators and propose new ones based on identified gaps. During breakout sessions, the primary task was to reach consensus on a set of indicators by winnowing, combining, and adding new indicators if necessary. We also wanted to better establish a shared understanding of the basic definitions of sustainability within each dimension (Table 1).

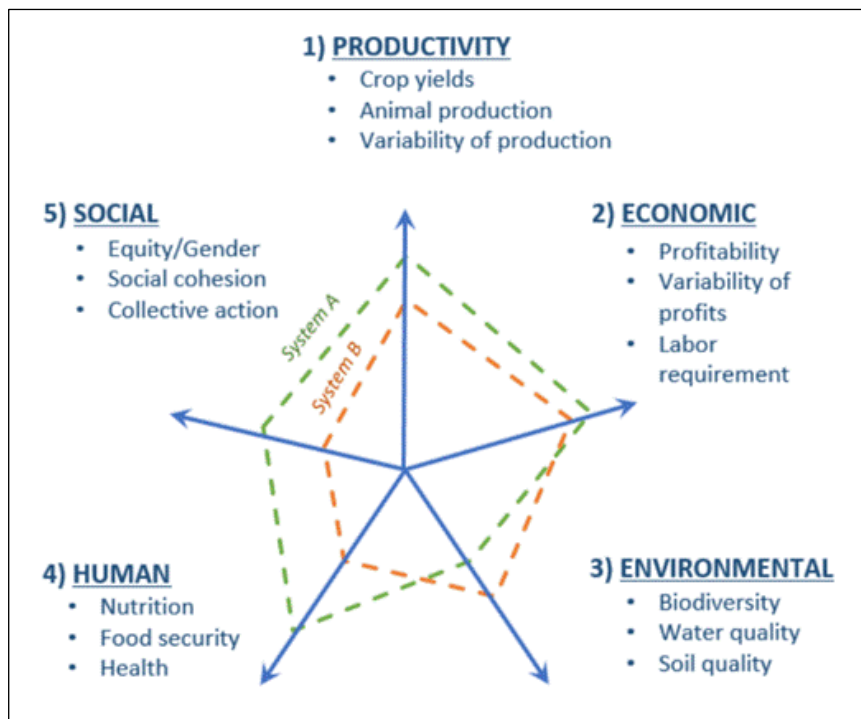
Report-Back Meetings

After the breakout process, we reconvened as a full team to synthesize findings and identify next steps. Changes proposed by the breakout groups to indicators and indices in each dimension were integrated into the overall assessment framework. The full team had a chance to critique and form consensus around all the proposed updates, as well as identify ongoing challenges.

For example, a specific need we identified, which has also been noted in the literature, was to develop better indicators of sustainability in the social dimension (Bacon et al., 2012). This is a challenge because social, institutional, and ecological contexts and processes can constrain and mediate other aspects of food systems, which the concept of “embeddedness” can help explain (Polanyi, 1975). We worked to incorporate a set of embeddedness indicators to reflect how the values, norms, and relationships of a regional food system promote or restrict the motivations, decisions, and actions of those operating within it (Ament et al., 2022).

We also identified a need to form consensus around our preconceived goals and

Figure 6. Five-Dimensional Sustainability Framework Used by USDA LTAR Indicators Team and Others, Illustrating Outcomes for Two Theoretical Food Systems



Reprinted from Spiegel et al. (2022).

assumptions for the framework. A narrative document—essentially a statement of researcher positionality to be used internally—was drafted collaboratively, with the core team assigning roles, after which several rounds of feedback from the full team were incorporated. The document helped us to refine our shared definitions of sustainability, why measuring it is important, our assumptions regarding who the tool is meant to be used by, how to engage with stakeholders beyond academics, and our plans for both qualitative and quantitative data collection and analysis.

Finally, the core leadership team synthesized revisions from the breakout groups into an updated assessment tool framework. Figure 7 gives an example of how the framework is structured,

illustrating the tiered layout. The full framework as it currently stands, including all dimensions, indices, and indicators, is shown in the Appendix, Table A.

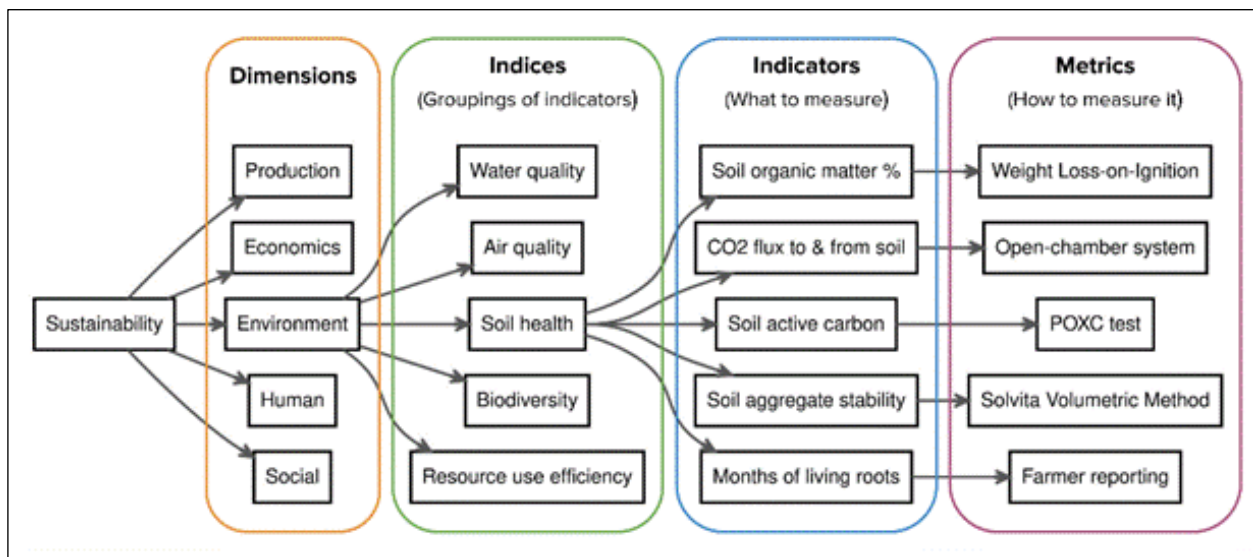
Discussion

The ultimate goal of this long-term project is to develop an indicator-based assessment tool to measure and track sustainability outcomes in regional food systems. This is a challenging task, and to tackle it we employed a transdisciplinary team science approach to facilitate critical thinking and consensus building throughout the framework development process. To date, we have focused primarily on the development and conceptualization stages, incorporating plentiful opportunities to

Table 1. Proposed Sustainability Definitions for Each Food System Dimension

Dimension	Sustainability definition
Environment	Interactions between food systems activities and environmental processes contribute to ecological health.
Economics	Individuals and firms can build and maintain financial value and thrive in the marketplace and community resources are distributed equitably.
Production	The food system supports the essential food, fuel, and fiber needs of its community.
Human	The food system supports the wellbeing of individuals in the community while wellbeing is equitably distributed.
Social	The social fabric of the food system and the social institutions that govern the system are inclusive, resilient, and robust.

Figure 7. Structure of the Sustainability Assessment Framework, Focusing on a Single Index (Soil Health) Within One Dimension (Environment) as an Example



address more theoretical aspects of the project, e.g., drafting a document outlining our positionality, implicit assumptions, and goals (Cross et al., 2022; Hall et al., 2012). It is important to prioritize this type of foundational work to ensure team members' diverse views are captured adequately in the final framework. We made substantial progress, iteratively honing the framework through the collaborative actions described in this paper. Our process brought us much closer to operationalizing our regional food system sustainability assessment tool. However, the primary purpose of this paper is to reflect on our successes and the lessons we have learned to help guide others. Below, we describe the challenges we faced, detail our plans to bring the framework to fruition, and provide suggestions to other teams undertaking similar research efforts.

Next Steps

To operationalize our assessment tool, we need to finalize the selection of indicators and metrics that compose the framework. This will involve further scrutinizing each proposed indicator relative to the four criteria identified for indicator selection (completeness, parsimony, compatibility, and feasibility) by involving the wider community in the process. We must also identify one or more metrics (methods of measurement) for each indicator. Some of the metrics will leverage existing data, while others will need to be collected directly. The next steps for developing the metrics include compiling relevant existing datasets and engaging with community members to determine the challenges and feasibility of collecting original data.

To facilitate this process, the FSRC held a series of workshops in the fall of 2022, followed by team planning grants, to develop full proposals for multiyear grants to hone indices and indicators, identify metrics, and fund the collection of data and community engagement necessary for the baseline assessment of local and regional food system sustainability. In July 2023, the FSRC funded five three-year grants for this process, which are deeply engaging with regional food system stakeholders. These grant teams are further refining and testing the indicators initially proposed here.

Through these new projects, the teams are being expanded to include more practitioners, poli-

cymakers, and other stakeholders. The project members are working with community members to evaluate the tool and implement data collection and assessment in a way that is respectful, not burdensome, and considers diverse experiences and needs (Baum et al., 2006). Community members will have an opportunity to provide perspectives on questions surrounding definitions of sustainability and how best to prioritize indicators to reflect diverse lived experiences. Ultimately, following further framework development and data collection, we envision the tool to be capable of tracking results through time and exploring how sustainability outcomes may change in the region based on policy, climate, economic pressures, supply chain issues, and other factors.

Recommendations for Other Team Scientists

While our process is ongoing, we summarize in Table 2 and below a series of early recommendations about the process, framework, and data for other scientists engaging in similar efforts.

Process recommendations

While the transdisciplinary team science process offers the invaluable opportunity to escape individual academic “silos,” it can also present challenges. As tends to be the case with this type of project, many people are involved, with different ideas about the most important aspects of food system sustainability, and different focus from their respective academic disciplines. Uniting these diverse perspectives is difficult, but critical. We have achieved success in this area by allowing ample space throughout the process for collaborative reflection and consensus formation. This included time within the teams to present disciplinary differences and try to develop a common language. As well, this included a process that first brought together interdisciplinary teams focused on a specific topic, but then a facilitated process to bring those teams further together as well. Through multiple additional activities and engagement across these teams with an external professional facilitator, we were able to arrive at a more integrated, albeit evolving, framework. Furthermore, these efforts continued through additional planning grants and multi-year grants to advance

these initial efforts. Thus, our process required teams to work beyond their own determined groups, and engage not only across disciplines, but also across topics of interest, scales, and methods, which began the process of having more detailed and challenging conversations to converge on indicators, metrics and the overall framework.

Another common challenge is defining an endpoint for the project. To address this, we embrace a “living document” mentality, in that we acknowledge flexibility to adjust indicators that may be lacking and to improve metrics over time as new data become available and understandings of sustainability shift. This type of science can’t be rushed, and in our case, we are funding the next phase of projects in this space for three years, and possibly many years after. As such, we hope to develop a framework that can serve as a baseline, which could then evolve over time as methods and approaches change, and provide opportunity for additional modules to “plug and play” within the framework. For example, some systems (e.g., animal versus cropping systems) may have additional

metrics or indicators which could be integrated in addition to the baseline framework.

Additionally, it is critical to ensure perspectives outside academia are fully integrated into the process (Baum et al., 2006). Projects like ours that originally stem from academia need to give community stakeholders a voice to ensure outcomes are practical and relevant. One key aspect to ensuring this with our projects was to require the participation and incorporation of non-academic community partners in funding applications. This included requiring funding within the budgets of these projects to be allocated to these partners, as well as a one-page community narrative document to be submitted with the project proposal, which detailed the community engagement. Furthermore, a specific review criterion in the evaluation of submitted project proposals considered the extent to which community partners were included and funded for their participation.

Framework recommendations

Framework development naturally presents chal-

Table 2. Suggested Recommendations for Sustainability Framework Development Among Interdisciplinary Team Scientists

Component	Recommendations
Transdisciplinary science	Allow ample time
	Use external professional facilitator
	Make time to present disciplinary assumptions and develop common vocabulary
	Have multiple interdisciplinary teams convene beyond their own groups
	Provide tiers of engagement (planning grants, multiyear grants)
Defining an endpoint	Utilize a living document approach
	Develop a core framework with “plug and play” modules
	Revisit over time
Community engagement	Require community partners
	Provide significant funding for community partner engagement
	Include community narrative document in funding proposal
	Establish explicit review criteria for community engagement in project evaluation
Scale of the system	Focus initially on a specific scale, but be flexible about including other scales in the future
Level of reporting	Be explicit on scale of reporting (e.g., metric, index, “score”)
Complexity	Core framework with “plug and play” modules
Data integration	Map how data fit together
	Normalize and standardize scales for quantitative data if possible
	Determine and be explicit about weighting and what informs any weighting

allenges, especially as such efforts tie themselves to indicators and metrics, which often necessitate a clear need for understanding the scale and scope of their measurement. Furthermore, in agriculture and food systems, the diversity of production systems, regionality, and even climate and geographical differences make efforts for frameworks that are “universal” especially challenging. We encountered many aspects of these challenges as we considered the framework’s level of analysis.

First, there is the question of delineating a “local/regional food system.” Further, how should we account for imports and exports from the region? Relatedly, what is the extent to which we should focus primarily on farms versus other food system actors? We overcame this by building flexibility into our framework’s scope and scale. We began by focusing on a single U.S. state that we know well, and from there we can expand the applicability of the framework to wider regions and incorporate more complex intraregional interactions.

Secondly, reporting sustainability outcomes involves a level of abstraction. Multiple levels of abstraction are possible, with higher levels (e.g., an “overall sustainability score”) making outcomes simpler to understand, but potentially neglecting important tradeoffs. In our case, we arrived at a middle ground, reporting primary results at the level of indices, which we hope will offer sufficient detail to capture fundamental properties of the system without overloading the audience.

Thirdly is the size and complexity of the framework. While many aspects of sustainability were identified as important to include for a full accounting, some team members have proposed that it may be useful to identify a core set of indicators—perhaps fewer than ten—that should be included in all assessments, with the rest serving as supplementary indicators used to tailor specific studies to their contexts. As noted earlier, this provides a “module” approach that could allow for industry- or region-specific metrics and indicators to supplement the framework.

Data recommendations

A core challenge of such large and multifaceted studies concerns data ontology, data storage, and

data integration across disciplines and scales. To this end, we identified the need to develop an online portal including (a) public data, for example collected by governments or NGOs; (b) private data, for example through multistakeholder initiatives like the Fieldprint Calculator (Gillum et al., 2016) or SISC (McIntyre, 2010), and (c) academic data, including those gathered through our process. These data will take the form of quantitative and qualitative metrics that encompass different scales, data collection methods, and sources. For example, some metrics may be self-reported by farmers, while others are measured by outside observers.

With many different datasets and collection processes, teams need to carefully consider how to combine datapoints (Mayer, 2008). We suggest developing methods to normalize metrics into a standardized scale, for example from 0–100%, although other options are possible. A key priority in this process is to include and recognize qualitative data as equally valid and useful, and to find a suitable way to incorporate the nuances of this type of data, which has been a challenge historically (Bacon et al., 2012).

Teams must then establish how to best combine metrics into indices, e.g., is a simple mean of a set of normalized performance metrics sufficient, or is something more complex required? Additionally, teams need to consider how to weight each indicator within indices. Issues of data weighting and prioritization are normative and depend on factors such as the decision-makers’ position in society, expertise, and identity; thus these decisions require careful consideration as well as input from diverse stakeholders.

Theoretical questions

Several more theoretical questions also presented themselves, each of which will require reflection by teams undertaking this type of study. We cannot claim to have unequivocally solved these puzzles, but they are certainly worth considering. First is whether sustainability goals should be normative or descriptive, i.e., should we examine how some outcomes are *more sustainable* and others *less sustainable*, or instead should we focus solely on non-value-laden descriptions (Heink & Kowarik, 2010)? Second, how are cross-cutting links handled, i.e.,

where an indicator's outcomes are tied to another indicator, even if they are categorized in different dimensions?

Finally, incorporating community embeddedness into the framework presents a challenge because the theory of embeddedness holds that many aspects of the system (especially the economic ones) are underpinned by social factors (Ament et al., 2022; Jones & Tobin, 2018; Polanyi, 1975). Whereas the ecological economics perspective holds that social and economic factors are constrained by biophysical limitations, some sociological perspectives view human interactions with each other and the environment as fundamentally social (i.e., the way we understand biophysical limitations is social in nature). Thus embeddedness is expansive, requiring a full accounting of all dimensions of sustainability, but if it can be operationalized effectively, it may capture the (thus far) elusive social processes that help explain why certain sustainability outcomes result.

Ultimately, sustainability is a complex concept with many feedback loops and interconnections, making it a difficult subject to study and characterize. However, we believe these inherent complexities and difficulties do not mean scholars should avoid studying and quantifying sustainability outcomes. On the contrary, these challenges make it

even more important that team scientists endeavor to develop and apply the most rigorous and inclusive methods possible to the problem at hand.

Conclusion

This reflective essay outlines the transdisciplinary team science process we used to develop a regional food system sustainability framework. While much progress has been made toward an actionable assessment tool, this work does not represent a finished product, but rather an opportunity to reflect on and learn from our process and progress, and a springboard for continued efforts in this area by our own team and others with similar goals. Going forward, the FSRC will continue to support new funding opportunities, leading to further investigations and publications, refinement of the framework, and collection of data to track and assess food system sustainability both in our region and further afield.

Acknowledgments

We thank the following individuals for their valuable input: Mark Cannella, Martha Caswell, Polly Ericksen, Hans Estrin, Vern Grubinger, Ernesto Mendez, Leslie Parise, Christian Peters, R. Chris Skinner, and Amy Trubek.

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Table A. Regional Food System Sustainability Assessment Framework as It Currently Stands with Proposed Dimensions, Indices, and Indicators

Dimension	Index	Indicator
<i>Environment</i>	Soil health	Soil organic matter %
		CO ₂ flux to & from soil
		Soil active carbon
		Soil aggregate stability
		Months of living roots
	Water quality	Agrochemical runoff
		Nutrient runoff
		Soil loss/sedimentation
	Air quality	Dust/particulates
		Odors
		GhG emissions
	Biodiversity	Insect, plant, & animal diversity
		Acres in conservation practices
		Land use diversity
	Resource use efficiency	External nutrient use efficiency
		Energy efficiency
		Water use/irrigation efficiency
<i>Economics</i>	Food business profitability	Total sales / revenue
		Total costs
	Value from rural landscape	Acreage in production
		Diversity of farm types
		Open acres
		Forest cover
		VT <i>terroir</i> /VT brand
	Food business resilience	Balance sheet (assets & liabilities)
		Operational diversification
		Business growth/fixed mindset
		Enterprise agility/flexibility
		Income stability
		Climate adaptation

continued

Dimension	Index	Indicator
	Distribution chain localness	% local sales % of farm / business inputs bought locally % direct-to-consumer sales Consumer awareness of VT products
	Community economy	Wealth/income distribution Availability or good-paying jobs in food systems Business failure rate of food businesses In vs. out-of-state ownership
	Externalities from businesses	Ecosystem services Ecosystem disservices
	Exogenous factors for businesses	Commodity price fluctuation Impacts of climate change/variability
	Access to capital/credit	Access to credit Access to land Capital markets
<i>Production</i>		
	Production quantity	Total qty. food products Total qty. forest products Total qty. non-food agricultural products
	Waste/losses	Food wasted Food losses Crop failure “Waste” converted to usable byproduct
	Product quality	Marketability Livestock product safety Agrochemical residue on crops Recalls in each industry Certificates of assurance Food safety
	Production diversity	Richness Nutritional staples
	Imports vs. exports	Total qty. imported Total qty. exported
<i>continued</i>		

Dimension	Index	Indicator
<i>Human</i>	Physical health	Nutritious diets
		Presence of obesity
		Presence of metabolic disease
	Mental health	Stress & anxiety
		Access to social support
		Uncertainty
		Risk aversion (e.g., social stigma)
	Food security	Food access
		Food affordability
	Food appropriateness	Access to culturally appropriate food
<i>Social</i>	Happiness	Happiness index
		Finding meaning in life
	Education	Educational attainment
	Food worker diversity	Gender diversity
		Race/ethnicity diversity
		Age diversity
	Community embeddedness	Trust
		Reciprocity
		Social connectedness
		Feeling of belonging to community
		Collective action
		Tradition/ heritage
		Common goals
	Rural community livability	NIMBYism
		Community safety
		Population drain (outmigration)
		Open space & natural beauty
	Food system governance	Participatory governance
		Government responsiveness
		Fair regulations & incentives

Experiences from a land-based learning project focused on local food interventions

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Submitted August 8, 2023 / Revised December 8, 2023, August 12, and October 3, 2024 /
Accepted October 3, 2024 / Published online December 10, 2024

Citation: Palmer, A. L., Warsaw, P., McKim, A. J., McKendree, R. B., Nettleton, M., Marzolino, T., & Brasier, H. (2025). Experiences from a land-based learning project focused on local food interventions. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 473–486.
<https://doi.org/10.5304/jafscd.2024.141.013>

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Abstract

Farm-to-school programs have many documented benefits but are typically centered around school gardens or local food procurement, which can be a limitation for schools. Land-based learning takes a student-centric approach to agricultural education,

allowing students to identify and develop interventions to improve their local food system based on the content presented in the classroom, providing the possibility for delivering farm-to-school con-

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Funding Disclosure

This work was supported by the Food and Agriculture Service Learning Program, project award no. MICL08599, from the U.S. Department of Agriculture National Institute of Food and Agriculture (USDA NIFA).

tent outside of its traditional settings. We present findings from the evaluation of a land-based learning program implemented in northern Michigan. The program engaged two teachers and their respective students across two schools, each school's food-service directors, two local farmers, and a Michigan State University extension educator to form two Locally Integrated Food Teams (LIFTs). Students were presented content about local food procurement across 20 instructional sessions, during which each LIFT worked to develop a shared understanding of the local food system and school lunch sourcing to identify an intervention to increase the amount of local food in their school lunches. The LIFTs then proposed their interventions to Michigan State University faculty, implemented their intervention, and presented the results of the intervention during the program wrap-up day. To explore the experiences of LIFT members, we conducted focus groups and collected observational data from the program participants. We find that delivering farm-to-school content in a land-based learning framework provides many of the same benefits of traditional farm-to-school programs, while allowing for greater flexibility in the construction of the program and providing additional educational benefits not commonly discussed in the farm-to-school literature.

Keywords

land-based learning, local food systems, community engagement, farm to school, experiential learning, pedagogy, alternative food networks

Introduction

Schools act as an important site of contact for students with the food system. Issues in food system sustainability, such as corporate consolidation and influence over public policy, devaluation of food-service labor, and the use of unsustainable industrialized growing practices, directly affect the food students receive in their cafeterias, which themselves are vital sites for the social reproduction of the current corporate food regime (Gaddis & Coplen, 2018). Furthermore, while not all schools have a formal agricultural education program, many educators across the U.S. already teach about food and agriculture, with or without state stand-

ards in place to promote their inclusion in classroom instruction (Stewart et al., 2021).

Education related to food systems encompasses agriculture, the environment, and nutrition as part of complex socio-environmental systems (Chase & Grubinger, 2014; Pauley et al., 2019; T. G. Roberts et al., 2016). There are several curricular approaches to teaching about food systems in U.S. high schools. School-based agricultural education (SBAE) remains the dominant paradigm in most formal agricultural education programs. Over the last three decades, scholars and practitioners have increasingly called for SBAE to integrate concepts and content related to sustainability and social justice to maintain relevance. During this same time span, farm-to-school (FTS) programs have become increasingly common, including in schools without an agricultural education program, as a method to provide opportunities for students to learn about and experience their local food system. This is accomplished by a variety of activities, including procuring locally produced food for school lunches or taste tests, creating school gardens that teach students about food production and preparation, visiting farms, doing cooking demonstrations, and holding promotional activities such as "harvest of the month," which highlight locally grown food (Prescott et al., 2020). In doing so, FTS programs emphasize the local context of each school and its community, resulting in a pedagogical approach valuing locally created knowledge over standardized curricula (McKim et al., 2019).

A pedagogy that values locally created knowledge has the practical impact of making students aware of the specific sustainability issues that exist in their local food system, improving their ability to engage as informed citizens in their communities. FTS programs have also increasingly integrated concepts related to social justice, food sovereignty, and sustainability, reflecting many of the demands made of SBAE (Powell & Wittman, 2018). A growing body of literature has subsequently documented the many potential social, educational, environmental, and economic benefits of FTS programs, indicating their potential to serve as a cornerstone for agricultural education (Mishra et al., 2022).

Despite the potential benefits provided by FTS

programs, several barriers remain to their universal adoption. First, while FTS organizations and practitioners indicate that local food procurement or the creation of school gardens are not necessary to operate a functional FTS program, most programs are anchored in one of these interventions. These can act as a barrier to adoption for schools lacking the capital to invest in either approach. Second, the diversity of approaches and interventions that exist under the FTS umbrella, while providing substantial flexibility, has also presented a challenge for practitioners and scholars seeking to evaluate the impact of their programs, particularly as it relates to educational outcomes. Finally, while FTS programs engage students in developing an understanding of the food system, the long-term investments associated with common FTS interventions necessitate less flexibility in how individual cohorts may interact with the program. This, in turn, can de-center students as potential change agents, which can instead reinforce neoliberal notions of individual responsibility and choice as their primary axes for driving change, while also placing constraints on the potential educational outcomes for students.

It is at this nexus that we position our research. This study explores the implementation of an innovative educational approach, land-based learning (LBL), a flexible, student-led approach to agricultural education with roots in place-based learning, in a FTS setting. In this study, we present findings from the implementation of an LBL curriculum that integrated FTS content related to local food procurement in two high schools in northern Michigan. In this program, students collaborated with community partners to identify barriers to sustainability in their local food systems and then developed and implemented an intervention at their school to address those barriers. This paper addresses the following research questions:

1. Does FTS academic content without a pre-determined intervention provide the same academic benefits as traditional FTS programs centered around local food sourcing or school gardens?
2. Does delivering FTS content in an LBL framework provide additional educational

benefits to students or other project participants?

Literature Review

Land-based learning is grounded in approaches that emphasize experiential learning, local engagement, and critical reflection, potentially addressing some limitations of other models and enhancing the relevance of agricultural education.

The Evolving Needs of SBAE

Currently, SBAE is structured around the three-circle model (Croom, 2008). This approach frames agricultural education as a Venn diagram between classroom instruction, leadership development via the National FFA Organization, and supervised agricultural experiences (SAE), which provide students with experiential learning opportunities. While this approach is nominally flexible and broad enough to meet the evolving demands of agricultural education, recent scholarship has argued that SBAE is constricted by its narrow focus on preparation for “traditional” agricultural careers and is losing relevance as other disciplines use agriculture to teach about broader and interconnected challenges such as climate change and systemic racism (Hartmann & Martin, 2021). These calls build on long-standing concerns that many SBAE programs offer limited or no SAE opportunities and struggle to encourage participation in leadership development experiences, further limiting the engagement students have with the increasingly complex real-world challenges facing producers and others invested in agriculture (Croom, 2008).

The American Association for Agricultural Education (AAAE) has identified using systems thinking as an important approach to “Addressing Complex Problems” in its national research agenda (T. G. Roberts et al., 2016). This call has been echoed by a range of practitioners and scholars of environmental education who have noted the growing overlap between sustainability and agriculture (e.g., land use, agricultural production and natural resource management, energy consumption, and climate change) that educators need to prepare their students to address (T. G. Roberts et al., 2016). Further, research illuminates the need to pull disciplines from their silos toward a shared

agenda of systemic resilience (Reilly et al., 2022; Pauley et al., 2019). In their work, T. G. Roberts et al. (2016) identified a lack of understanding among educators about how best to prepare students to address complex problems as a gap within agricultural education, criticizing research within the discipline for not providing sufficient information on processes, procedures, and programs that educators could utilize.

An additional conversation is taking place in agricultural education about how social justice is entwined with teaching and learning in the discipline. Hartmann and Martin (2021) have proposed a critical pedagogy of agriculture, which would not only integrate conversations about sustainability into agricultural education, but also broader conversations about food insecurity, social inequality, and community health. Such an approach would not only be more relevant to the deep connections between social and agricultural systems but would also encourage students to see themselves as capable of changing the social realities of current agricultural systems (Hartmann & Martin, 2021).

These recommendations go beyond a call for individual educators to adjust their approach in the classroom; instead, they require systemic support from organizations such as the National FFA Organization, without which individual teachers will be working against the prevailing winds in the discipline to accomplish localized change (Hartmann & Martin, 2021). However, while the National FFA Organization and other relevant organizations have shown some willingness to evolve over the last several decades, progress has remained slow. For instance, the rise of service learning as a relevant pedagogical approach over the last three decades has prompted many practitioners to call for its formal integration into the three-circle model. As Roberts and Edwards (2015) documented, this rise ultimately led to the FFA adopting a range of service-learning initiatives beginning in 2007, as well as service-learning-based SAEs being recognized as a distinct category within that pillar of the three circle model. However, despite these developments, service learning has not been universally adopted in SBAE, reflecting ongoing resistance ranging from critiques that the current three-circle model is already flexible

enough to functionally allow space for service learning as well as questions regarding the intellectual rigor of service-learning curricula. This resistance has stymied the creation of resources to facilitate the universal adoption of service learning in SBAE (R. Roberts & Edwards, 2015). These challenges add to the existing challenges of placing SAE on a more equal footing in practice within the current three-circle model.

Farm to School and Agricultural Education

While not explicitly discussed in the context of SBAE, the rise of FTS programs over the last three decades has indirectly addressed many of the calls made within SBAE, largely at a local level. FTS provides valuable insights into integrating environmental education and systems thinking into SBAE while providing material benefits to the local community. FTS programs first emerged in the mid-1990s as an outgrowth of concerns about the state of the food system, including climate change, the plight of small and midsize producers, growing food insecurity, and the rise of public health concerns due to inadequate diets (Feenstra & Ohmart, 2012). The initial focus of FTS was on the procurement of local food by school cafeterias; however, as FTS programs have expanded nationally, a wide variety of activities has been included under the FTS umbrella, including the development of school gardens, composting and food waste reduction initiatives, farm tours, cooking demonstrations, and nutritional education (Feenstra & Ohmart, 2012). The National Farm to School Network, a prominent nonprofit in the space, defines FTS programs as having one or more of the following features:

- “1. Procurement: Local foods are purchased, promoted and served in the cafeteria or as a snack or taste test;
- “2. School gardens: Students engage in hands-on learning through gardening; and
- “3. Education: Students participate in educational activities related to agriculture, food, health or nutrition.” (NSFN, n.d., para. 4–6)

The grounding of FTS programs in attempts to address meaningful challenges facing actors across

the food system via experiential learning ideally places FTS programs to address many of the concerns expressed regarding SBAE. Further, the reach of FTS programs has extended to many communities that do not include traditional agricultural education programs, most notably schools in urban settings. In the existing literature, there is a growing body of research documenting the impact this community focus and widespread adoption of FTS has had across the food system. For students, the benefits of FTS programs include greater awareness of gardening, healthy eating, and seasonality; an increased willingness to consume fresh fruits and vegetables; and overall academic achievement (Mishra et al., 2022). For the community, efforts to bolster sourcing from local producers has increased local economic activity by providing midsized producers with a stable source of income, encouraging consumer dollars to circulate locally (for instance, see Christensen et al., 2019).

While FTS programs have many documented benefits, challenges remain to their widespread adoption. First, while FTS programs can nominally feature only educational activities, the overwhelming majority feature some focus on local food procurement and/or the development of school gardens, stemming from the roots of the movement. These interventions require marshaling considerable resources, whether financial, logistical, physical, or in human capital, which can be prohibitive (Mishra et al., 2022). While significant progress has been made in mitigating the common barriers to local food procurement in schools, many still face the same challenges. Second, while there is a growing body of literature documenting the potential impacts of FTS programs, Prescott et al. (2020) note the limitations to generalizing many of these studies due to factors such as study designs that preclude causal inference, difficulty in developing evaluation frameworks appropriate to the chosen FTS intervention, and inability to determine long-term outcomes. Finally, the nature of FTS programs is such that while they are designed to engage students on a level closer to their own lived experience, the interventions are more often led by institutional champions, such as food-service directors, who will ostensibly remain and administer the program as students transition out of their school

(Bagdonis et al., 2009). While this is often a necessary logistical approach, and some scholars have noted the potential for farm-to-institution approaches that build structures to limit the need for an individual champion (Warsaw & Morales, 2022), this has raised questions about the potential limitations created by such a structure. Most notably, Allen and Guthman (2006) noted the parallels between FTS programs and existing school lunch programs in arguing that FTS programs actually *reinforce* neoliberal notions of individual responsibility, consumerism, and choice in students by emphasizing the value of these programs in developing students as conscious future consumers. Crucially, their comparison of FTS vs. conventional school lunch programs lists students solely as *recipients* of the programming, not as partners. However, growing bodies of literature within education, such as youth participatory research, have pointed to the value of viewing students not just as consumers of content, but as active participants in the creation of curricula (Anyon et al., 2018).

Land-Based Learning

A pedagogical approach that contains many elements of FTS, LBL addresses the call for delivery methods in agricultural education where students engage with communities or partners outside of the school to change systems (T. G. Roberts et al., 2016). LBL is a flexible process for building student-led teams that act on sustainability issues through four stages, each of which builds on the prior stage: (a) *identification* of a local phenomenon and partners; (b) *understanding* of place and connected systems; (c) place-based *intervention* to enhance sustainability; and (d) *evaluation* of changes in place, systems, and community (McKim et al., 2019). This flexible process provides an outline to engage students in a change process within a complex system.

LBL has roots in place-based education, which emerged out of a call within environmental education to focus on the impact of social systems on the environment, as well as place greater emphasis on the local environmental challenges facing learners (McKim et al., 2019). Place-based education eschews or adapts “universal knowledge” curricula developed in places far from where students learn

and live, to “link local knowledge with scientific thought and respect for place” in a specific setting (Ferguson et al., 2019, p. 726). The aim of place-based education is to develop an *enlightened localism*, wherein students are able to connect local phenomenon to global challenges through a *local/global dialectic* (Sobel, 2004). LBL further builds on the foundation of place-based learning by addressing criticisms of the approach raised within critical theory, particularly among decolonial scholars who noted place-based education often represents a continuation of settler-colonialism, wherein practitioners fail to acknowledge the histories and knowledge of Indigenous populations in their pedagogies and thus reproduce the settler-colonial project in creating “new” localized knowledge (Calderon, 2014). LBL, then, represents an approach seeking to pair the community-engagement principles of place-based education with this explicit commitment to social justice and critical theory (McKim et al., 2019).

While the approach has clear parallels and points of overlap with FTS, it differs in several key aspects. First, students are explicitly centered not just as recipients of the curriculum, but also as co-creators and leaders in the educational experience. While the other approaches discussed include significant levels of student engagement by design, they are defined primarily by the type of intervention involved (e.g., FTS and school gardens, service learning and community-facing projects). Within LBL, students are empowered to envision and design an intervention based on their understanding of the local food system, spaces for potential intervention, and their resources for implementing the said intervention. Since 2017, project leaders have been engaged with students who do not have access to state-certified agricultural education programs to carry out projects in collaboration with food systems actors with a focus on social, ecological, and economic sustainability (McKim et al., 2019).

The efficacy of these interventions draws from the literature in place-based education and the concept of *empathetic experience*. *Premature abstraction*—asking students to dive into big crises and solve problems before they have had a chance to situate themselves in place—can result in them being

overwhelmed and thus disengaging (Sobel, 1996). Educators are responsible for contextualizing problems and making developmentally appropriate choices when it comes to asking students about addressing complex problems. Having students and educators engage directly with agroecological principles in their schools allows them to connect to the place they live by reinhabiting, a mode more difficult to evaluate than outcomes based on test scores, but nonetheless critical for the decolonization of the mind (Gruenewald, 2003). Place-based education asks educators to reflect on questions like, how does your teaching influence the place you live in and what will you leave for future generations (Gruenewald, 2003)? Place-based education asks an entire community to “take responsibility” for teaching about the possibilities of adulthood in their community (Smith & Sobel, 2010, p. 42).

Another key difference and point of innovation within LBL is the emphasis on evaluation. While the flexible nature of LBL makes a universal approach to evaluation impossible to outline, McKim et al. (2019) frame this as an important element of LBL. As learners develop their understanding of the local environmental and agricultural system and design an intervention to improve the sustainability of that system, a vital marker of understanding is the ability to express both *how* the proposed intervention will accomplish this and *how they will know* whether the intervention was successful. Notably, this often requires a deeper level of engagement between community, learners, and educators, as this level of evaluation requires a longitudinal approach.

In this paper, we analyze a case study of the application of LBL to two schools in Michigan’s Upper Peninsula. In comparison with previous applications of LBL, this project builds on the approach with several innovations, including the integration of content related to each school’s supply chain and barriers to local food procurement.

Methods

Given the unique approach to this LBL project, we used a case study design to gain the perspectives of those involved in the bounded system. Described by Merriam (2002) as a “description and analysis of a phenomenon” (p. 8), case studies may focus any-

where on the continuum from individuals to institutions to communities. In our study, the unit of analysis was an LBL project engaging high school students and their respective teachers, food-service directors, local farmers, and Michigan State University extension and faculty members. All research activities were approved by Michigan State University Institutional Review Board prior to initiating the project.

Case Study Design

The implementation of LBL in two schools in Michigan provided the case for our study. Each school developed an independent team, dubbed a Locally Integrated Food Team (LIFT), each of which comprised a school-based educator and corresponding class of students, their respective school food-service director, a local farmer, a nutrition educator, and an extension educator. In total, 33 high school students participated in the project, ranging from sophomores to seniors. LIFTs were engaged in a six-month experience that walked through the four stages of the land-based learning process. First, LIFTs *identified* those involved in local food production and cafeteria food procurement; worked to *understand* the challenges and af-

fordances of cafeteria food and local food production systems; developed, proposed, and implemented an *intervention* to increase local food offerings in the school cafeteria; and *evaluated* the impact of their intervention on local food consumption within the cafeteria. At Superior Central High School, the chosen intervention was to extend the growing season of their school's hoop house, which supplies food to the cafeteria, by piping heat from the school's boiler room. The LIFT at Negaunee High School chose to purchase and manage a hydroponics unit that could provide food for the cafeteria.

The research team provided LIFTs with multiple resources. First, the project team developed curricular materials that integrated common topics related to local food systems and FTS programs (e.g., the logistics of local food purchasing) with content aligned with the LBL model so students could apply these concepts to their own local food system (e.g., identifying key foods served in the cafeteria that are grown locally and when the growing season overlaps with the school year). A list of the learning objectives related to these materials is provided in Table 1. This content was complemented by experiential activities that gave students

Table 1. Learning Objectives of the Land-Based Learning (LBL) Curriculum

Objective	Day
1 Define food system, local food, and farm-to-school (FTS) purchasing	1
2 Explain the importance of purchasing local food	
3 Describe two food producers in Michigan	
4 Identify <i>what</i> is grown in Michigan and <i>when</i> it is produced	2
5 Explore the food purchasing and offerings within your school cafeteria	
6 Identify "key foods" that intersect local food production and cafeteria food purchasing	3
7 Describe food production, economics of food, food processing, and marketing and education	
8 Align personal interests to one of the local food systems	4
9 Identify salient barriers to local food purchasing by the school	
10 Develop potential solutions to identified barriers to local food purchasing	
11 Research the costs, anticipated benefits, timeline, and barriers to proposed solutions	8
12 Present a solution to peers and relevant stakeholders	
13 Propose the selected interventions through a mini-grant application	8, 11
14 Implement an intervention to increase local food purchasing	
15 Evaluate the impacts of an intervention on the four systems of local food purchasing	12–14
16 Implement an intervention to increase local food purchasing	
17 Evaluate the impacts of an intervention on the four systems of local food purchasing	15–19
18 Analyze career opportunities throughout the food system	

direct engagement with the individuals supporting their school's nutritional program and the local food system, including question and answer (Q&A) sessions with their school's food-service director and local farmers. Next, each LIFT team was offered up to US\$2,500 to implement their chosen intervention and was required to write a proposal for its projects, which the project team, along with other LIFT members, provided feedback on via a virtual session during the school day. Upon the completion of the program, each LIFT presented the findings of its evaluations to the project team for feedback.

Data Collection

Qualitative data describing the experiences of the LIFTs were collected via three mechanisms: (a) focus groups with each LIFT member type (i.e., students, teachers, food-service director, and farmer); (b) observations of student presentations; and (c) researcher observations of the implemented projects. All data were collected at the conclusion of the project during the wrap-up day held at a university-affiliated research and education farm. Two research team members conducted focus groups with students separately, the two teachers collectively, and then jointly interviewed one farmer and one food-service director. For all focus groups, data were collected using a semi-structured protocol that was developed and reviewed by all research team members, allowing for flexibility (Flick, 2009). During these sessions, participants were asked about the perceived successes and challenges of their interventions and how participating in this program affected how they viewed themselves within the food system, as well as next steps for increasing local food procurement based on their experiences with the LIFTs. A handheld recording device was used to capture focus group and interview data, and data were then sent to a third-party transcription service. Two project team members made notes of their observations during the wrap-up day, which were then discussed as a research team prior to formal analysis.

Data Analysis

The data were inductively analyzed, informed by observational notes taken by the research team

from classroom visits and student presentations during the wrap-up event. Open, axial, and selective coding processes were used to identify codes, categories, and themes. We employed open coding procedures reflecting our stage and style of research (Flick, 2009), with one research team member reading transcripts to identify descriptive patterns of data. Those identified patterns then informed a systematic open coding process where data were "disentangled" with concepts added to them, followed by axial and selective coding (Flick, 2009, p. 307). Two researchers performed open coding with the research team, meeting to perform thorough peer reviews to achieve consensus for identified codes. Several steps were taken to ensure quality, including peer debriefing, audit trails, member checks, and providing thick descriptions (Flick, 2009).

Subjectivity Statement

Our research team was composed of faculty, extension educators, a nutrition educator, a graduate student, and one undergraduate researcher, all of whom were engaged with the delivery of the project. Our team members worked directly with teachers and their students, and one of our team members also worked directly with the food-service directors and local farmers. Therefore, each member of our team had a vested interest in the success of the LBL project and personal connections with participants in the project. As a collective, we believed in the ability and agency of students, teachers, farmers, and food-service directors to carry out the functions of this project.

Our collective previous experiences influenced the project, particularly with the type of data we were able to collect. Teachers, farmers, and students in the project all had prior relationships with one of the team members, whose credibility was extended to the rest of the team members. Most likely, this resulted in a willingness to participate and provide deeper levels of data, and required the research team to be reflective about those relationships and how they could influence data analysis.

Findings and Discussion

Themes, categories, and codes are introduced in Table 2. The primary theme that emerged focuses

Table 2. Summary of Themes, Categories, and Codes

Theme	Category	Code
Students Re-Envisioning School and Local Food Systems	Student Interpretation of Experience	Agency
		Consequentiality
	Collaboration	Leadership
		Delegation
		Problem-Solving
	Project Legacy	Continuing Ideas
		Influence
		Relationship to Food

on how the project—and the adults engaged in it— influenced students’ vision of school and local food. While adults (i.e., teachers, farmers, food-service directors, and research team members) played important roles in the LBL project, our data suggested that the most notable outcome was how students were affected by their experience with the project. This theme is explored by looking at its three categories: student interpretation of experience; collaboration; and project legacy.

Student Interpretations of the LIFT-UP Experience

Our first category explores how students interpreted the LBL experience, with students making direct juxtapositions to the type of school learning they typically experience. Principal among these connections and interpretations was *agency* within their educational experience. This agency, in conjunction with the other elements present from other educational approaches, is one of the distinguishing features of LBL. Students, teachers, and food-service directors discussed the existence and importance of student agency to design and implement their own intervention to increase the amount of local food in the school. One student stated the following when describing the agency felt after their teacher provided an option of adult help or not: “We decided we don’t want any adult help, so we got to do a lot of it on our own.” The same focus group elaborated on when adults were pulled in, “Then [after the interventions had been designed], we ran it by the adults in order to make sure that that was covered, and that was okay with

our [food-service director].” This agency, with students being in control of the design of the intervention as well as when to reach out for support, led one of the LIFTs to highlight they felt even more empowered by adult presence in the project: “It felt like we were in charge because the grown-ups were involved. It felt like we had more control over our situation.” On a few occasions, students offered that the project provided adult-like experiences, saying, “Giving us a chance to work together and work it out like adults.” Several adult perspectives highlighted student agency as well, with one food-service director expressing how schoolwide connection to the project has resulted in more willingness to engage in dialogue about food options at school:

Once this project started, I’ve noticed the high schoolers being more open to conversing and giving their opinion and just input in general on what they’d like to see on the menu, what they do like, what they don’t like.

The second code describing the student interpretation of experience category is *consequentiality*, where the tangible impacts of the project on their schools led to stronger feelings of connection with the experience for students in contrast to contrived learning situations. One teacher noted how the project was framed for students, saying, “And it’s not hypothetical solutions. You’re going to do it,” adding for several weeks students said “oh, you mean we’re really going to do this?” Students described the project as “more official” when com-

paring it to their usual project-type activities in other coursework. In addition to realizing how consequential these projects were in terms of them actually happening outside of a hypothetical context, one student noted their project “actually makes an impact in our community,” adding another layer of importance to the work done in this program. Harkening to the adult-like feelings discussed previously, one focus group of students described how outside professionals affected their feelings toward the project during their intervention of piping warm air from the school’s boiler room to the school’s hoop house to extend the growing season,

... That’s when I thought, “wow this actually serious, we’re actually doing something big here.” When we had to get [administrator], and started talking about making a hole in a wall. ... And a bunch of older, more official, professional people came in to talk to us about what we were gonna do and everything, and, of course, [State University Extension Educator] I think it is came in a lot to talk to us about it.

LIFT and Educational Collaboration

Our second category, collaboration, describes how students engaged with the curriculum and worked to implement their intervention. The first code, *leadership*, is built on ideas from students positing “all were included” and getting to “participate in something bigger than myself.” One focus group highlighted how the project provided growth opportunities to expand their notions of how leaders act, with one student saying that leaders would

Not necessarily sit back, but a big part of it is taking other people’s ideas, and kind of going along with it because I mean, if I was just a leader [who insisted on] my idea only, nobody else—you would get nowhere with that.

Students also described leadership opportunities they engaged in outside the project class, with one saying that “branching out, we do good things at the beginning of class sometimes in Spanish. So, whenever I got the chance, I would like [to] update my class on what we’re doing.”

The second code in collaboration we identified was *delegation*, where students offered the importance of defining roles within teams. One focus group discussed the importance of sub teams, “I feel like the teams evenly split up the projects, and every team had a sort of importance” and that the teams “had their own mission” but “meshed together to make it, you know, more integrated, and everyone was involved.” Connected to delegation, the third and final code that emerged was *problem-solving*—even when there was no clear solution. A teacher postulated the coming-to-terms with realizing the solution would not be immediate,

We kind of had five phases, or five solutions to the one problem. And we realized early on that the product we get from each one of these phases may not be realized this year. You know, it’s more of a long-term outlook.

Students offered a more focused discussion on working on compromise to solve issues, noting, “We obviously had some disagreements, but they were worked out throughout the process of talking [about what is happening].” Another added, “we were picking at all the bits and pieces to find compromises in between each group.” Lastly, another group highlighted how dialogue sometimes meant dropping an idea: “[we had an idea to] continue during the summer, like have a summer program, but there was [*sic*] also a couple questions with that one. So, we didn’t end up doing that one.”

The Legacy of LBL

Our final category identifies the legacy of LBL projects, exploring concepts including continuing ideas, influence, and relationship to food. The first, continuing ideas, looks at project continuation within the respective schools as an institution. Students and teachers had hopes of the work they started lasting beyond the end of the project, with one student stating, “we prepared things for the future like so, it doesn’t end with us, it continues on to future classes.” Included were specific ideas, such as hoop house expansion: “Hopefully future classes will be able to expand on what we’ve done this year. It’s not perfect, but hopefully they’ll make it more efficient. ... [Our teacher will] probably

apply for another grant, and ... maybe even expand the hoop house.” Students from the other school echoed similar thoughts, hoping to continue the healthy trend: “We’ll get other people with different ideas and the school can keep getting better and healthier lunches.” Finally, hinting at inspiration from the project, one food-service director also posited continuation thoughts: “one of my, kind of, my five-year goal is to be able to have some sort of hydroponics system in each school that I run, um, all the way from elementary to the high school.”

Influence was the focus of our second project legacy code, exploring how engagement in the project influenced others in the community and school institutions. Teachers, students, the farmer, and the food-service director all substantiated this code, with teachers offering ideas such as, “I think, before we started, I think there was like, two staff members eating. Now there’s staff members almost eating salad bar on a daily basis,” and “the amount of people talking about their lunch now is way higher.” The farmer saw the project as an opportunity to influence others, saying “So, this has been an interesting opportunity to influence how people think about food in local food systems, especially in upcoming generations,” while the food-service director was excited because the project is in line with the influence they want to make on the food served: “I’ve been very excited about this, um, project because it has been on my docket to try to get more local produce into the school system.” Lastly, students even put numbers to that influence, tracking a “15% increase of vegetables and fruits being taken at lunch,” with this finding consistent with prior research (Mishra et al., 2022).

The third and final code for the project legacy category explores the relationship to food and the application of new learning to one’s connection to the food system and related careers. The food-service director highlighted an educational program on composting as helping develop that relationship,

And the process, seeing the kids learn about the process of composting and how the food waste goes to grow more food. And that was one of the, not so much local food but a local

part of the community that really, uh, spoke to me.

Meanwhile, students suggested a growth in career awareness after having participated in the project:

Not gonna lie at the beginning, we, I always heard farming, you know, you just kind of think of like the very typical like, oh, you’re on a farm, you got to deal with cows, animals, chickens. But I didn’t realize that there are so many more, um, opportunities within farming.

One student who hails from a farming background even mentioned how the project has influenced his family’s business relationship to the food system: “We’re looking into buying stuff from other farmers, and I don’t think we ever did that before.” Finally, offering an emblematic quote of the impact of the project, another student from the same focus group offered a new realization about local food: “Yeah, I always appreciate local food, I just never realized how difficult it was to get it out there.”

Conclusions and Recommendations

The findings of this research have several implications for the ongoing FTS movement. First, while much of the existing literature has focused on the specific content and interventions at the center of FTS programs, this research indicates the method of delivering that content is potentially just as meaningful as the content itself. LBL is a pedagogical approach that promotes student agency and project legitimacy. Consistently, students expressed the agency they experienced in this project as unique in educational settings, exciting, and constructive to their learning. While these projects yielded several of the same findings as previous FTS research about changes between participants and their views of the local food system, providing students with the opportunity to be directly engaged with the development of the FTS interventions from the beginning of the project is an innovative and replicable approach that drove meaningful impacts for student outcomes. Educators can employ LBL to structure and engage students in

authentic problems situated in their local community, such as asking students to answer the question, “How can we get more local food in the lunchroom?” As students encounter barriers to progress, supportive adults can engage in the classroom in roles that correspond to their professional identity—such as extension educators, nutrition educators, and farmers with experience in food systems and education. While students are driving the investigation and devising interventions, having a process in place to guide their action provides a sense of direction without determining the outcome of the project.

Notably, this approach may also address one of the longstanding barriers to FTS programs, namely a lack of startup capital to invest in local food procurement or the creation of a school garden. While this project did provide funds for each LIFT, the budget for each team (US\$2,500) was relatively modest when compared to sustaining long-term purchasing requirements. At the same time, the results suggest the possibility that these smaller projects may build the momentum necessary to generate support for more substantial investments by local administrators, both by creating a greater demand for change, and demonstrating a “proof-of-concept” that such investments are worthwhile, a finding demonstrated elsewhere in the farm-to-institution literature (see, for instance, Warsaw & Morales 2022).

The results of this work also have broader pedagogical implications for agricultural education. LBL provided an educational approach that promoted student engagement in and ability to influence the local food system. Adults lent power to students, operating as the nearest levers for systems change in the school food environment. The project increased conversations between students and adults about school lunch, what values they share, and helped to define a direction for future

community engagement in local food. Additionally, through LBL, students were provided opportunities to engage in authentic leadership experiences. Recognizing that a project is only as strong as its support, the importance of sharing power, and of compromising were understood by students through lived experiences in the project. As students engaged with a real-world problem that had no predefined solution, they experienced frustration and authentic responsibility for the outcomes of their collective action. These experiences are expected to help students conduct future open-ended investigations and problem-solving in group settings, skills which are urgently needed to address complex problems in the Anthropocene.

Future research should continue to expand and evaluate the value of LBL when applied to new contexts (e.g., urban settings, nonformal education spaces, postsecondary education). Importantly, evaluations of LBL should be inclusive of diverse outcomes such as systems thinking, community engagement, leadership skill development, content learning, career interest, empathy, and place identity. All these activities could support increasing the use of pedagogies, like LBL, that critically evaluate systems and engage students in changing those systems for a more sustainable future. In the FTS literature, additional research is needed to validate the findings of the approach presented here compared to other FTS applications. While the findings here suggest that a student-centric approach to FTS generates feelings of agency and connection among students, they do not imply that this approach does so more than other, traditional FTS programs centered first around a local food procurement strategy or school garden. Instead, these findings add to the growing need for more robust investigation and evaluation of various approaches to FTS to identify the mechanisms that drive positive community and educational outcomes.



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A research brief describing a logic model framework for planning a Food Recovery Network chapter at an undergraduate university

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Submitted June 5, 2024 / Revised September 14 and October 29, 2024 / Accepted October 29, 2024 /
Published online December 31, 2024

Citation: Altomare, T. K., & Payton, C. (2025). A research brief describing a logic model framework for planning a Food Recovery Network chapter at an undergraduate university. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 487–501. <https://doi.org/10.5304/jafscd.2024.141.027>

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Abstract

In the United States, both food security and food waste are critical issues for population health and well-being. Approximately 13.5% of U.S. households experienced food insecurity in 2023. In a given year, an estimated 22 million pounds (10 million kg) of food are wasted in college campus dining halls. Food Recovery Network (FRN) student-led chapters work to reduce food waste on campus, connect food-insecure populations with excess food, and provide various opportunities for students to participate in activities related to food security and food sustainability. This research brief describes the development of a logic model

framework for planning an FRN chapter at an undergraduate university in Lehigh Valley, Pennsylvania, and initial outcomes from Weigh the Waste events and a food drive. A logic model was developed to outline the situation, priorities, inputs, outputs, outcomes, assumptions, external factors, and FRN chapter evaluation plan. The main outputs include regular FRN chapter meetings, FRN chapter social media outreach, collaboration with community-based organizations, Weigh the Waste events to address campus food waste, and food drives to provide resources for organizations serving food-insecure populations. For the Weigh the Waste events, a total of 529 lbs. (240 kg) of food waste, 296 lbs. (134 kg) of beverage waste, and 88 lbs. (40 kg) of plastic utensil waste was collected from 1,555 dining hall visitors during four meal periods. For the food drive, 1,618 items totaling 548 lbs. (249 kg), including food, toiletries, and cleaning supplies, were collected and donated. FRN chapters at other universities may find this model useful for program planning and for the sustainability of the student group over time.

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Keywords

logic model, program planning, food recovery, food insecurity, food waste, higher education, student engagement

Introduction

This article describes (1) the development of a logic model framework for planning a Food Recovery Network (FRN) chapter at an undergraduate university in Lehigh Valley, Pennsylvania, and (2) two implementation case studies including Weigh the Waste and a campus food drive. This logic model could be used by students and faculty at other universities to outline key stakeholders and plan short-term and long-term activities to work toward higher impact strategies for reducing both food insecurity and food waste on campus and in their local communities. This detailed planning is needed for measurable and sustainable outcomes and is valuable for transitions since students on campus change every few years.

Food Insecurity

Food insecurity is defined as limited or uncertain access to adequate food on a household level (U.S. Department of Agriculture Economic Research Service [USDA ERS], 2024-a). Approximately 13.5% of U.S. households were food-insecure at least some time during 2023, and around 5.1% experienced severe food insecurity, where normal eating patterns were disrupted and food intake of some household members was reduced (USDA ERS, 2024-b). As of 2022, 11.9% of residents and 16.6% of children in Pennsylvania were food-insecure (Pennsylvania Department of Agriculture, n.d.). Similarly, 11.4% of residents in the Lehigh Valley were food-insecure as of 2022 (Hake et al., 2024). Federal data reports that across the U.S., about 23% of undergraduates and 12% of graduate students experienced some level of food insecurity during their academic career (Cameron et al., 2021). The physical health impacts from prolonged food insecurity include anemia, heart disease, high blood pressure, and obesity (OoNorasak et al., 2022). Populations experiencing prolonged food insecurity are also at higher risk of psychological impacts, including stress, anxiety, and depression (Ejiohou et al., 2024).

Food Waste

Along with food insecurity, food waste is a significant public health and sustainability issue. Around 30-40% (approximately 133 billion pounds or 60 billion kg) of food produced in the U.S. is wasted. This equates to US\$161 billion worth of food wasted on a yearly basis (Buzby et al., 2014). In 2022, approximately 6.2 billion pounds (2.8 billion kg) of food was wasted in Pennsylvania; almost 60% of this was wasted at the residential level, and the remainder was wasted at the retail and manufacturing levels (Parwani & D'Onofrio, 2024). Approximately 22 million pounds or 10 million kg of food are wasted annually in college campus dining halls across the U.S. (Tobler, 2019). Discarded food, specifically fruits and vegetables that are nutrient-dense and are prone to spoilage, leads to lost potential for adequate nutrition and can lead to health issues related to obesity, heart disease, type 2 diabetes, and other chronic illnesses associated with shelf-stable diets (Sharma et al., 2017).

Along with human health issues, food waste contributes to environmental concerns. Discarded food sent to landfills and incinerators produces significant amounts of CO₂ and methane, two greenhouse gases (GHGs) driving global climate change. Overproduction of food from industrial agriculture uses water, fuel, fertilizer, and pesticides, leading to water shortages, water contamination, and additional discharges of GHGs and further exacerbation of climate change effects (Hall et al., 2009).

Food Recovery Efforts on University Campuses

Students living in a college setting face many of the same issues as a residential community in regard to equitable food access—location, logistics, and finances (Evans & Roggio, 2023). Their nutrition and food knowledge may also be similar. Many campuses have stop-gap measures in place, such as food pantries, which have a marginal effect on food security among students (OoNorasak et al., 2022). Additionally, many college students today are deeply concerned with climate change, sustainability, and food security, though their awareness of and passion for these issues does not necessarily lead to measurable action (Genovese, 2022). Lastly, college campuses represent a significant contribu-

tor to unsustainable food practices, given the millions of pounds of food wasted at college dining halls every day. Providing a framework on campus from which students can participate in sustainability activities has the potential to positively impact students' behaviors, skills, and values regarding food waste and sustainable living (Brophy et al., 2022).

Colleges and universities in the U.S. have implemented various initiatives to address food security and food waste. Student-led campus kitchens invite campus and local community members to learn new ways of healthy cooking using recovered food from campus dining halls (OoNorasak et al., 2022). Some campuses, including Moravian University (MU), have made a commitment to dedicate a percentage of their dining budget to purchase locally produced, ethical, or sustainable food products (Berger et al., 2022). Others have established community gardens (Schragar et al., 2023), food pantries (Jones et al., 2024), or a combination of strategies to recover unused food and improve nutrition for the populations they serve.

Campus organizations such as the Food Recovery Network (FRN) work to reduce food waste on campus and connect food-insecure populations with excess food (OoNorasak et al., 2022). FRN was created by students in 2011 at the University of Maryland, College Park. Since its inception, FRN has worked to recover over a million pounds or 450,000 kg of food at nearly 200 campuses across the U.S. through food diversion initiatives, social media campaigns, and partnerships with local institutions (Food Recovery Network, n.d.). During fall 2021, the FRN reached out to an MU faculty member to share more about the mission and to recruit students and faculty to start an FRN chapter. A public health student founded the FRN chapter, which was derived as part of a sustainability internship with Sodexo. Additional public health students were recruited for leadership positions in the club, and an official application was submitted and accepted by the MU United Student Government. Undergraduate student members were recruited to join; common majors of those joining include public health, health sciences, and environmental science.

Sustainability Initiatives on Moravian University's Campus

MU is located in Bethlehem, Pennsylvania. It is one of six colleges in the Lehigh Valley Association of Independent Colleges (LVAIC). As of fall 2023, a total of 2,658 students were enrolled in MU undergraduate and graduate programs, and approximately 53% of undergraduates reside on campus (Moravian University, n.d.-a). MU employs 152 full-time faculty, 214 part-time faculty, and 372 staff members (Moravian University, n.d.-a). More than 90% of MU students receive some form of financial aid (Moravian University, n.d.-b). Over 41% of students living on campus and 54% of students living off campus or commuting reported that they did not have enough money to cover all of their expenses (Cann, 2018). Previous surveys on campus had identified food insecurity as an issue for MU students (Cann, 2018).

The MU Sustainability Committee was established in 2009 and comprises eight faculty members, along with students, staff, and alumni. Although students serve on the Sustainability Committee, active student participation in sustainability initiatives has been limited. The goal of the committee is to promote and potentially fund sustainability efforts on campus. One such effort to address food issues is the implementation of the Food for All app, which connects students with excess food from university or department events. Due to restrictions internal to the app's interface, enrollment in Food for All is limited to 200 students, approximately 7.5% of the overall MU student population. Additionally, the Sustainability Committee supports Mo's Cupboard, an on-campus food and resource pantry that offers shelf-stable food products, cleaning supplies, toiletries, and community resources to MU students.

MU's dining services are managed by Sodexo, an independent company contracted with Moravian. Sodexo oversees full-service dining halls and three to-go locations. In 2015, MU was named one of the greenest colleges in the nation by the Princeton Review (Moravian University, 2015). The university dining department has initiated several sustainable practices to address food waste. It implemented the LeanPath tracking system, which reduced food waste by 40% by managing serving

sizes to prevent overpreparation of food items; solid food products are recycled using an onsite food pulper and composter; and cooking oil is recycled using an automated management system for reuse as biofuel and animal feed (Moravian University, n.d.-b). Sodexo employs an undergraduate student as a dining sustainability intern to work on food sustainability projects and food waste prevention campaigns. Although there have been systems-level interventions to address food waste on the MU campus, there is a need for changes at the individual level to reduce food waste, including changes in knowledge, attitude, and behavior.

Logic Model Framework

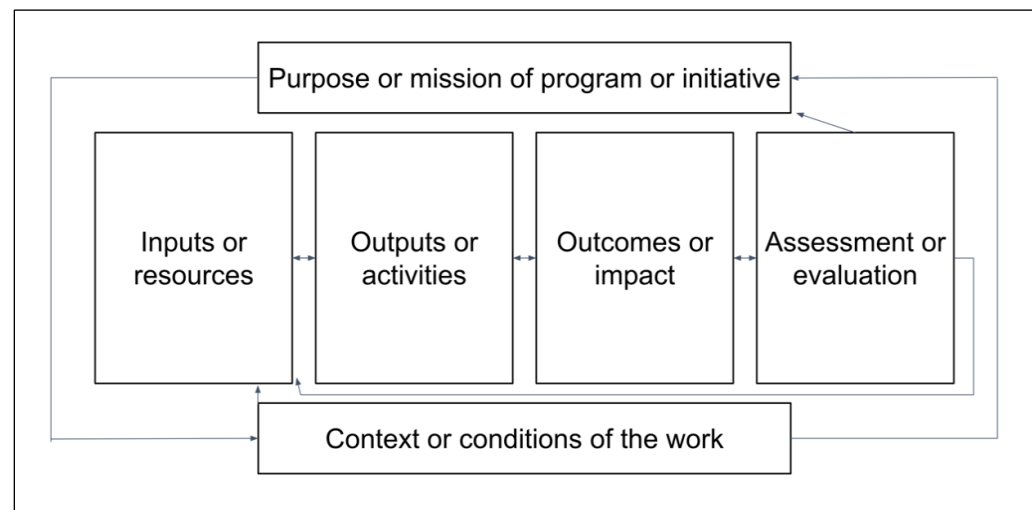
A logic model is a visual map that describes a program's resources, activities, outputs, and outcomes (Centers for Disease Control and Prevention, 2018; Taylor-Powell & Henert, 2008) (Figure 1). Logic models are useful for program planning, implementation, and evaluation and have been an effective planning tool for collaborative committees (Payton et al., 2022). A logic model was developed for the New Visions Hunger Project in Ulster County, New York, to outline the problem statement, goal, resources, activities, output, and outcomes (Spratt, 2011). Creation of a logic model for Ka Ora, Ka Ako, a healthy school lunch program in New Zealand, identified strengths related to community impact and areas for improvement that warrant continued investment (Garton et al., 2023). FRN chapters have disseminated findings related to planning, implementing, and evaluating their work (Blankas, 2015; Dickinson et

al., 2014; Losekamp, 2020; Schonberger, 2020; Schonberger et al., 2018; Sherwood, 2022). However, programs focused on food insecurity such as FRN chapters could benefit from the development of a logic model. A logic model is a tool for both short-term and long-term planning, which is valuable on a campus where undergraduate students spend an average of four years. A logic model guides students toward higher-impact activities that build on previous work, as opposed to repeating lower-impact activities every few years. It is beneficial to key stakeholders involved in sustainability work on the MU campus when students are knowledgeable about the groups working on this issue, the previous activities that have been completed, and ways to scaffold work toward larger goals over time.

Logic Model Development

A draft logic model was developed by two faculty advisors and two student leaders of the MU FRN Chapter. Weekly meetings occurred over a semester to draft the logic model and further refine each section. Students met with employees at FRN, FRN chapter leaders at another university, and MU dining services to learn more about food waste on college campuses and to brainstorm ideas that would be feasible to reduce food waste on the MU campus. The logic model outlined the situation, priorities, inputs, outputs, outcomes, assumptions,

Figure 1. Example Logic Model Framework



Adapted from the Centers for Disease Control and Prevention Office of Policy, Performance, and Evaluation,

external factors, and evaluation plan for the FRN Chapter (Taylor-Powell & Henert, 2008).

Situation and Priorities

The situation describes the context; the epidemiology related to food insecurity and food waste, in addition to an overview of the FRN Chapter as a contributing solution, have been described in the Introduction portion of this paper and outlined in Table 1. The priorities were defined as the primary purpose of the FRN chapter. The MU FRN Chapter is part of the FRN, the largest student-led movement to reduce food waste and end hunger in the U.S. FRN's top priority is to engage students on campus in food recovery efforts as described in the public health logic model (Figure 2). Students participate in education activities on campus related to food waste, food insecurity, and sustainability. They partner with local organizations to collect and deliver excess food.

Assumptions and External Factors

Assumptions and external factors are an extension of the “conditions of the work” piece of a logic model framework. For the logic model framework to function as intended, it was assumed there will be adequate recruitment of student leaders and that responsibilities will transition effectively between outgoing and incoming leaders. Changes in the socioeconomic conditions of Lehigh Valley residents, as well as disasters, climate conditions, or other emergency events may affect the food needs of the population, and subsequently may require us to reevaluate our priorities, inputs, and outcomes.

Assumptions and external factors are summarized in Table 2.

Inputs and Outputs

The inputs included the key people, committees, and resources for the MU FRN Chapter. The FRN Chapter is led by a faculty advisor and four student ambassadors including a president, vice president, treasurer, and secretary. They host chapter meetings and receive a budget from the university. The FRN Chapter has an Instagram account to share its work, an email address to communicate with members, and a Google Drive to store electronic files. The FRN provides marketing materials such as an FRN banner, sweatshirts, laptop stickers, and buttons. The MU dining services is a crucial partner that leads campus events and provides the opportunity for students to conduct events in the dining halls. Other key partners include the Public Health Club and other FRN chapters. The public health program has a dedicated space on campus where students can work on FRN projects and store FRN materials.

The outputs included the FRN Chapter activities and participation. The main activity outputs include regular FRN Chapter meetings, Instagram posts, Weigh the Waste events, food drives, and delivery of excess food to community organizations serving populations experiencing food insecurity. The FRN Chapter reaches other committees on campus, community partners, and professional networks that all work to support persons experiencing food insecurity (Figure 3). Mo's Cupboard and the Sustainability Committee are resources that

Table 1. Summary of the Situation and Priorities of the Moravian University (MU) Food Recovery Network (FRN) Logic Model

Situation	Priorities
As of 2021, 10.7% of residents and 15% of children in the Lehigh Valley are food-insecure.	Engage students in food recovery efforts at MU.
It is estimated that 40% of food produced on commercial farms is wasted.	Educate MU campus community on food waste, food insecurity, and food sustainability.
Approximately 22 million pounds of food are wasted annually in college campus dining halls across the U.S.	Partner with local farms, community-supported agriculture (CSAs), and other organizations to collect excess food.
Campus organizations such as the FRN can work to reduce food waste on campus and connect food-insecure populations with excess food.	Partner with local organizations to deliver excess food where it is needed.

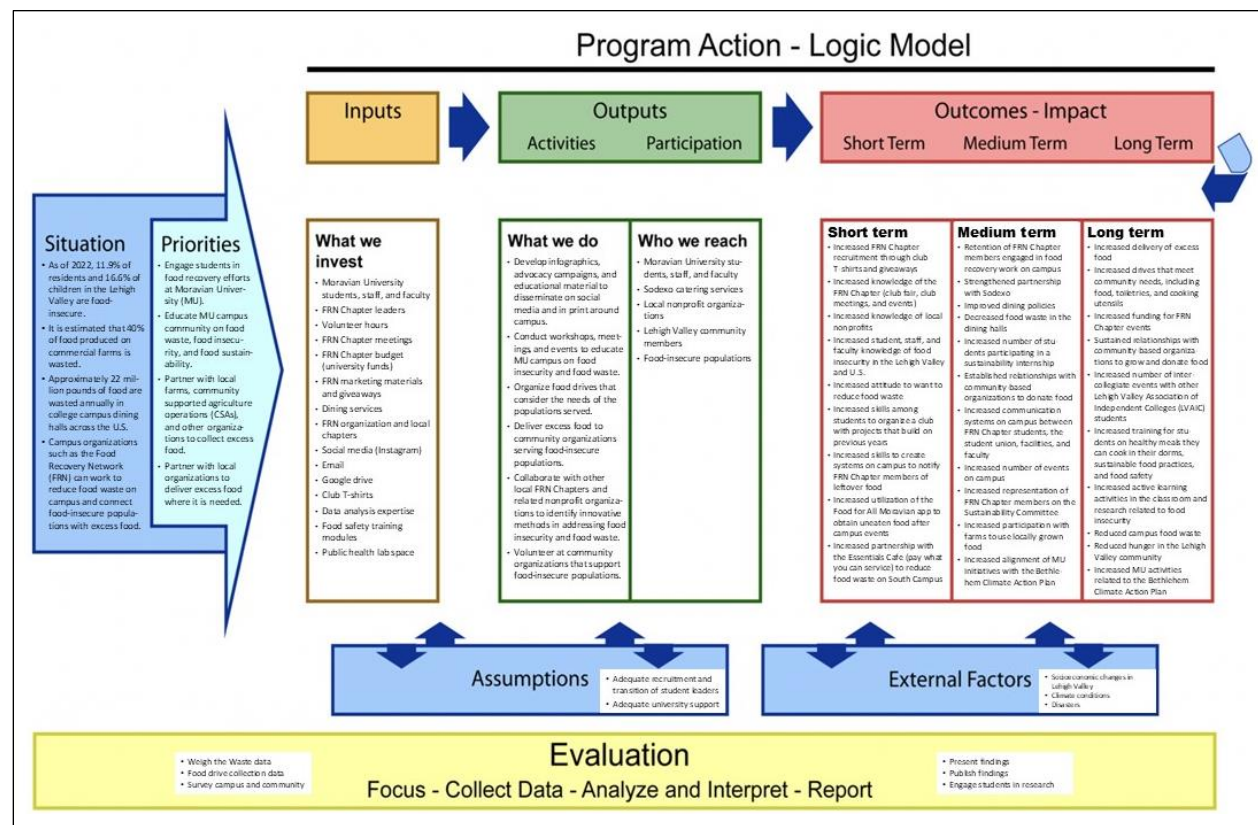
address food insecurity among the student population. Campus dining has five locations through Sodexo including two dining halls, two cafes, and a convenience store; vending options and a food truck are also available. Public health faculty teach courses that provide students with related knowledge and skills, including courses on Sustainability from a Public Health Perspective, Environmental Health, Social Determinants of Health, Epidemiology, Essentials of Health Behavior, Nutrition, and Program Planning and Evaluation. Community partners include nonprofit organizations such as homeless shelters, food banks, local farms and

community supported agriculture operations, and healthcare organizations. Inputs and outputs are summarized in Table 3.

Outcomes and Evaluation Plan

The outcomes were described including the short-term (1–3 year), medium-term (3–5 years), and long-term (5–10 years) outcomes. The main short-term outcomes include increased FRN Chapter recruitment, increased knowledge of food insecurity among those on campus, increased attitude to want to reduce food waste, increased skills among students to organize a club with projects that build

Figure 2. Logic Model for Planning the Food Recovery Network Chapter at Moravian University



Note: Logic model template derived from Taylor-Powell and Henert (2008).

Table 2. Summary of Assumptions and External Factors of the Moravian University (MU) Food Recovery Network (FRN) Logic Model

Assumptions	External Factors
Adequate recruitment and transition of student leaders	Socioeconomic changes in the Lehigh Valley
Adequate funding and support from MU	Climate conditions and disasters

on previous years, and increased skills to create systems on campus to notify FRN Chapter members of leftover food. The main long-term outcomes include decreased food waste on campus, increased food drives that meet community needs, increased delivery of donated food to local populations experiencing food insecurity, increased events on campus related to sustainable food practices, and sustained partnerships with stakeholders on campus, at other LVAIC schools, and in the Bethlehem community.

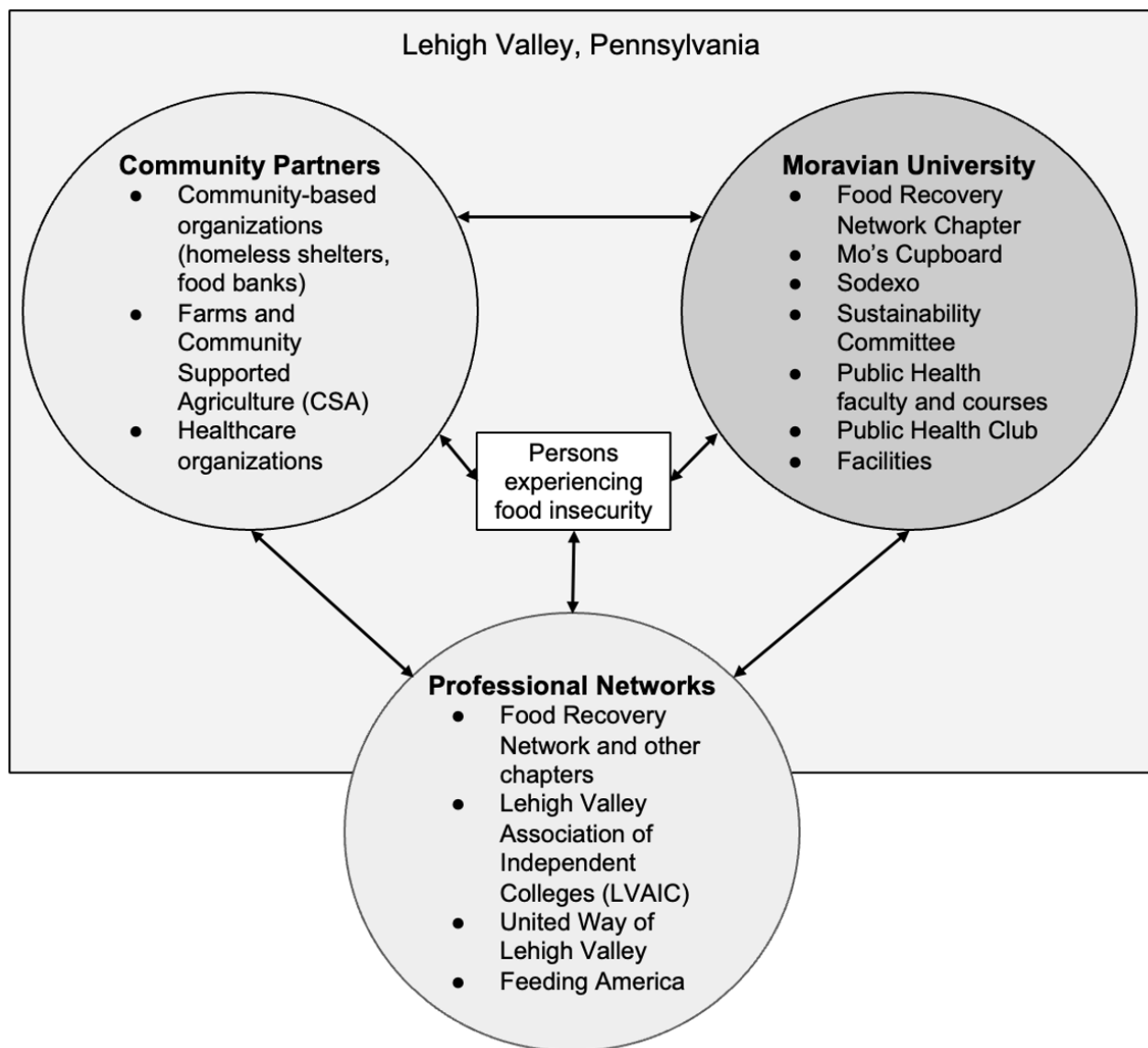
The activities of the MU FRN Chapter will

continue to be evaluated through the collection and analysis of data, including campus events (Weigh the Waste, food drives) and campus and community surveys. These findings will be shared with the community through oral presentations and publications. A periodic review and update of the logic model will also be conducted. Outcomes and evaluation are summarized in Table 4.

Implementation

Two activities were planned and implemented in the first year to address short-term goals of the

Figure 3. Organizational Map of Key Stakeholders for the Moravian University (MU) Food Recovery Network (FRN) Chapter



chapter. These activities—Weigh the Waste and food donation drives—have continued into the third year since the chapter’s founding. Data collected from these events will be used to evaluate inform the medium- and long-term goals of the chapter.

Case Study #1: Weigh the Waste

At total of four Weigh the Waste events were conducted between January 2022 and February 2023 to measure food and beverage waste that diners did not eat during a meal period in a campus dining hall. Communication with the dining vendor, Sodexo, was required to implement this event. A four-hour block was reserved for either lunch

(11:00 am–3:00 pm) or dinner (4:30–8:30 pm). A sign-up sheet was created for three to five volunteers to sign up for a 30-minute to one-hour time slot. Student volunteers were recruited in public health classes and through clubs on campus. Some courses offered extra credit for volunteering.

A safety email was sent out before the event (see the Appendix). Volunteers were given personal protective equipment (gloves, aprons, and shoe slipcovers) and collection equipment (slotted and unslotted scraping spoons and separate plastic basins for solid food waste and paper products, liquid waste, and plastic utensils). Plates were collected from diners and waste deposited in their respective basins. If there was a substantial amount

Table 3. Summary of the Inputs and Outputs of the Moravian University (MU) Food Recovery Network (FRN) Logic Model

Inputs	Outputs	
	Activities	Participation
MU students, staff, and faculty	Develop infographics, advocacy campaigns, and educational material to be disseminated on social media and in print around campus	MU students, staff, and faculty
FRN Chapter leaders	Conduct workshops, meetings, and events to educate MU campus on food insecurity and to change behavior to reduce food waste such as Weigh the Waste events	Sodexo catering services
FRN organizations and local chapters	Organize food drives that consider the needs of the populations served	Local nonprofit organizations
Volunteer hours	Deliver excess food to community organizations serving food-insecure populations	Lehigh Valley community members
FRN Chapter meetings	Collaborate with other local FRN chapters and related nonprofit organizations to identify innovative methods in addressing food insecurity and food waste	Food-insecure populations
FRN Chapter budget (university funds)	Volunteer at community organizations that support food-insecure populations	
FRN marketing materials, T-shirts, and giveaways		
MU Dining services		
Social media		
Email and cloud storage		
Data analysis expertise		
Food safety training modules		
Public Health lab space		

of food left on a utensil, it was first scraped into the solid waste basin before being deposited into the utensil basin. Plastic utensils were used during three of the four Weigh the Waste events due to existing pandemic precautions before the dining

halls transitioned back to reusable metal utensils.

The contents of each basin were weighed using a digital food scale. Measurements were taken in ounces and converted to pounds. Extrapolations of waste were calculated assuming three meals per

Table 4. Summary of Outcomes and Evaluation Plan of the Moravian University (MU) Food Recovery Network (FRN) Logic Model

Outcomes			Evaluation Plan
Short-Term	Medium-Term	Long-Term	
Increased FRN Chapter recruitment through club T-shirts and giveaways as measured by the active club email list, member participation, and social media engagement	Retain FRN Chapter members engaged in food recovery work on campus	Increased delivery of excess food to students on campus and nonprofit organizations	Weigh the Waste data over multiple semesters to determine magnitude and changes in dining hall food waste
Increased knowledge of the FRN Chapter (club fair, club meetings, and events)	Strengthened partnership with Sodexo as measured by increased collaborative events	Increased drives that meet community needs including food, toiletries, and cooking utensils	Food drive data to evaluate amount and type of items donated
Increased knowledge of local nonprofits focused on addressing food insecurity	Improved dining policies	Increased funding for FRN Chapter events	Campus surveys to evaluate food attitudes, behaviors, and values
Increased student, staff, and faculty knowledge of food insecurity in the Lehigh Valley and U.S. after campus events and social media posts	Increased number of students participating in a sustainability internship	Sustained relationships with community-based organizations to grow and donate food	Community surveys to determine needs and inform food drive collection practices
Increased attitude to want to reduce food waste as measured by surveys before and after Weigh the Waste events	Decreased food and beverage waste in the dining halls over time as measured through Weigh the Waste events	Increased number of inter-collegiate events with other LVAIC students	Dissemination of data and analyses
Increased skills among students to organize a club with projects that build on previous years as measured by an end of the year summary report	Established relationships with community-based organizations to donate food	Increased training for students on sustainable food practices and food safety	Mentor at least one student poster presentation or oral paper at a conference or meeting per academic year
Increased skills to create systems on campus to notify FRN Chapter members of leftover food	Increased number of events on campus (food drive, Weigh the Waste)	Increased active learning activities in the classroom and research related to food insecurity and waste	Identification of and contact with one new community partner per academic year
Increased utilization of the Food for All MU app to obtain uneaten food after campus events	Increased communication systems on campus between FRN Chapter students, the student union (HUB) desk, facilities, and faculty	Engagement of students in research process and presentation	Maintain at least one food sustainability activity in the following courses: Introduction to Public Health, Environmental Health, Sustainability in Public Health, and Social Determinants of Health
Increased partnership with the Essentials Cafe (pay what you can service) to reduce food waste on south campus	Increased representation of FRN Chapter members on the Sustainability Committee	Reduced hunger in the Lehigh Valley community as measured by community needs assessments	Ongoing evaluation of food security data at MU and in Lehigh Valley on a biyearly basis
	Increased participation with local farms to use grown food	Reduced food waste in the MU campus community	
	Increased alignment of MU initiatives with the Bethlehem Climate Action Plan	Increased MU activities related to the Bethlehem Climate Action Plan	

day, seven days per week, 16 weeks per semester, and two semesters of a fall and spring academic year. Data are summarized in Table 5. During four meal periods, 529.42 lbs. (240 kg) of food waste and 296.35 lbs. (134 kg) of beverage waste were collected from 1,555 diners (see Table 1). On average, there were approximately 1.61 lbs. (0.73 kg) of food (solid and liquid) waste per person per day, which amounts to approximately 361 lbs. (164 kg) of food waste per person over the course of an academic year (two semesters consisting of 16 weeks).

Case Study #2: Food Drive

A campuswide food drive was conducted in October 2021. Donations were categorized by the team name of the donor (examples: public health courses, volleyball team, Zeta Tau Alpha). The team with the most donations won a pizza party. Some public health courses offered extra credit for students to donate items. Food items were collected daily in multiple locations on campus. Items were counted and tracked in a spreadsheet. Donations of 1,618 items, weighing 548 lbs. (249 kg), of non-perishable food, toiletries, and cleaning supplies were collected during the four-week food

drive and delivered to New Bethany. This non-profit organization, located on the southside of Bethlehem, provides food and hygiene assistance, short-term housing, and employment assistance for the Lehigh Valley community (New Bethany, n.d.). New Bethany was selected for this donation drive due to previous collaborations with Moravian University's Public Health Program and a shared mission toward addressing food insecurity in the Bethlehem area.

Ethical Considerations

The MU Institutional Review Board (IRB) reviewed these projects and determined they were exempt from IRB approval.

Discussion

College campuses can serve as a smaller-scale model to gain an understanding of attitudes and behaviors related to food waste and food insecurity and to foster participation in sustainability initiatives (Evans & Roggio, 2023). The MU FRN Chapter found it valuable to develop a logic model to initiate activities and for the sustainability of the university student group over time. Strengths of the FRN Chapter's work to date include the use of

Table 5. Food and Beverage Waste During Four Meal Periods in the Campus Dining Hall Measured as Part of Weigh the Waste Events led by the Moravian University Food Recovery Network Chapter

	February 16, 2022	April 20, 2022	November 14, 2022	February 15, 2023	
Students residing on campus (number)	972	972	968	968	
Meal period	Dinner	Dinner	Lunch	Lunch	Total
Number of diners during each meal period	327	366	460	402	1,555
Plastic utensil waste (lbs.) ^a	34.10	32.80	21.00	N/A	87.90
Food waste (lbs.)	131.20	138.80	145.79	113.63	529.42
Beverage waste (lbs.)	64.59	76.22	71.83	83.71	296.35
Food and beverage waste per person (lbs.)	0.60	0.59	0.47	0.49	0.53
Estimated food and beverage waste per person, per day (lbs.)	1.80	1.76	1.42	1.47	1.61
Estimated food and beverage waste per person, per week (lbs.)	12.57	12.34	9.93	10.31	11.29
Estimated food and beverage waste per person, per semester (lbs.)	201.18	197.40	158.96	164.94	180.62
Estimated food and beverage waste per person, per academic year (lbs.)	402.36	394.79	317.91	329.88	361.24

^a Plastic utensils were temporary and no longer used in Moravian University dining halls beginning in January 2023.

social media to highlight FRN events and recruit additional students, the partnership with Sodexo to plan events and new initiatives, student participation in Weigh the Waste events and food drives, and the partnership with Mo's Cupboard to donate food. Challenges of the FRN Chapter's work to date include maintaining continuity of activities as students graduate, scheduling regular meetings with students to plan events, and fluctuating student participation and interests over time. Another challenge includes maintaining the email list and the cap on the maximum number of emails that can be sent by the Food for All app. Future directions include reviewing the logic model on an annual basis and increasing the quality and quantity of partnerships with community-based organizations and groups on campus such as the Sustainability Committee, faculty members, and other student clubs like Eco Club. Student-led food recovery organizations at other universities may find this model useful for program planning, especially those who are in the early stages of planning or are attempting to revitalize existing programs. Due to the transient nature of students, time is a critical element in the success of an organization. A logic model framework such as the one discussed here can support students in maintaining initiatives on their campus between academic years and through leadership changes. This framework also provides students with clear goals and plans, so they can utilize their time efficiently.

Case Study: Weigh the Waste

Weigh the Waste events have been successful in gathering information on food waste at MU. Similar lunchroom food waste evaluation efforts have been conducted at secondary and post-secondary institutions and can serve as a future model for FRN Chapter activities (Ellison, et al. 2019). Starting in spring 2023, the Star Dining Hall no longer utilized plastic eating utensils. Additional strengths include increasing knowledge of food waste through the creation of infographics and other marketing material, and student engagement in sustainability projects on campus. A key factor in the success of these events is recruiting student volunteers; working with faculty to offer extra credit served as an effective recruitment tool. The success

and expansion of food waste evaluation will rely on adequate recruitment of student volunteers and effective planning and communication between the FRN Chapter and Sodexo. Future work will include conducting a Weigh the Waste event at MU's south campus dining hall. The chapter also plans to conduct a survey of students, faculty, and staff to measure the knowledge, attitude, and behaviors related to food insecurity and food waste (Alattar et al., 2020). This survey project will precede a social media outreach campaign followed by Weigh the Waste event to evaluate any changes in attitudes and behaviors.

Case Study: Food Drive

The FRN Chapter food drive was successful in collecting items for donation to New Bethany. Promoting the event at the department and school level and creating a competition between majors, departments, and student organizations assisted in receiving adequate donations. Recruitment of student volunteers and participants, as well as sufficient promotion of the food drive, remain potential barriers to future success of these events. Future food drives will include the collection of measuring cups and spoons, spatulas, can openers, and other food-related items in addition to nonperishable food and toiletries as community-based organizations expressed this need (Verpy et al., 2003). A future goal to enhance the value of the food drive will involve a community needs assessment to gain insight into most-needed items.

Limitations

Although the development of a logic model was useful for the MU FRN Chapter, it had limitations. The logic model may be modified over time as the goals and resources of the FRN Chapter evolve. Implementation and evaluation of the logic model are dependent on FRN Chapter student leaders, who may have differing levels of participation over time. Identifying and connecting with key stakeholders is still in the early stages and will continue to develop and strengthen over time. Since each Weigh the Waste event was conducted at the dining hall for only four-hour increments, data might not be reflective of the actual eating patterns of dining hall patrons over the course of an entire day.

Additionally, data were not collected on the type of food offered during each event, which may contribute to food waste volume. Reductions in food waste in the cafeteria do not necessarily translate to increased food access. Limitations to the food drive include a need to categorize the food, toiletries, and cleaning supplies donated and to determine if this matches the needs of the community.

Conclusions

The FRN Chapter at MU was established to address food waste and food insecurity. The logic model provides FRN Chapter leaders with a road map of detailed activities and related outcomes that can guide transitions as students graduate and new students are recruited. The FRN Chapter has recruited new student members, implemented Weigh the Waste and food drive events, and educated the campus community via social media in efforts to reach short-term outcomes. In the

future, the FRN Chapter will continue to implement and evaluate planned activities and collaborations to reduce food waste on campus and to decrease hunger among students and in the local community. This research brief may be useful for students or college organizations who are in the early stages of designing or implementing a food recovery program at their institution. 

Acknowledgments

We would like to acknowledge students Andrew Goodolf (founder of the FRN Chapter at Moravian University), Madison Houchens, and Kara Smith for their work on the FRN Chapter activities at Moravian University and development of the logic model for the FRN Chapter. We would also like to acknowledge Christine Bainbridge during her role as marketing manager of Moravian University Dining Services for her partnership and support of FRN.

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Appendix

Email Sent to Student Volunteers for Weigh the Waste Events

A quick reminder that this Wednesday, February 16th, we are hosting Moravian University's first Weigh the Waste event! Below are the safety expectations for the event.

1. Wear flat, sturdy shoes that cover your entire foot. No open-toed shoes or sandals.
2. Wear comfortable clothing such as long pants and a T-shirt.
3. Bring/wear a hat. Hair will need to be put up if it is long.
4. Don't wear any hand/wrist jewelry.
5. All participants will be provided with an apron, gloves, and shoe slipcovers if you would like them.

First-year hemp farmers' motives and resources to cultivate hemp

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Submitted July 11, 2024 / Revised October 11 and November 6, 2024 / Accepted November 6, 2024 /
Published online January 13, 2025

Citation: Colclasure, B. C., Caldwell, J., Granberry, T., Rost, C., & Gasseling, B. (2025). First-year hemp farmers' motives and resources to cultivate hemp. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 503–518. <https://doi.org/10.5304/jafscd.2025.141.028>

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Abstract

Recent legislative changes have opened new avenues of hemp production for farmers seeking to diversify their operations. With the availability of

these opportunities comes the need to better understand the decision making processes of new hemp growers. The purpose of this study was to explore what motivated first-year hemp farmers to grow hemp and to better understand the resources they utilized for decision-making. Fifteen farmers engaged in one-on-one interviews, which were analyzed using qualitative research methods. Three dis-

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Author Note

Portions of this research were presented as a research poster at the National Council for Science and the Environment, 2021 Drawdown Conference, held virtually.

Funding Disclosure

This work was supported by internal funding that included Undergraduate Research Funding from Doane University and by a University of Tennessee-Knoxville Developmental Research Award for an Undergraduate Research Assistant.

tinct themes emerged that undergirded farmer motivations to grow hemp: personal characteristics, identified advantages of hemp as a crop, and trialability and compatibility. Additionally, four themes were central to the resources new hemp farmers sought out: grower networks, digital media, government-based resources, and print media. The findings of this study align with components of Rogers' Diffusion of Innovation Theory and recent research related to hemp and hemp-based products. Based on these findings, we recommend developing and expanding educational resources for those interested in entering hemp production to aid in their decision-making process and assist them as they navigate their entry into hemp cultivation.

Keywords

alternative crops, cannabidiol, cannabis, diffusion of innovations, farmer behavior, hemp, hemp adoption

Introduction and Literature Review

Hemp, a nonpsychoactive form of cannabis grown for industrial and consumable uses, is an agricultural crop that has maintained a global presence throughout history and has provided significant contributions to human development. In the early U.S., hemp was an important agricultural commodity used to produce ship cordage, rigging, and sails (Fike et al., 2020). However, hemp production soon waned due to competing fiber production and technology development (Jenkins, 2016). Although the production of hemp made a brief resurgence in the U.S. during World War II (Small & Marcus, 2002), the crop's association with marijuana and resulting federal regulation and public stigma toward cannabis undermined hemp's potential in the mid- to late 20th century (Cherney & Small, 2016).

All forms of cannabis were made federally illegal in the U.S. with the passage of the Comprehensive Drug Abuse Prevention and Control Act of 1970 (Duppong, 2009). The act did not differentiate between hemp and marijuana, and hemp remained federally illegal for nearly 50 years. During this period, investments in hemp research and development almost entirely halted due to the

plant's Schedule 1 Controlled Substance status. Investments in hemp research remained sparse until the signing of the 2014 farm bill, which allowed institutions and state departments of agriculture to apply for permits to conduct pilot hemp research programs (Johnson, 2018). Hemp and marijuana were further established as distinct forms of cannabis when the 2018 farm bill removed hemp as a Schedule 1 Drug. The federally legal status of hemp soon prompted state departments of agriculture to form hemp cultivation and processing regulations under the direction of the U.S. Department of Agriculture (USDA).

Federal law in the U.S. differentiates forms of cannabis based on the content of Delta-9-tetrahydrocannabinol (THC), the principal psychoactive compound that produces a euphoric effect when consumed. Cannabis with a THC content of no more than 0.3% on a dry-weight basis is classified as hemp and is currently legal both federally and at the state level in all U.S. states (Hemp Industry Daily, 2021; Johnson, 2018). The characteristics of hemp cultivation vary by three primary targeted products: fiber, grain, and cannabinoids (Colclasure & Rothenberger, 2021).

Hemp production for fiber or grain is generally like that of other agronomic crops: producers in large-scale operations use mechanical farm implements to plant and harvest the crop. Hemp varieties grown for fiber typically grow fast and tall and are composed of quality yet variable bast fibers found in the outer portion of the stalk (Riddle et al., 2019). Products made from hemp fiber include a wide range of textiles, absorbents (e.g., animal bedding), composite reinforcements, and construction materials (e.g., hempcrete) (Malabadi et al., 2023; Riddle et al., 2019; Shahzad, 2012). Varieties of hemp grown for grain are traditionally shorter in stature and produce compact clusters of achenes—simple, dry fruits containing seeds (Small & Marcus, 2002). The hemp seeds can be used whole or processed into hempseed oil, which is used for human and animal consumption as well as in personal care products, biofuels, and industrial solvents (Burton et al., 2022). According to the U.S. *National Hemp Report* (USDA, 2022), in 2021 hemp was grown for grain on approximately 8,200 acres (3,318 hectares) and was valued at nearly US\$6 mil-

lion. Hemp was grown for fiber on 12,700 acres (5,140 hectares) and valued at US\$41.4 million (USDA, 2022).

Hemp grown for cannabinoids, such as cannabidiol (CBD), is sometimes referred to as floral hemp and is more characteristic of a horticultural crop than an agronomic crop. Production typically targets hemp flower because cannabinoids are most concentrated in the trichomes found on the flowers of female plants (Livingston et al., 2020). Floral hemp production can be labor intensive and have high input costs; however, as a specialty crop, it is more lucrative than hemp grown for fiber or grain (Moore, 2020). Floral hemp can be propagated by seed or vegetative clones and grown outdoors or in controlled environments (USDA, 2022). Many varieties have been selectively bred to produce desired cannabinoid concentrations, including minor cannabinoids such as cannabigerol (CBG). The market for the primary hemp-derived cannabinoid, CBD, has emerged in the health and wellness sector. Although clinical research on CBD is still in its infancy, emerging research has suggested that CBD may be beneficial in alleviating the symptoms of insomnia (Ranum et al., 2023), reducing stress and anxiety (Lookfong et al., 2023), and modulating inflammation (Pagano et al., 2023), among other medical uses (White, 2019). Hemp-derived cannabinoids are primarily sold in health and wellness products for human and pet consumption (Alvarenga et al., 2023; Wheeler et al., 2020) and cosmetic products (Jeong et al., 2019). The 2021 U.S. market for floral hemp far outweighed hemp grown for grain or fiber, with floral hemp making up US\$687 million of the US\$824 million total hemp value (USDA, 2022).

In addition to economic value, proponents of hemp postulate that the crop contributes to a myriad of environmental and social benefits. Hemp can be used to diversify farming operations (Dingha et al., 2019), improving sustainability by reducing pests and enhancing soil quality (Kremen & Miles, 2012). Hemp grown for fiber or grain can be compatible with the large-scale, yearly crop rotational systems typical of the Midwest and Great Plains regions of the U.S. (Tenkorang, 2016). The deep root system of hemp can also improve soil aeration, reduce erosion, and enhance soil organic

matter (Nath, 2022). Additionally, field trials have demonstrated hemp's ability to remove contaminants from the soil (Golia et al., 2023). Many hemp products can be considered eco-friendly and thereby support a green economy (Karche & Singh, 2019).

Despite the potential benefits of hemp and hemp products, a multitude of challenges has threatened the ability of hemp to reemerge as a mainstream agricultural commodity.

Researchers have found that the public has a limited ability to differentiate between the properties of hemp and marijuana, often defining hemp as a plant that causes euphoric effects when consumed (Colclasure et al., 2021; Rampold et al., 2021). When these misattributions exist, individuals who have a negative perception of marijuana likely have a similar perception of hemp (Rampold et al., 2021). However, the public has become more accepting of marijuana in recent years despite differences in acceptance by political ideologies (Chiu et al., 2022; Denham, 2019). As of May 2024, marijuana for recreational or medical use remained illegal in only 13 states (Breen & Johnston, 2024), including in Nebraska, where lawmakers have voiced opposition to all forms of cannabis (Young, 2019).

The rapidly changing and sometimes ambiguous laws on cannabis production and processing may hinder hemp cultivation (Dingha et al., 2019). Additionally, regulatory approval of chemical controls (e.g., synthetic pesticide options) to be used on hemp is lagging due to how recently hemp has been legalized, thus leaving farmers with limited chemical pest control options (Wortmann, 2020). Similarly, Barker (2020) posited that the future of the hemp industry depends on the development of appropriate infrastructure (e.g., equipment, processing facilities, lending), which is currently lacking. Lastly, unclear guidance and a lack of available resources may deter farmers from adopting hemp (Adesina et al., 2020).

After the federal legalization of hemp in the U.S., state governments soon enacted programs allowing farmers to grow hemp. Like in many states, farmers in Nebraska actively decided to seek hemp cultivation permits. In 2020, the first year that the Nebraska Hemp Farming Act was fully

implemented, 84 farmers were granted approval for hemp cultivation (Nebraska Department of Agriculture, 2020). In this study, we sought to explore the lived experiences of those farmers, paying particular attention to what motivated them to cultivate hemp and the resources they used to inform their cultivation. In doing so, we used Rogers' (2003) diffusion of innovation theory to situate our investigation.

The hemp industry in the U.S. entails a storied history, from being a foundational crop in colonial America to being a plant discouraged by the government. Although the successful reemergence of the hemp industry may strengthen environmental, economic, and human health, the advancement of the industry will depend on many factors. One factor is the willingness of U.S. farmers to grow the newly legal crop. The purpose of this study was to explore what motivated first-year hemp farmers to make the decision to grow hemp. Additionally, we sought to explore the types of resources these farmers used to make important decisions in their hemp farming operations. The results from this exploratory research can be used to inform policymakers, university extension, agricultural educators, and agricultural communicators who work with farmers interested in resilient and sustainable agricultural systems. The two overarching research questions that guided this study were:

- (1) What motivated farmers to cultivate hemp?
- (2) What resources did first-year hemp farmers utilize to inform their cultivation of hemp?

Research Methods

Hemp cultivation became legal in Nebraska in 2020 for all farmers obtaining state-granted hemp cultivation permits. All farmers obtaining legal permits in 2020 served as the population for our study. The Nebraska Department of Agriculture's website was used to identify publicly available names and addresses of all farmers who held state hemp cultivation permits. We used these names and addresses to compile a sampling frame that consisted of all Nebraska hemp cultivation permit holders ($N = 84$; Nebraska Department of Agriculture, 2020).

Due to the exploratory nature of our research

and the relatively small number of farmers who received hemp permits, we opted to use qualitative methods to best answer our research questions. Specifically, we conducted in-depth, one-on-one interviews (Kafle, 2013). We used this approach to elicit thick and rich data to describe first-year hemp farmers' motives and resources used to grow hemp.

Our participant recruitment procedures entailed mailing all members of our sampling frame ($N = 84$) a letter requesting their participation in our research study. The individualized recruitment letters briefly introduced the researchers, described the purpose of the study, and offered potential participants a US\$50 incentive to complete a one-hour interview with us. Fifteen of the 84 individuals responded and agreed to participate in the interviews, yielding an 18% response rate. We believed that 15 participants was an ideal sample size for our study, as qualitative research employing in-depth one-on-one interviews typically ranges between five and 50 participants (Dworkin, 2012). Additionally, we experienced data saturation as we approached interviewing approximately three-fourths of the participants, indicating that additional interviews would yield little to no new findings (Fusch & Ness, 2015).

We generated a semi-structured interview guide to facilitate the one-on-one interviews. The semi-structured interview guide contained five sections composed of 28 general questions and discussion points. However, the guide allowed the interviewers the flexibility to ask follow-up and probing questions to elicit the thick and rich data deemed valuable in qualitative research (Morse, 2015). We utilized the interview guide as part of a larger study; data obtained from approximately the first half of the guide served as the focus of this study. An external panel of experts reviewed the interview guide to improve face and content validity (Kerlinger, 1986). The panel consisted of a professor of chemistry and director of a cannabis studies program, an assistant professor of agricultural communications with experience in hemp research, and a professor of biology with expertise in cannabis biology. Additionally, we used an audit trail throughout the research process to improve trustworthiness (Lincoln & Guba, 1985).

We conducted individual interviews via Zoom to mitigate safety concerns associated with in-person interviews during the COVID-19 pandemic. Prior research has supported the use of remote interviews when in-person interviews are not feasible or practical (Cachia & Millward, 2011). During each interview, a second researcher was present to take detailed notes on the participant's audio and visual cues that would otherwise not be represented in transcriptions (Muswazi & Nhamo, 2013). Toward the conclusion of each interview, the moderator conducted member-checking by summarizing the main findings with each participant to ensure the accuracy and completeness of the data (Creswell, 2005; Lincoln & Guba, 1985). For accuracy, we recorded and transcribed all interviews.

We uploaded the transcriptions to NVivo, a software for qualitative coding, for data analysis. Two researchers worked together to code the data. As coding can be highly subjective, we attempted to bracket our biases in the coding process. One coder had an extensive background in hemp cultivation and held expertise in qualitative research. The second researcher was a novice qualitative researcher but held some prior knowledge of hemp cultivation. The two coders first established a codebook using deductive coding methods (Bingham & Witkowsky, 2022). The initial codebook contained codes aligning with Rogers' (2003) diffusion of innovation theory. Throughout the coding process, the researchers added emerging codes to the codebook that extended beyond the codes deriving from theory. The final codebook consisted of 20 codes, each with a definition and example passage.

The two coders then coded each transcript individually. After coding each transcript, the two coders met to discuss similarities and differences in coding until they agreed upon all codes found in each transcript. All passages for each code were then exported from NVivo for thematic analysis, where the two researchers again worked collaboratively to generate themes from the data that pertained to our research questions. We triangulated the findings between our thematic results, researcher notes, theoretical bases, and audit trails (Carter et al., 2014).

Results

Each of the 15 participating farmers completed a one-on-one, in-depth interview. Additionally, all farmers met the parameters of our research participants: (1) licensed hemp cultivator in Nebraska; (2) first-year hemp farmer in Nebraska; (3) above 18 years of age; and (4) provided voluntary informed consent as a research participant. We used pseudonyms in our findings in place of real names to protect participants' identities. Limited participant demographic and farm characteristics are illustrated in Table 1 to provide context for our participants' lived experiences.

Seven distinct themes emerged from our interviews with the 15 hemp farmer participants. Aligning with our first research question, "What motivated farmers to cultivate hemp?" the themes of personal characteristics, identified advantages of hemp as a crop, and trialability and compatibility emerged. The themes of grower networks, digital media, government-based resources, and print media provided answers to our second research question, "What resources did first-year hemp farmers utilize to inform hemp cultivation?" These findings are illustrated in Figure 1 and are described below.

Question 1: What Motivated Farmers to Cultivate Hemp?

Theme 1: Personal Characteristics. When describing their individual backgrounds and motivations for growing hemp, most producers illustrated personal traits that aligned with the characteristics of innovators, as described by Rogers (2003). The idea of participating in the frontier of a new agricultural industry was appealing to many. Dan wanted to be a leader in the industry. He stated, "It was to be a part of something new," and discussed his enthusiasm for leading a "really exciting industry to be part of" that is comparable to the "Wild West." Similarly, Ted described his interest in innovation and stated, "I like to try anything new." Aaron described how trying new things was exciting for him, stating, "I know I get bored if I'm not trying something new on a semi-regular basis." For Max, the challenge of trying new things was appealing to him. He stated, "It's a challenge and

Table 1. Participant Demographics and Production Characteristics

Name	Age Range	Gender	Targeted Hemp Product	Farming Background	Interview Length ^a
Ryan	40-50	Male	CBD	Conventional corn and soybean and diversified agriculture	43
Jordan	60-70	Male	CBD	Conventional corn and soybean	41
Max	40-50	Male	CBD	Conventional corn, soybean, and wheat	34
Ted	70-80	Male	Grain	Conventional corn, soybean, and wheat	33
Lincoln	20-30	Male	CBD	New farmer	45
Kyle	40-50	Male	CBD	Entrepreneur and rancher	38
Dan	40-50	Male	Fiber, Grain, CBD	Diversified agriculture	46
Riley	40-50	Male	Grain	Diversified agriculture	37
Molly	30-40	Female	CBD	Conventional corn and soybean	56
Todd	50-60	Male	CBD	Agricultural research	37
Jasper	40-50	Male	Fiber, Grain, CBD	Agricultural research	39
Marley	20-30	Male	CBD	New farmer	37
Daryl	70-80	Male	CBD	Diversified horticulture	55
Aaron	50-60	Male	CBD, CBG	Organic agriculture	53
Jack	50-60	Male	CBD	Organic agriculture	27

^a Interview length in minutes

stuff like that. I'm the type of personality that if someone says it can't be done, I'm going to try to do it anyway."

For these farmers, the idea of growing a crop that had not been legally grown in nearly half a century was part of the appeal to grow hemp rather than a hindrance. Todd discussed a desire "to experiment" and to provide data that can be used to help others. He stated, "The research side actually made it even a little more tempting because I like to try to do the research and figure out a better way to do it." Several farmers' existing operations and schemas that went beyond the region's conventional agricultural operations illustrated the desire to try new things, leading new advancements and challenging themselves to operate differently within agriculture. For example, Aaron saw an opportunity in organic agriculture and transitioned to an organic farming operation 25 years ago. When describing his family farm, he stated, "We've been very open to trying new crops, and because of that, we have an unusual store of information." Similarly, Ted mentioned growing popcorn, an unconventional crop in the region, in addition to his conventional corn and soy operation. Ryan

described his family farm, where they have raised corn and soybeans on large acreage for 150 years. However, Ryan's drive to delve into new agricultural markets led him to add greenhouses to his farmstead around 15 years ago, where they have been growing fresh herbs for wholesale.

Theme 2: Identified Advantages of Hemp as a Crop. Farmers shared their beliefs that growing hemp had advantages over growing other crops. These beliefs served as motivating factors that influenced them to grow hemp. The main advantage of growing hemp, as perceived by nearly all our participants, was the economic potential of the crop. Most farmers described their beliefs that hemp could be a cash crop; however, most were cautiously optimistic. For example, Dan stated, "The gold rush is over. ... I came in with pretty darn low expectations, but as far as financial incentives, I hope to transition into a full-time role with the hemp industry." For Max, who was growing hemp for cannabinoids, it was the opportunity to make a high profit on a small amount of acreage. He stated, "The high return on your investment is the biggest thing." Kyle, who was limited by the

Figure 1. Themes Pertaining to First-Year Hemp Farmers' Motives and Resources to Cultivate Hemp

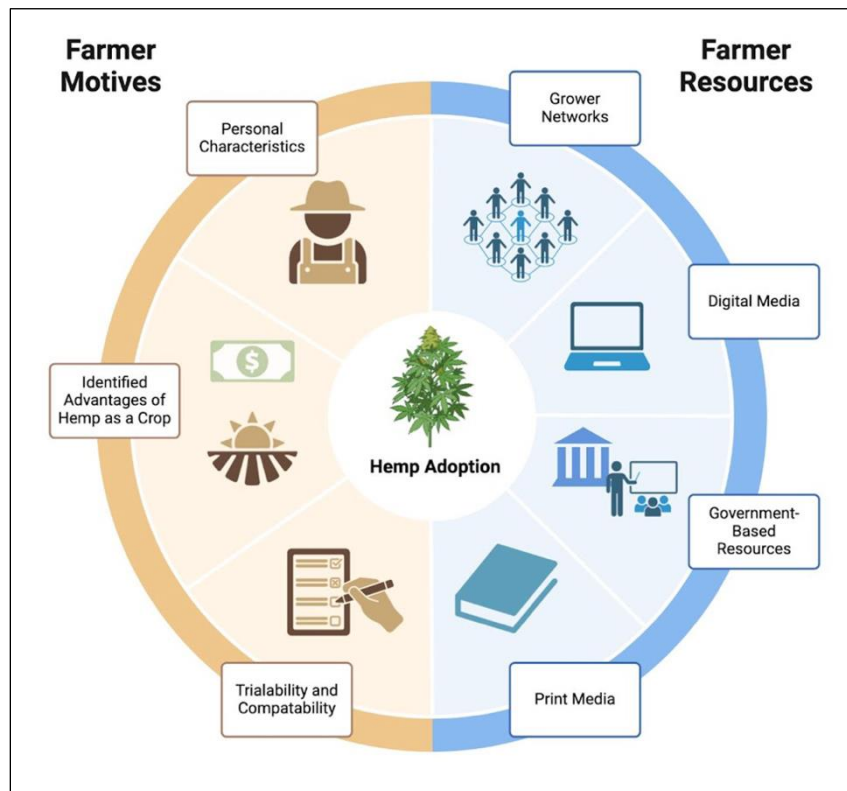


Figure created with BioRender.

acreage on his “small homestead,” shared a similar sentiment. He asked himself, “What can I do with the amount of ground that I have that would be economically viable?”

Some farmers described growing hemp as an opportunity to diversify the types of crops in their operations. According to Jordan, he wanted “a crop that was a little more profitable to raise than corn and beans,” and he just “hoped it would work out.” Other farmers, like Molly, also mentioned using hemp to diversify their farming operations to improve economic sustainability. She stated, “We’ve been told time and time again we got to diversify. You know, corn and soybean prices are not great. It’s not a great outlook for farmers to keep along that stream.” Similarly, Riley said, “We need to find a substitute for growing soybeans,” while Ryan added, “This is just another step for us to diversify our farm and create more opportunities for our kids.”

Although the primary identified advantage of

hemp over other crops was economic advantages, most farmers perceived additional advantages. Around half of the farmers mentioned aspects of hemp and hemp-based products that are environmentally favorable. Several farmers described a reduction in their use of pesticides. Molly stated, “You don’t have to put chemicals on it, you don’t have to put herbicide on it, so you’re doing a favor to everybody by growing it.” Dan also mentioned pesticide reduction, “I’m not using pesticides or herbicides, so I guess there’s some benefit to that.” Dan and Daryl also mentioned hemp’s capacity to remove contaminants, such as “heavy metals,” from the soil. However, both farmers described the capacity of hemp for phytoremediation as unsubstantial in their decision to grow hemp.

Several participants alluded to the environmentally favorable products made from hemp as a motivating factor for them to grow the crop. For example, Jordan said, “There are many things you can [make] from hemp that could help our environment” and mentioned green “insulation” and “construction materials.” Other farmers also mentioned products from hemp, but as opposed to environmental health, they described advantages of the crop to support human health, and these perceived advantages made cultivating hemp an appealing avenue for them. Marley, who was growing hemp for cannabinoids, stated, “I’m growing CBD. It’s a health supplement that people can use to better their lives, and that’s really powerful, ... so that is a lot of my motivation.” Like Marley, Jordan also found the medical properties of hemp interesting and valuable. Jordan described wanting to eventually “grow certain varieties to do certain beneficial things, medicine-wise, once the genetics, science, and technology catch up with the industry.”

Overall, all farmers believed in the potential of hemp to bring positive attributes to their farming operations, community, and the state. They specifically believed that hemp had a strong potential to improve economic, environmental, and human health. Jasper summarized such attributes by saying,

We need to have something more regenerative and stable in the plant world that's healthier for not only the actual earth that it's being planted into but then, also all the byproducts that come from the plant and how those actually impact the environment and us. That's [my] motivation – to have a healthier culture.

Theme 3: Trialability and Compatibility. In addition to farmers identifying advantages of hemp, they also described two general characteristics of successfully adopted innovations that applied to hemp: trialability and compatibility. Nearly all participants explained that their first year growing hemp was more of a trial year, and they opted to grow the crop on a limited scale. Jordan stated that his first year was to “get [his] feet wet and get in there and grow some.” Some farmers, like Molly, rationalized limiting production due to trusted advice from others. Molly mentioned, “One of those things that I was told right away, I kind of heeded toward, was ‘it’s a new crop, don’t bite off more than you can chew.’” Kyle described his first year growing as essential to determine if the crop would be profitable. He mentioned, “Before a person makes a big leap, you’re going to want to make sure you’re doing something that is economically viable.”

Farmers viewed the first year of production as an opportunity to experiment with crop varieties and growing conditions to learn more and to prepare them for the possibility of a larger operation in years to come. This view was illustrated by Marley when he said, “This year is a big learning experience and kind of like figuring out what the climate is like and what the environment in Nebraska is like and what [hemp] varieties grow good here.” Ryan shared a similar sentiment: “I looked at this year being a strong research and development year for our company, learning the

plant, learning timing ... learning all the bumps in the road and figure out how to do it better in the second season.” Dan said this year was to “make sure [he] was set up for next year to optimize [his] operation.” He explained his focus this year was to “figure out what seeds, what varieties, and what genetics to pick.”

All but two farmers were incorporating hemp into an existing farming operation. In doing so, these farmers described their perceptions of the compatibility of hemp with their prior operation. Ted, who also grows wheat, believed he could grow hemp for grain as a viable option to diversify his farm without significant disruption to his current operation. Ted stated:

I thought I could start with the grain end of it because I’m a grain producer anyway, so if I got the grain drill that I use for wheat. ... If you look at these real old grain drills, they’ve got a hemp setting right in there. You lift the lid, and it’ll tell you a hemp setting, especially the ol’ John Deere L13 grain drills... but anyway, I used the grain drill that I normally [use to] plant wheat... It should be the same as growing wheat, as far as planting.

Jordan believed incorporating hemp would “work well with corn and beans,” citing the environmental benefits. However, Molly, who was growing hemp for cannabinoids, explained that this was not the case for her. She described challenges to growing hemp for CBD as a steep learning curve and very different from her current operation. She stated, “We have large equipment for cultivating corn and soybeans, so hemp cultivation has been a little bit more of a challenge as far as how do we get this into the ground and then what do we do as far as care for it when it comes up.” Interestingly, several farmers growing hemp for cannabinoids mentioned hemp being compatible with their current operations because they were used to growing specialty crops. For example, Kyle described growing many specialty crops, such as tobacco and aronia, on his small “hobby farm.” He described hemp as a crop that “checked all of the boxes” for his growing operation. Similarly, Ryan described the crop as compatible with his existing

operation, which ranges from conventional corn to fresh herbs.

Question 2: What Resources Did First-Year Hemp Farmers Utilize to Inform Hemp Cultivation?

Theme 1: Grower Networks. Nearly all the first-year hemp growers in our study built a network of trusted and knowledgeable individuals who served as a resource informing their hemp cultivation. Todd described his network as his primary resource: “I created a network of people that I talk to, and I think that’s what is helping me more than anything right now.” He continued by saying “I can call on individuals that have experience and some that don’t, and we just talk about what we are seeing.”

Hemp farmers formed these networks through many channels. Most hemp farmers started to build their network by attending seminars, workshops, or conferences. Several farmers, like Dan and Molly, mentioned joining the National Hemp Industry Association and taking advantage of knowledge exchanges through the organization. Jack discussed learning a lot through the Midwest Organic and Sustainable Education Services (MOSES) Organic Farming Conference, Ryan discussed attending the NoCo hemp exposition and conference, and Ted described attending the Midwest Hemp Forum. Ted elaborated on his experience by stating, “I went to seminars the last three years on hemp.” He further explained how he found out-of-state conferences more beneficial, “I’ve been to seminars in Kansas. I’ve been to seminars in Colorado. I follow other states and what they are doing because they were ahead of Nebraska.”

Some farmers would then use these contacts to reach out to others. Aaron summarized his experience by stating, “It was one of those cascade effects. One person met another person that allowed another person to be met. ... We found some people that were very smart and knew a lot about the industry.”

Uniquely, Marley, a young farmer, described finding his network through online chat groups. He described participating in Google Hangouts with experienced cannabis growers who were

growing marijuana. Marley explained, “You could go and talk to them. ... Just getting consensus on what problems they’re having and how to avoid some of those problems. ... At the end of the day, it’s the same crop (marijuana and hemp) that we’re growing.”

Theme 2: Digital Media. Most farmers described searching the internet to find resources to inform their hemp operations, with Aaron stating that “Google was [his] honest friend.” Farmers described finding a plethora of helpful information, yet a good portion of that information pertained to marijuana cultivation as opposed to hemp. Although Aaron stated that he found some helpful information online, some of the resources were produced by “backyard potheads,” and while he took “tidbits of information from them,” he found resources produced by larger operations more useful. Daryl described websites such as Grow Weed Easy and I Love Growing Marijuana as trusted resources for him. Several farmers described YouTube as being a primary resource. Jordan stated, “There are some good videos and everything on how to grow [cannabis] on YouTube, ... and I just kept watching videos.” Similarly, Marley got his start by watching YouTube videos. He stated, “I was always watching YouTube videos. That’s where I got a lot of my information from ... because there wasn’t a lot of like set research or anything like that.” He continued, “some people would just upload videos, like weekly, or daily, and you’d follow along with them.” Jack described a similar experience of watching an online video of no-till, organic hemp production and telling himself, “that’s the way I want to do it.”

Theme 3: Government-Based Resources.

Regarding laws and regulations for growing hemp in Nebraska, all participants stated they utilized the Nebraska Department of Agriculture website. Jasper summarized the sentiment, “As far as regulations go, we looked mostly to the Department of Agriculture.” Some farmers found the information presented on the website straightforward, while others found it to be complex or incomplete. In these instances, farmers would reach out to the lead of the hemp program for the state for answers

to their questions or to assist them through the regulatory process.

Another commonly utilized government resource was Extension services provided by land-grant universities. The most mentioned modalities for these resources were online materials, in-person seminars, and field days. While only Riley described utilizing Nebraska's 1862 land-grant institution, the University of Nebraska-Lincoln, as a resource, other farmers mentioned utilizing materials from land-grant institutions in other states. For example, Jordan stated, "I was on a website for the University of Wisconsin. And there's a lot of universities now that are really getting with the idea of growing hemp." Furthermore, Jordan described his belief that the information from these universities was more credible than other resources. He stated, "I think [a] university, no matter where it's at, is probably more reliable source of information." Kyle stated, "Lots of different states had information on their state's [land-grant university] sites, meaning I could look at [the] University of Kentucky or the University of Kansas ... [the] University of Washington ... there was a lot of information out there." Dan similarly shared, "Wisconsin had a lot of good resources, the University of Wisconsin."

Theme 4: Print Media. Approximately half of our participants recalled using some form of print media as a resource. Several farmers described finding information from magazines. For example, Dan mentioned that he subscribed to *Hemp Grower* magazine. Similarly, Jordan recounted learning more about hemp cultivation from farm magazines, such as *Successful Farming* and *Farm Journal*. Molly, Ryan, and Marley all described using the textbook, *The Cannabis Bible*, as one of their primary resources. Ryan explained, "One of the big resources that I got a lot of facts from is *The Cannabis Bible*. It talks about the differences on both plants (hemp and marijuana) and how that plant grows and how all of it comes together." Uniquely, Ryan also described "digging into old literature and books," particularly information "coming out of Europe."

Discussion

Our findings illustrate that the farmer characteristics in this study and their views toward hemp

closely aligned to components of Rogers' (2003) diffusion of innovation theory. As described by Rogers (2003), innovators are the first individuals who adopt an innovation. These individuals have distinct personal characteristics that influence their motivation to adopt new agricultural practices and technologies (Hubbard & Sandmann, 2007). The farmers in our study had an ingrained desire to be change agents and leaders in a new agricultural industry. Furthermore, they were motivated by new challenges and viewed hemp cultivation as an appealing challenge they wanted to pursue. Exploring new opportunities was not limited to their pursuit of hemp cultivation. Most of our participants shared a history of exploring new agricultural opportunities and challenges, being entrepreneurs, risk-taking, and seeking new ways to manage their farms for the betterment of themselves, their families, and their community food systems. Prior research has identified similar traits in farmers who grow specialty crops, practice nonconventional agricultural methods (e.g., organic production), or employ climate-smart agricultural practices (Dingha et al., 2019; Kangogo et al., 2021; Padel, 2001; Rakesh et al., 2015)

Beyond the personal characteristics influencing the adoption of new technologies, individual attitudes toward the attributes of the technology influence the adoption of innovations (Rogers, 2003). Of these innovation attributes, we found that farmers perceived hemp to have relative advantages over other crops. Rogers (2003) describes the scholarly consensus that relative advantage is one of the strongest predictors of the adoption of an innovation. One of the most consistent participant viewpoints was the economic advantage of hemp as a motivation to cultivate the crop. Farmers believed they could make money from growing hemp, and thus it was a primary motive for their venture into the hemp industry. These findings align with Dingha et al. (2019), who surveyed potential hemp farmers in North Carolina and found that a viable hemp market was important for farmers to determine whether they would consider growing hemp.

Prior literature has illuminated the need for more crop diversification to improve agricultural sustainability (Paroda, 2022; Shah et al., 2021).

Farmers similarly acknowledged that they viewed hemp as impactful in this context. They sought to incorporate hemp as a means of crop diversification, primarily focused on diversification for economic sustainability. However, several farmers also described crop diversification as critical for improved environmental sustainability. Farmers described the ability of hemp to reduce the need for pesticides and improve soil conditions, which were found to be attributes of hemp described in scientific research (Golia et al., 2023; Nath, 2022). The farmers in our study described their belief that hemp provides tangible benefits to society, increasing their motivation to grow the crop. Farmers who were growing floral hemp for CBD believed that CBD was a beneficial health and wellness product. Although the claims of health benefits of CBD may be exaggerated in digital spaces (Merten et al., 2020), clinical research has shown there to be beneficial properties of CBD for medical uses (Lookfong et al., 2023; Pagano et al., 2023; Ranum et al., 2023; White, 2019).

The compatibility of a new crop, or its ability to be integrated within existing farming operations without significant disruption to operational characteristics, can influence wide-scale farmer adoption of the crop. Tenkorang (2016) described that hemp grown for fiber or grain is similar to the operational characteristics of other fiber and grain crops. These characteristics make hemp a potential crop for implementation in crop rotations with corn, soybeans, and wheat found in conventional large-scale operations in the Midwest and Great Plains regions of the U.S. (Tenkorang, 2016). Farmers in our study who were growing hemp for fiber or grain alluded to the compatibility of hemp with their current conventional farming operations. Conversely, the farmers growing hemp for cannabinoids found the crop to vary considerably from conventional agronomic crops. However, several of these farmers had experience growing specialty crops and found that floral hemp was compatible with their operations. This finding corroborates the suggestion of Hubbard and Sandmann (2007), who posited that farmers are more willing to adopt farming practices that they view as compatible with their existing operations. Neiden (2021) recommended that farmers who plan to enter the hemp

industry should start on a small scale. Thus, trialability appears to be an important attribute for hemp adoption. The farmers in our study alluded to this, describing that their first year growing hemp was primarily for their own research and development in order to learn what works well for them and their operation.

The prohibition of hemp cultivation in the U.S. from 1970 to the early 21st century significantly disrupted hemp research and development (Cherney & Small, 2016). This void in research and education likely caused a lack of resources on hemp cultivation for farmers to utilize. Dingha et al. (2019) found that a lack of knowledge and information about hemp was a factor that negatively impacted hemp adoption by potential hemp farmers in North Carolina. Interestingly, we found that farmers used a variety of resources to inform their hemp-growing operations. Among their primary resources was a robust personal network of other hemp farmers and hemp-related organizations. Participants discussed seeking out individuals through attending hemp conferences and expositions and utilizing this network to support their decision-making. Farmers often relied on each other to share information, resources, and personal experiences. Padel (2001) found that similar formal and informal farming networks were important to the distribution of information and the decision-making of farmers growing specialty crops or using niche production methods.

Although a lack of hemp production in recent years reduced its observability to U.S. farmers, an important attribute for adoption (Rogers, 2003), many of our farmer participants discussed online websites and videos as valuable resources to inform their hemp cultivation programs. This online modality allowed the participating farmers to observe aspects of hemp production that may have been difficult to access otherwise. Rust et al. (2022) described that more farmers are seeking information from online resources. Our findings show that the farmers in our study were using a variety of online resources, including online video-sharing platforms such as YouTube. Despite some farmers describing viewing online media specific to hemp cultivation, some farmers described using resources that were made to inform marijuana cultivation.

As farmers now have access to copious information online, including unverified information, farmers must decide what information to trust (Rust et al., 2022). Some participants questioned the trustworthiness of online resources they encountered from independent content creators, such as those produced by hobby marijuana growers. Farmers did seek information they perceived to be more trustworthy for growing hemp, including information produced through university Extension services. However, several of our participants described a lack of research-based resources for hemp growers produced by Extension services in their state. These farmers described finding information from Extension in states beyond Nebraska. While they believed this information to be both trustworthy and helpful, best practices in hemp production vary by differences in each state's economic, political, and environmental landscapes. This variability leads to a need for each state to develop educational resources for hemp farmers tailored to the unique conditions of their state and stakeholder needs. Ruth et al. (2022) recommended that Extension specialists and agricultural communicators in each state work with hemp growers and processors in the state to support the reemerging hemp industry. Additional hemp research and educational efforts, especially through the integration of existing hemp farmer networks, may be valuable to the success of the hemp industry.

Conclusions and Recommendations

The results of this study demonstrated that farmer characteristics and their perceptions of hemp influenced their decision to grow hemp. Based on the results of our qualitative study, we found that Nebraska hemp farmers exhibited characteristics aligning with Rogers' (2003) description of innovators. They saw themselves as change agents and disruptors to the agricultural industry, had a history of adopting new practices, and expressed excitement in seeking new challenges and opportunities for the betterment of themselves, their farming operations, and their communities. We believe these farmer characteristics are valuable to improve community food systems. Additionally, two of our participants became new farmers due to the desire to grow hemp. Thus, hemp can be a unique crop

that encourages individuals to enter farming, and new farmer programs should be considered in the context of hemp.

Farmers also saw hemp as having a relative advantage over other crops, aligning with the diffusion of innovation theory (Rogers, 2003). Participants were motivated to grow hemp because they believed that hemp could increase the revenue of their farming operations over other crops. Although prior research has suggested that growing hemp can be a profitable endeavor (Khanal & Shah, 2024), we recommend that farmers be cautious due to uncertainty in hemp markets (Mark & Will, 2019; Sterns, 2019). As we found economic incentives to be the primary motive for farmers' adoption of hemp, extension-based educational programs to support profitable hemp operations can be valuable in supporting economic sustainability. These programs should be based on modeling from agricultural economists to project realistic profitability for farmers on a state-level basis (e.g., Moore, 2020). Due to the lack of hemp research, train-the-trainer programs or educator professional development on hemp may be necessary to guide such workforce and farming training programs in the cannabis industry (Colclasure et al., 2023).

Some farmers described a desire to increase the crop diversity of their farming operations to improve economic and environmental sustainability. Several farmers also believed hemp products would benefit human health and society. Farmers' attitudes toward the trialability and compatibility of hemp also influenced their decision to grow hemp. Participants described their first year growing hemp as a trial run and an important learning experience to inform their production decisions in future years.

The farmers in this study sought information from university Extension services to guide their decision-making in hemp production. However, these farmers were utilizing information from Extension services from states beyond their home state. We suggest that consideration should be given to the regional variations in growing hemp and therefore recommend that state Extension services create and disseminate cultivation resources specific to the regulations and environmental characteristics distinct to hemp in their state. Many of

the farmers in this study utilized online video resources to guide their hemp management decisions; therefore, we recommend that government support providers, such as Extension, explore the use of video resources to inform producers.

The characteristics of hemp cultivation vary state by state due to political, social, and geographical differences. We recommend that future studies

explore hemp adoption in other states. Lastly, although the qualitative nature of our study provided valuable exploratory data on farmers' adoption of hemp, it does not lend itself to being generalizable to farmers beyond our study. Additional social science research should investigate the characteristics of hemp adoption from a quantitative methodology to provide generalizable data. 

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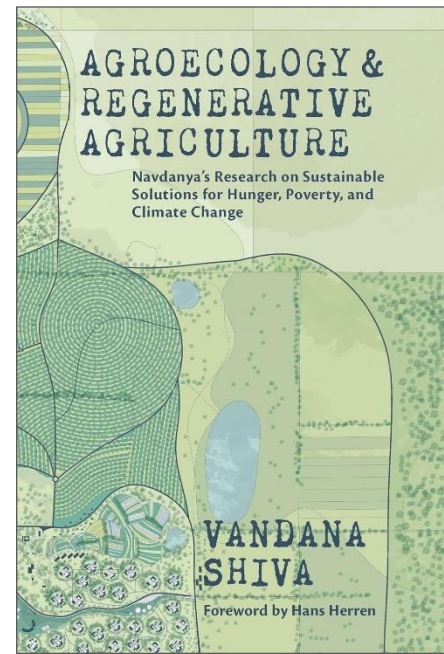
Getting into the weeds: Vandana Shiva calls for an alternative to industrial agriculture

Book review by

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Review of *Agroecology and Regenerative Agriculture: Sustainable Solutions for Hunger, Poverty and Climate Change*, by Vandana Shiva. (2022). Published by Synergetic Press. Available as paperback and eBook; 344 pages. Publisher's website: <https://synergeticpress.com/catalog/agroecology-and-regenerative-agriculture-sustainable-solutions-for-hunger-poverty-and-climate-change/>



Submitted December 16, 2024 / Accepted January 3, 2025 / Published online January 15, 2025

Citation: Marchessault, A. (2025). Getting into the weeds: Vandana Shiva calls for an alternative to industrial agriculture [Book review]. *Journal of Agriculture, Food Systems, and Community Development*, 14(1), 519–521. <https://doi.org/10.5304/jafscd.2025.141.029>

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In a world where industrial agriculture dominates, Vandana Shiva's *Agroecology and Regenerative Agriculture: Sustainable Solutions for Hunger, Poverty and Climate Change* asks a pivotal question: Can we transform our food systems to heal the planet and its people? Shiva's work challenges conventional farming, advocating for a future of regenerative, organic agriculture. Shiva is an inspiring scholar

and activist with expertise in food sovereignty, ecofeminism, and commoning. Drawing on decades of research conducted at her farm, Navdanya, and global examples from scholarly literature, she argues that regenerative agriculture is both viable and essential for tackling the interconnected crises of hunger, poverty, and climate change. In this book, Shiva takes the reader through six distinct agricultural issues with overlapping themes: seeds of biodiversity, soil and water, climate change solutions, biodiversity for pest control, food nutrition and health, and farmer livelihoods and rural economies.

Shiva weaves together ecological, economic, and health crises as they relate to food, suggesting that the current food paradigm not only allows

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these crises to persist but actively endorses them. Shiva criticizes industrial agriculture's reliance on reductionist metrics—such as yield—by comparing it to GDP in its failure to account for broader systemic impacts. She describes how industrial farming practices produce nutritionally empty, toxic commodity crops, many of which are used as livestock feed and biofuels. She proposes that in place of yield, we use metrics like “nutrition per acre” to better account for the human health implications of farming practices.

In addition to these novel metrics, the book introduces the reader to essential concepts like biodiversity, regenerative agriculture, and agroecology. To people unfamiliar with these concepts, however, this book may seem to conflate agroecology and regenerative agriculture. Agroecology, by nature, combines ecological principles with social and economic considerations for systemic change in the agri-food system regarding climate, food, ecosystem crises, and social injustices. Shiva first defines agroecology as “the science of ecology applied in agriculture” (p. 15), missing its broader socio-political foundation. The book goes on to describe many of the social and political dimensions of the food system, but it would have been more effective to explicitly frame these within agroecology to provide a more comprehensive understanding of the term.

The bulk of the book digs deep into regenerative on-farm practices that benefit soil health, ecology, biodiversity, and water resources. Shiva's insights on seeds effectively illustrate the destruction of agroecological systems under the control of industrial agriculture. This section highlights how the processes of privatization, centralization, and corporate dependency not only undermine farmer livelihoods but also intersect deeply with the ecological challenges explored in subsequent sections. Shiva beautifully illustrates the connections between human and more-than-human life through the motif of soil: “Humus, which is the Latin word for living soil, is also the root of ‘human.’ We are connected to the soil. When soils are healthy, societies are healthy. When soils are sick and desertified, societies become sick” (p. 264). She criticizes the industrial agricultural system's disregard for soil health, naming the far-reaching consequences of

the Green Revolution in India—including chemical runoff, declining farmer well-being, and negative health impacts—while dismantling the myth of industrial efficiency. She equips the reader with practical techniques to promote sustainable farming practices while backing up her claims with peer-reviewed literature and lots of data. Shiva's passion for and experience with regenerative farming shine through in her writing, giving her arguments authenticity and conviction.

An underlying theme in this book is that regenerative agroecosystems are more ecologically and economically efficient. Shiva challenges the misconception that industrial agriculture produces higher yields and higher incomes, providing evidence to the contrary. However, this analysis unsuccessfully addresses the labor or consumer cost implications of a shift to regenerative and organic systems. Questions about who will perform this additional labor, how to ensure fair labor protections, and how prices and markets may affect consumer food security remain unexplored, leaving a critical gap in the discussion.

The book is packed with compelling facts refuting industrial agriculture, such as “Industrial agriculture that relies on fossil-fuel intensive, chemical-intensive monocultures uses 75% of the land yet produces only 30% of our food supply while small, biodiverse farms utilizing 25% of the area produce 70%” (p. 168), and “fifteen plant and animal species supply 90% of our food” (p. 187). However, the sheer amount of content covered may overwhelm readers, leaving them unable to fully grasp these glaring statistics. Some sections feel overly dense for newcomers, while others lack the depth expected by more advanced readers, leaving the intended audience unclear.

Reminiscent of, and perhaps inspired by, Rachel Carson's *Silent Spring*, Shiva uses the beauty and wonder of natural systems to argue against industrial agriculture. Shiva's writing offsets technical rigor with a deeply personal tone. Shiva conveys her own experiences and passion in the pages, connecting the reader more deeply with the violence of the current food system. Ultimately, *Agroecology and Regenerative Agriculture* is a valuable resource for those with a foundational understanding of sustainable agriculture. It offers practical

solutions and a compelling critique of industrial farming but struggles to fully synthesize its wealth of material into a cohesive narrative. Despite its

limitations, Shiva's passionate advocacy for a regenerative future inspires readers to reconsider the hidden costs of conventional food systems. 