

Developing a food system indicators database to facilitate local food systems assessments: Using a scoping review approach

Abiodun T. Atoloye ^{a*}
University of Connecticut

Karen Bassarab ^f
Johns Hopkins University

Sophie Schouboe,^b Caitlin Misiaszek,^c and
Jamie Harding^d
Johns Hopkins University

Larissa Calancie ^g
Tufts University

Kristen Cooksey Stowers ^e
University of Connecticut

Submitted December 11, 2022 / Revised April 24, July 11, and August 23, 2023 / Accepted August 24, 2023 /
Published online December 6, 2023

Citation: Atoloye, A. T., Schouboe, S., Misiaszek, C., Harding, J., Cooksey Stowers, K., Bassarab, K., & Calancie, L. (2023). Developing a food system indicators database to facilitate local food systems assessments: Using a scoping review approach. *Journal of Agriculture, Food Systems, and Community Development*, 13(1), 99–112. <https://doi.org/10.5304/jafscd.2023.131.008>

Copyright © 2023 by the Authors. Published by the Lyson Center for Civic Agriculture and Food Systems. Open access under CC BY license.

Abstract

Many food policy councils, food and agriculture-oriented groups, coalitions, organizations, funders, nonprofits, decision-makers, government depart-

ments, and other entities work to address local food system issues and inequities that negatively affect human, animal, and planetary wellbeing. In this article, we summarize and reflect on the process of creating an open-access food system indicators database. Our goal has been to create a library of indicators from which groups can draw when assessing their local food system, identifying

^{a*} *Corresponding author:* Abiodun T. Atoloye, UCONN Rudd Center for Obesity and Health, Hartford, Connecticut.

Abiodun T. Atoloye is now Assistant Professor, Department of Nutrition, Dietetics, and Food Sciences, Utah State University; Logan, Utah, USA; +1-435-797-1586; abiodun.atoloye@usu.edu

^b Sophie Schouboe, MPH Student, Center for a Livable Future, Johns Hopkins University, Baltimore, Maryland USA.

Sophie Schouboe is now Partnership Manager, United Way, Bay Area; San Francisco, California, USA; sschouboe42@gmail.com

^c Caitlin Misiaszek, Program Officer, Center for a Livable Future, Johns Hopkins University; Baltimore, Maryland, USA.

^d Jamie Harding, GIS Specialist, Food Communities and Public Health, Center for a Livable Future, Johns Hopkins University; Baltimore, Maryland, USA; jhardi14@jhu.edu

^e Kristen Cooksey Stowers, Assistant Professor, UCONN Rudd Center for Obesity and Health and Department of Allied Health Sciences, University of Connecticut; Storrs, Connecticut, USA; kristen.cooksey@uconn.edu

^f Karen Bassarab, Senior Program Officer, Food Communities & Public Health, Center for a Livable Future, Johns Hopkins University; Baltimore, Maryland, USA; kbanks10@jhu.edu

^g Larissa Calancie, Assistant Professor, Friedman School of Nutrition Science and Policy, Tufts University; Boston, Massachusetts, USA; larissa.calancie@tufts.edu

See disclosures at the bottom of the next page.

improvement opportunities, and evaluating their efforts. The indicators were extracted from seven sources selected to cover a wide range of food system elements and pertinent topics, including nutrition, agricultural production, racial equity, health outcomes, environmental impacts, and economics. Our work can contribute to needed research on monitoring and evaluating food system attributes and changes, developing a common set of indicators that groups can use to track food systems across places and over time and to assess racial equity, justice, and fairness in the food system.

Keywords

food system, monitoring and evaluation, equity, public health, collective impact, indicators

Introduction

A food system is a complex network of systems and processes that includes all inputs and outputs associated with agricultural and food production and consumption (U.S. Department of Agriculture [USDA], n.d.). The food system is dynamic and involves diverse actors, processes, and interactions in the production, aggregation, processing, distribution, consumption, and disposal (loss or waste) of food products (Healthy Food Policy Project, 2017; International Food Policy Research Institute, n.d.; von Braun et al., 2021). Despite a steady increase in food production across the country over the past 50 years (USDA Economic Research Service [ERS], 2020), the food system does not currently meet all Americans' food and nutrition security needs. In 2019, about 10.5% (13.7 million)

of U.S. households were food insecure, meaning they lacked consistent access to reliable, safe, and appropriate food (Coleman-Jensen et al., 2020). About 46% of American adults have a suboptimal diet, or a diet that lacks sufficient nutrients (Rehm et al., 2016).

Moreover, six in 10 American adults have at least one diet-related disease, such as obesity, diabetes, or hypertension (Boersma, 2020), with a higher prevalence of diet-related diseases experienced by racial and ethnic minorities (Hales et al., 2017). Food production and distribution systems also impact health disparities through occupational and community hazards (e.g., exposure to industrial waste), which are disproportionately suffered by low-income, minority, and immigrant communities (Gochfeld & Burger, 2011; Lindgren et al., 2018; Institute of Medicine & National Research Council, 2015). Food system inequalities have a far-reaching negative impact on the environment, society, and ecosystems (McMichael et al., 2015; Shannon et al., 2015). For example, pesticides, methane, nitrates, and carbon dioxide emitted through food production and distribution affect soil health, air quality, and water quality and contribute to climate change (Landrigan et al., 2018). These issues and more need to be addressed to improve the food system in the U.S. However, assessing and measuring changes within the food system is challenging because of its complexity. Although we need to know whether activities aiming to improve the system are having an impact, selecting *what to measure* and *what data to use* are tough decisions faced by various groups working to address food system issues.

Food policy councils (FPCs) and similar groups are working to improve their local food systems by implementing programs, facilitating connections between individuals and organizations within their community, and advocating for policy change (Calancie et al., 2018; Eicher & Eicher-Miller, 2015; Franzen-Castle et al., 2021). FPCs are unique, as they comprise a network of members from different community and food system sectors (Eicher & Eicher-Miller, 2015; Franzen-Castle et al., 2021; Schiff, 2008). FPCs operate at different scales, including local, regional, and state levels. Their work may include fostering coordination

Author Disclosures

Authors of this publication are members of the Food Policy Council working group, part of the Nutrition and Obesity Policy Research and Evaluation Network (NOPREN).

Funding Disclosure

The authors are members of the Food Policy Council working group, part of the Nutrition and Obesity Policy Research and Evaluation Network (NOPREN). NOPREN is supported by Cooperative Agreement Number (5U48DP00498-05) funded by the U.S. Centers for Disease Control and Prevention's Division of Nutrition, Physical Activity, and Obesity (DNPAO) and Prevention Research Centers Program. The findings and conclusions in this publication are those of the authors and do not necessarily represent the official position of the CDC or DHHS.

between sectors in the food system, mobilizing residents to influence decision-makers, conducting local food policy evaluation, advising governments and institutions on policy, and/or supporting programs that address local needs (Eicher & Eicher-Miller, 2015; Harper et al., 2009; Palmer et al., 2020). Many councils, academics, consulting groups, governments, and other entities have developed reports, guides, scientific journal articles, and other resources employing various approaches and methods for evaluating community food systems (Abi-Nader et al., 2009; Bargainer et al., 2011; Freudenberg et al., 2018; Los Angeles Food Policy Council, 2020; Miewald, 2009; NYC Food Policy, n.d.). Existing resources include guides on how best to partner with community groups and collect data through primary data collection (Abi-Nader et al., 2009; Bargainer et al., 2011; Miewald, 2009). Other resources include reports or articles using data indicators important to the goals of their local jurisdiction (Freudenberg et al., 2018; Los Angeles Food Policy Council, 2020; NYC Food Policy, n.d.) and online resources for food system stakeholders to download and use data to assess and evaluate their food systems, such as the Maryland Food System Map or the Food Systems Dashboard (Fanzo et al., 2020; Global Alliance for Improved Nutrition [GAIN] & John Hopkins University, n.d.; Johns Hopkins Center for a Livable Future, n.d.-a). Reports or articles with specific suggestions on metrics to measure food system outcomes also exist (Campbell et al., 2022; Rodman-Alvarez & Colasanti, 2019). However, little information exists on standardized metrics or indicators to inform routine monitoring of community food systems (Schreiber et al., 2019). Furthermore, Ludden et al. (2018) highlight the need for continued development of metrics systems for our food systems.

Food systems are diverse and location specific; thus, attempts to make and evaluate changes and impacts should reflect the uniqueness of the locations and environments (von Braun et al., 2021). However, access to a consolidated set of food system indicators could provide a starting point for FPCs and other food system interest groups' evaluation efforts. This access could help save time and resources when identifying food system issues and deciding how to measure the impact of their initia-

tives. FPCs often operate with limited resources, so having one centralized place to look for food system indicators and ways to access or collect data about them could greatly benefit their work. FPCs and other food system interest groups might choose to adapt the indicators to fit their local cultures, ecologies, and economic structures or use a common set of indicators. Using common indicators would allow researchers and practitioners to compare the impact of food system initiatives across communities and identify the most effective initiatives in various community contexts. As suggested by the collective impact approach, using common metrics helps groups focusing on similar food system challenges align their efforts to have a concentrated impact on outcomes that matter to their communities (Frost & Stone, 2009; Kania & Kramer, 2011). Using a common set of indicators across groups combined with selected indicators that are particularly meaningful to a community could be an effective approach for advancing the science of food system change and ensuring it is relevant to those shaping and experiencing those food systems.

In this essay, we reflect on a step toward understanding the breadth of available food system indicators and the feasibility of creating a consolidated set of food system indicators. All the authors have experience working with FPCs and have heard consistently that councils struggle to assess the impact of their initiatives. This project was undertaken with FPCs and similar groups in mind. We report on our experience conducting a limited scoping review of food system indicator resources; developing a free, publicly available, searchable database of indicators we extracted during the review; and identifying opportunities to further develop food system evaluation resources. We anticipate that the database will be useful to FPCs, food and agriculture-oriented groups, coalitions, organizations, funders, nonprofits, decision-makers, and governmental and other entities working to improve elements of their food system and who are seeking to evaluate or keep track of their efforts.

Methods

We conducted a scoping review to identify reports that featured and recommended food system indi-

cators and then extracted indicators from a selection of reports to get a sense of the breadth of the indicators. The scoping review approach was selected because it is useful for rapidly identifying key concepts in a research area, sources of evidence, and research gaps (Colquhoun et al., 2014). Using the steps described below, we aimed to identify a sample of resources that featured a range of food system indicators that would be a useful starting point for creating a list of recommended indicators using the steps described below.

Search Methods

To identify resources mentioning food system indicators, from September to November 2019, we conducted a search of the phrase “food system indicator” in Google Scholar and “food system indicator” or “food system metrics” in Google Web Search Engine. We also searched for resource recommendations from the Johns Hopkins Center for a Livable Future’s Food Policy Networks resource database (Johns Hopkins Center for a Livable Future, n.d.-b) and the CDC-funded Nutrition and Obesity Policy Research and Evaluation (NOPREN) Food Policy Council Working

Group. We first identified 24 resources with information on indicators or methods for measuring the food system, including databases, guides, tools, and frameworks. We selected a subset of seven resources that offered the broadest coverage across the food system. Table 1 presents the characteristics of the included reports. The included reports were published between 2015 and 2019 and had a range of 13–128 indicators each. These reports covered a variety of food system components, such as agricultural production, racial equity within the food system, health outcomes, participation in federal nutrition programs, environmental impact, and agricultural economics. Two reports were global in scope, three focused on the U.S., and two were specific to U.S. states.

Data Extraction

Food system indicators were extracted from reports and added to the emerging database exactly as they appeared in each report. Additional information for each indicator, such as geographic scale, data source, frequency of update, and example of use, was added to the database. To gain insight into how to organize the indicators in a user-friendly

Table 1. Characteristics of Reports From Which Food System Indicators Were Extracted

| Report title | Institution | Publication year | Scope | Number of indicators |
|--|--|------------------------|---------|----------------------|
| <i>State Level Food System Indicators</i> | University of Minnesota | 2016 | State | 124 |
| <i>Oregon’s Community Food Systems Indicators</i> | Oregon Community Food Systems Network, the Oregon State University Center for Small Farms & Community Food Systems, and Rural Communities Explorer | 2016 (updated in 2018) | State | 53 |
| <i>IOM Report: A Framework for Assessing the Effects of the Food System</i> | The National Academies of Science, Engineering, and Medicine | 2015 | Country | 36 |
| <i>SNAP-Ed Evaluation Framework</i> | USDA SNAP-Ed Program | 2016 | Country | 21* |
| <i>Measuring Racial Equity in the Food System: Established and Suggested Metrics</i> | Center for Regional Food Systems, Michigan State University | 2019 | Country | 86 |
| <i>Global Nutrition Report</i> | Global Nutrition Report Stakeholder Group (published by the International Food Policy Research Institute [IFPRI]) | 2015 | Global | 20 |
| <i>Milan Urban Food Policy Pact Monitoring Framework Indicators</i> | Milan Urban Food Policy Pact | 2019 | Global | 44 |

* 21 indicators were drawn from food system–related domain of the SNAP-Ed evaluation framework.

manner, we received feedback from a convenience sample of FPCs and individuals who provide technical assistance to councils as well as from the NOPREN working group members and an expert in design thinking at Tufts University. The project team used feedback to revise the database to be primarily organized and easily searchable using keywords. The team also received feedback to provide an example of how keywords could be used in coordination with food system frameworks.

The keywords for each indicator were categorized into three phases. First, an initial list of keywords was created with words pulled directly from the indicators and written in their singular form (e.g., “farm” rather than “farms”). Second, a keyword list was created that listed each keyword pulled from the indicators and a short list of commonly used synonyms or words or phrases with similar concepts for that keyword. For example, “SNAP” had synonyms such as “federal nutrition program” and “food access.” This keyword list was reviewed by all team members and provided a standardized approach for adding keywords to indicators. For each indicator, synonyms were included in the keyword list if they were relevant to that indicator. For example, the final list of keywords for the indicator “Number of farmers markets accepting SNAP” included “farmers market,” “SNAP,” “local,” “food retail,” “food environment,” “food access,” and “federal nutrition program.” The keywords act as tags for indicators and can be used to search for indicators related to a specific topic. On a separate tab in the database, the team sorted keywords into nine domains. Six of the domains include “justice and fairness,” “strong communities,” “vibrant farms,” “healthy people,” “sustainable ecosystems,” and “thriving local economies” according to the Whole Measures for Community Food Systems framework (Abi-Nader et al., 2009). The three additional domains are food supply chain, food access, and racial justice. “Justice and fairness” refer to salient themes in the food systems with a broader emphasis on equity considerations, including but not limited to race and ethnicity, whereas “racial justice” describes

topics related to justice and equity that are narrowly focused on race and ethnicity. Two research team members categorized keywords according to the domains, and then the rest of the team reviewed the categorization. Any disagreement about categorization was discussed and resolved through consensus. The Whole Measures framework is a community engagement tool that reflects social and economic values of equity and well-being in addition to conventional agricultural indicators (e.g., pounds of food produced). We sorted the indicators in the database according to the framework to allow FPCs and other interest groups to more easily search the database based on the framework’s domains, since the groups we spoke with reported using that framework to guide their work. For example, “cultural competency,” “demographic,” and “Black” were some indicators categorized under the “justice and fairness” domain. “Affordability,” “availability,” and “access” were some of those under the “strong community” domain, and “anemia,” “air quality,” and “diet quality” were under “healthy people.”

Results

An extensive set of 384 indicators spanning many aspects of the food system were extracted from the seven reports in the scoping review. After removing exact duplicates, the database included 381 unique indicators. The Food System Indicator Database¹ (Schouboe et al., 2021) and user guide² are free and publicly available. There is a written user guide as well as a video showing how to use the database.

A total of 291 unique keywords were assigned to the 381 indicators. The Appendix shows an example of how the keywords were organized into eight food system–related domains drawn from the Whole Measures for Community Food Systems framework. The keywords span all aspects of the food system, from production, processing, distribution, and disposal to the economic, environmental, social, and health impacts of food systems.

Data availability sources vary for the included indicators. Some indicators are suggested but lack a

¹ <https://airtable.com/shrK9MVR7l5BYZ8JS>

² https://nopren.ucsf.edu/sites/g/files/tkssra5936/f/wysiwyg/Food%20System%20Indicators%20Database%20User%20Guide_8.26.21.pdf

specific data source. Others need primary data collection or require a combination of secondary datasets or calculations. For example, of the 86 indicators listed in the Measuring Racial Equity in the Food System report, 27 require new data collection using surveys or interviews; 29 are from secondary databases like the U.S. Bureau of the Census and the USDA Census of Agriculture; one combines both primary and secondary data; and 29 others are simply suggested concepts that have not been fully defined or measured (Rodman-Alvarez & Colasanti, 2019).

Discussion

In summary, we identified resources mentioning food system indicators, extracted indicators, and assigned keywords to indicators to create a free, searchable database of food system indicators. We anticipated identifying and removing duplicate indicators during the review process, aiming for a concise selection of recommended indicators. However, the reports we examined contained a significantly higher number of distinct indicators than we had initially expected. The results from our small sample show high variability in the content of reports containing food system indicators. The food system indicators identified in this study span multiple topics, such as nutrition, agricultural production, racial equity within the food system, health outcomes, environmental impact, and agricultural economics. The database developed during this research process and referred to in the manuscript will give FPCs and other food system groups a sample of available indicators and will indicate whether existing data is associated with those indicators. Gathering this information in one place with a guide and video showing how to use the database can help groups measure their impact in the way that best fits their goals. Human-centered design thinking is an iterative process where community members and other stakeholders design solutions that meet their needs (Barlow & Lévy-Bencheton, 2018). That process and other community engagement approaches could be applied to identify or co-create meaningful food system indicators that are not currently in the database. On a practical note, it is important to keep in mind that engaging community members is an ongoing pro-

cess that takes time, resources, and trust (Freedgood et al., 2011).

There were no duplicate indicators that used exactly the same words, a finding that surprised the project team. However, a few indicators measured the same concept in a different dimension or context. For example, “availability of farmers’ markets” was an indicator in the IOM report, while the report titled “Oregon’s Community Food Systems Indicators” used “number of farmers’ markets.” Another example is the “number of grocery stores” in the “Oregon’s Community Food Systems Indicators” report and “number of grocery stores per 10,000 people” in the “State-Level Food System Indicators” report. The last example is the indicator “Households participating in SNAP, by race/ethnicity, relative to the portion of all households in the state, by race” in the “Measuring Racial Equity in the Food System: Established and Suggested Metrics” report, “SNAP participation (percent of individuals participating in SNAP)” in the “Oregon’s Community Food Systems Indicators” report, and “Percent population receiving Supplemental Nutrition Assistance Program (SNAP) benefits” in the “State-Level Food System Indicators” report. This finding underscores challenges facing FPCs and similar organizations trying to assess, monitor, and evaluate initiatives within their food system: what indicators should these groups use, and how might these groups identify a concise set of meaningful indicators that can be compared across places and over time?

Multiple keywords were often assigned to indicators. For example, multiple keywords were assigned to the indicator “Retail Food Environment Index (RFEI) by the percentage of residents of color in the neighborhood,” such as retail, food environment, residents of color, food retail, business, race, racial equity, racial justice, justice, and fairness, index. For the indicator “Number of farm operators by race,” farm, operator, race, agriculture, production, racial equity, racial justice, justice and fairness, and producer were assigned. This underscores the complexity of the food system, where concepts such as labor, natural resources, and health interact, shape, and are shaped by the system. The emergent conditions of the food system are a feature of complex adaptive

systems (Chapman et al., 2017). Systems science evaluation methods are particularly useful for studying complex adaptive systems and how they respond to initiatives that groups like FPC might implement. One report included in this study, the IOM's *Framework for Assessing Effects of the Food System*, describes multiple systems science evaluation techniques that can be applied in food systems research and includes examples of their application (Institute of Medicine & National Research Council, 2015). Councils and similar groups might seek evaluation support from university partners or nonprofits that specialize in using systems science methods to study food systems. If evaluation bandwidth is limited, councils may still benefit from drawing out and discussing *how* food system indicators like those identified in this study interact and shape conditions they care about in their communities. Developing a shared understanding of the mechanisms at work in a complex system can empower groups to find opportunities for meaningful change. The shared understanding can facilitate communication within and beyond the group (Black & Andersen, 2012).

Another finding from this review is the limitations on data availability. Even when appropriate indicators have been identified, they may be of little use to FPCs and similar groups if there is no existing data linked to those indicators since many groups have minimal capacity to collect primary data or to use large, complicated datasets. In those cases, FPCs and other groups might seek partnerships with researchers, government departments, school systems, cooperative extensions, and other entities that may have the skills and resources to collect and analyze relevant data.

Recently, there has been increased public interest in diversity, racial equity, justice, and fairness issues across the different sectors in the U.S., with a push for policies and practices that promote racial equity (Chui et al., 2021; The White House, 2021). Many FPCs and similar groups are working to promote such policies and practices in the food system. However, they cannot track and evaluate progress due to a lack of readily available data on racial equity, justice, and fairness within the food system. Data that can be disaggregated by race, ethnicity, gender, age, and other characteristics must

be available to assess and address disparities within food systems (Rubin et al., 2018; United Nations Human Rights, Office of the High Commissioner, 2015).


This study has limitations. First and foremost, we acknowledge that we had limited resources to conduct this review and thus only included a small subset of the many resources that include food system indicators. Future research using a comprehensive search strategy to identify other food system indicators and a study of food system assessments is warranted. The results from our sample show that there is high variability in the content of reports containing food system indicators. Therefore, it was not feasible for our small team to conduct a systematic review of all indicators or systematically narrow the list to a manageable set of common indicators we could recommend here. This project intended to identify and catalogue a list of food system indicators; it did not address the challenges regarding time and resources to collect local data. Not all recommended data indicators will exist for every community, so finding indicators listed in the database for a specific community or jurisdiction may still be challenging. In addition, local community input on defining, collecting, and measuring important food system concepts is not addressed through this database. However, it is a necessary component to understand and evaluate food system change.

Despite these limitations, our study identified almost 400 indicators spanning the food system, resulting in a publicly available, searchable database of those indicators. Our findings show the breadth of topics and outcomes associated with the food system. They can serve as input to future studies that employ artificial intelligence and other techniques to systematically and comprehensively identify food system indicators that could be used to assess, monitor, and evaluate initiatives within the food system.

Recommendations

The results highlight the need for more research and resources available for groups looking to assess their food systems and evaluate their efforts to improve them. The number of indicators identified from this limited scoping review underscores the

complexity of the food system and the challenges facing FPCs and other groups when deciding how to assess their food system and how to evaluate their initiatives. Our findings highlight the need to approach monitoring and evaluation with a trans-disciplinary team if the goal is to create a holistic view of a local food system. While groups could adapt the food systems indicators to their local context, using common indicators for similar contexts/scenarios would allow scientists and practitioners to further aggregate data and/or compare trends across communities and over time. With more resources, the database could be routinely updated and serve as a first step toward a common

platform where food system indicators could be identified, data for those measures extracted from existing databases, and information presented according to users' needs. Creating user-friendly data access and integration platforms can help FPCs and other groups advance food system change, ensuring sustainable, equitable access to foods that support nutrition security, health, and well-being. 

Acknowledgments

We want to thank those who provided valuable feedback during the development of the food system indicators database.

References

* indicates sources used in the scoping review

- Abi-Nader, J., Ayson, A., Harris, K., Herrera, H., Eddins, D., Habib, D., Hanna, J., Paterson, C., Sutton, K., & Villanueva, L. (2009). *Whole measures for community food systems: Values-based planning and evaluation*. New Entry Sustainable Farming Project. <https://nesfp.nutrition.tufts.edu/resources/whole-measures-community-food-systems>
- Bargainer, M. C., Eley, M., Fogel, J., Jakes, S., Peery, S., Prohn, S., Sanberg, N., & Smutko, S. (2011). *Community based food system assessment and planning: A guide to working with your community*. <https://fyi.extension.wisc.edu/foodsystemstoolkit/files/2014/12/CommunityBased-FoodSystemAssessment.pdf>
- Barlow, M., & Lévy-Bencheton, C. (2018). *Smart cities, smart future: Showcasing tomorrow*. John Wiley & Sons. <https://doi.org/10.1002/9781119516224>
- Black, L. J., & Andersen, D. F. (2012). Using visual representations as boundary objects to resolve conflict in collaborative model-building approaches. *Systems Research and Behavioral Science*, 29(2), 194–208. <https://doi.org/10.1002/sres.2106>
- Boersma, P. (2020). Prevalence of multiple chronic conditions among US adults, 2018 [Research brief]. *Preventing Chronic Disease*, 17, Article 200130. <https://doi.org/10.5888/pcd17.200130>
- Calancie, L., Cooksey-Stowers, K., Palmer, A., Frost, N., Calhoun, H., Piner, A., & Webb, K. (2018). Toward a community impact assessment for food policy councils: Identifying potential impact domains. *Journal of Agriculture, Food Systems, and Community Development*, 8(3), 123–136. <https://doi.org/10.5304/jafscd.2018.083.001>
- Campbell, C. G., Papanek, A., DeLong, A., Diaz, J., Gusto, C., & Tropp, D. (2022). Community food systems resilience: Values, benefits, and indicators. *Journal of Agriculture, Food Systems, and Community Development*, 11(4), 89–113. <https://doi.org/10.5304/jafscd.2022.114.006>
- Chapman, M., Klassen, S., Kreitzman, M., Semmelink, A., Sharp, K., Singh, G., & Chan, K. M. A. (2017). 5 key challenges and solutions for governing complex adaptive (food) systems. *Sustainability*, 9(9), Article 1594. <https://doi.org/10.3390/su9091594>
- Chui, M., Prince, S., & Stewart III, S. (2021). *America 2021: The opportunity to advance racial equity in America*. McKinsey Institute for Black Economic Mobility. <https://www.mckinsey.com/featured-insights/diversity-and-inclusion/america-2021-the-opportunity-to-advance-racial-equity>
- Coleman-Jensen, A., Rabbitt, M. P., Gregory, C. A., & Singh, A. (2020). *Household food security in the United States in 2019*. U.S. Department of Agriculture Economic Research Service. <https://www.ers.usda.gov/publications/pub-details/?pubid=99281>

- Colquhoun, H. L., Levac, D., O'Brien, K. K., Straus, S., Tricco, A. C., Perrier, L., Kastner, M., & Moher, D. (2014). Scoping reviews: Time for clarity in definition, methods, and reporting. *Journal of Clinical Epidemiology*, *67*(12), 1291–1294. <https://doi.org/10.1016/j.jclinepi.2014.03.013>
- Eicher, B., & Eicher-Miller, H. (2015). *Using food policy councils to address rural food issues*. Purdue Extension. https://mdc.itap.purdue.edu/item.asp?Item_Number=EC-795-W
- Fanzo, J., Haddad, L., McLaren, R., Marshall, Q., Davis, C., Herforth, A., Jones, A., Beal, T., Tschirley, D., Bellows, A., Miachon, L., Gu, Y., Bloem, M., & Kapuria, A. (2020). The Food Systems Dashboard is a new tool to inform better food policy. *Nature Food*, *1*, 243–246. <https://doi.org/10.1038/s43016-020-0077-y>
- *Food and Agriculture Organization of the United Nations, Milan Urban Food Policy Pact, & RUAF. (2019). *The Milan Urban Food Policy Pact monitoring framework*. <https://www.fao.org/documents/card/en/c/ca6144en/>
- Franzen-Castle, L., Remley, D., McCormack, L., Adamski, R., Henne, R., Eicher-Miller, H. A., Mehrle, D. J., & Stluka, S. (2021). Engaging rural community members with food policy councils to improve food access: Facilitators and barriers. *Journal of Hunger & Environmental Nutrition*, *17*(2), 207–223. <https://doi.org/10.1080/19320248.2021.1997858>
- Freedgood, J., Pierce-Quinonez, M., & Meter, K. (2011). Emerging assessment tools to inform food system planning. *Journal of Agriculture, Food Systems, and Community Development*, *2*(1), 83–104. <https://doi.org/10.5304/jafscd.2011.021.023>
- Freudenberg, N., Willingham, C., & Cohen, N. (2018). The role of metrics in food policy: Lessons from a decade of experience in New York City. *Journal of Agriculture, Food Systems, and Community Development*, *8*(Suppl. B), 191–209. <https://doi.org/10.5304/jafscd.2018.08B.009>
- Frost, L., & Stone, S. (2009). Community-based collaboration: A philanthropic model for positive social change. *Foundation Review*, *1*(1), 55–68. <https://doi.org/10.4087/FOUNDATIONREVIEW-D-09-00004>
- Global Alliance for Improved Nutrition (GAIN) & John Hopkins University. (n.d.). *Food systems dashboard*. Retrieved October 13, 2022, from <https://foodsystemsdashboard.org/>
- *Global Nutrition Report Stakeholder Group. (2015). *Global nutrition report 2015: 7 indicators for nutrition-friendly and sustainable food systems*. <http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/129442/filename/129653.pdf>
- Gochfeld, M., & Burger, J. (2011). Disproportionate exposures in environmental justice and other populations: The importance of outliers. *American Journal of Public Health*, *101*(Suppl 1), S53–S63. <https://doi.org/10.2105/AJPH.2011.300121>
- Hales, C. M., Carroll, M. D., Fryar, C. D., & Ogden, C. L. (2017). Prevalence of obesity among adults and youth: United States, 2015–2016. *NCHS Data Brief*, *288*, 1–8. <https://pubmed.ncbi.nlm.nih.gov/29155689/>
- Harper, A., Shattuck, A., Holt-Giménez, E., Alkon, A., & Lambrick, F. (2009). *Food policy councils: Lessons learned*. <https://archive.foodfirst.org/publication/food-policy-councils-lessons-learned/>
- Healthy Food Policy Project. (2017). *Local laws & policies that promote access to healthy food: A food system crosswalk*. <https://healthyfoodpolicyproject.org/crosswalk>
- *Institute of Medicine & National Research Council. (2015). *A framework for assessing effects of the food system*. The National Academies Press. <https://www.nap.edu/catalog/18846/a-framework-for-assessing-effects-of-the-food-system>
- International Food Policy Research Institute. (n.d.). *Food systems*. Retrieved October 13, 2022, from <https://www.ifpri.org/topic/food-systems>
- Johns Hopkins Center for a Livable Future. (n.d.-a). *Maryland food system map*. Johns Hopkins. Retrieved October 25, 2020, from <https://mdfoodsystemmap.org/>
- Johns Hopkins Center for a Livable Future. (n.d.-b). *Food policy networks | Food policy resources*. Retrieved October 25, 2020, from <https://foodpolicynetworks.org/food-policy-resources>
- Kania, J., & Kramer, M. (2011). Collective impact. *Stanford Social Innovation Review*, *9*(1), 36–41. <https://doi.org/10.48558/5900-KN19>

- *King, R. P., Anderson, M., DiGiacomo, G., Mulla, D., & Wallinga, D. (2012). *State level food system indicators*. University of Minnesota.
<https://hfhl.umn.edu/statefoodindicators#:~:text=State%20Level%20Food%20System%20Indicators.%20The%20food%20system,updated%2C%20and%20compared%20across%20locations%20and%20over%20time>
- Landrigan, P. J., Fuller, R., Acosta, N. J. R., Adeyi, O., Arnold, R., Basu, N. (Nil), Baldé, A. B., Bertollini, R., Bose-O'Reilly, S., Boufford, J. I., Breysse, P. N., Chiles, T., Mahidol, C., Coll-Seck, A. M., Cropper, M. L., Fobil, J., Fuster, V., Greenstone, M., Haines, A., ... Zhong, M. (2018). The Lancet Commission on pollution and health. *Lancet*, 391(10119), 462–512. [https://doi.org/10.1016/S0140-6736\(17\)32345-0](https://doi.org/10.1016/S0140-6736(17)32345-0)
- Lindgren, E., Harris, F., Dangour, A. D., Gasparatos, A., Hiramatsu, M., Javadi, F., Loken, B., Murakami, T., Scheelbeek, P., & Haines, A. (2018). Sustainable food systems—A health perspective. *Sustainability Science*, 13(6), 1505–1517. <https://doi.org/10.1007/s11625-018-0586-x>
- Los Angeles Food Policy Council. (2020). *Food system dashboard*.
<https://www.goodfoodla.org/blog/food-system-dashboard>
- Ludden, M. T., Welsh, R., Weissman, E., Hilchey, D., Gillespie, G. W., & Guptill, A. (2018). The Progressive Agriculture Index: Assessing the advancement of agri-food systems. *Journal of Agriculture, Food Systems, and Community Development*, 8(3), 159–185. <https://doi.org/10.5304/jafscd.2018.083.003>
- McMichael, A. J., Butler, C. D., & Dixon, J. (2015). Climate change, food systems and population health risks in their eco-social context. *Public Health*, 129(10), 1361–1368. <https://doi.org/10.1016/j.puhe.2014.11.013>
- Miewald, C. (2009). *Community food system assessment: A companion tool for the guide*. American Planning Association.
<https://www.planning.org/knowledgebase/resource/9128540/>
- NYC Food Policy. (n.d.). *Food metrics report*.
<https://www1.nyc.gov/site/foodpolicy/reports-and-data/food-metrics-report.page>
- *Oregon State University. (n.d.). *Community food systems indicators in Oregon: An introduction*. OSU Extension Service. Retrieved October 13, 2020, from
<https://extension.oregonstate.edu/food/food-systems/community-food-systems-indicators-oregon-introduction>
- Palmer, A., Atoloye, A., Bassarab, K., Calancie, L., Santo, R., & Stowers, K. C. (2020). COVID-19 responses: Food policy councils are “stepping in, stepping up, and stepping back.” *Journal of Agriculture, Food Systems, and Community Development*, 10(1), 223–226. <https://doi.org/10.5304/jafscd.2020.101.013>
- Rehm, C. D., Peñalvo, J. L., Afshin, A., & Mozaffarian, D. (2016). Dietary intake among US adults, 1999–2012. *JAMA*, 315(23), 2542–2553. <https://doi.org/10.1001/jama.2016.7491>
- *Rodman-Alvarez, S., & Colasanti, K. (2019). *Measuring racial equity in the food system: Established and suggested metrics*. Center for Regional Food Systems, Michigan State University.
<https://www.canr.msu.edu/resources/measuring-racial-equity-in-the-food-system>
- Rubin, V., Ngo, D., Ross, A., Butler, D., & Balaram, N. (2018). *Counting a diverse nation: Disaggregating data on race and ethnicity to advance a culture of health*. PolicyLink.
https://www.policylink.org/sites/default/files/Counting_a_Diverse_Nation_08_15_18.pdf
- Schiff, R. (2008). The role of food policy councils in developing sustainable food systems. *Journal of Hunger & Environmental Nutrition*, 3(2–3), 206–228. <https://doi.org/10.1080/19320240802244017>
- Schouboe, S., Atoloye T., A., Misiaszek, C., Harding, J., & Calancie, L. (2021). *Food System Indicators Database user guide*. Nutrition & Obesity Policy Research and Evaluation Network.
<https://nopren.ucsf.edu/content/food-system-indicators-database-user-guide-0>
- Schreiber, L. R. N., Gold, A., Anfinson, A., Boelcke-Stennes, K., Caspi, C., Chalise, N., Dahl, M., Hane, A., Jenkins, T., Marczak, M., Nikodym, E., Saunoi-Sangren, E., Shanfelt, A., Walhowe, J., & Zukoski, A. (2019). Creating a food system report card to advance the Minnesota food system. *Journal of Agriculture, Food Systems, and Community Development*, 9(Suppl. A), 241–242. <https://doi.org/10.5304/jafscd.2019.091.023>
- Shannon, K. L., Kim, B. F., McKenzie, S. E., & Lawrence, R. S. (2015). Food system policy, public health, and human rights in the United States. *Annual Review of Public Health*, 36, 151–173.
<https://doi.org/10.1146/annurev-publhealth-031914-122621>

United Nations Human Rights, Office of the High Commissioner. (2015, February 25). *SDGs Indicator Framework: A human rights approach to data disaggregation to leave no one behind.*

<https://www.ohchr.org/Documents/Issues/HRIndicators/DataDisaggregation.pdf>

U.S. Department of Agriculture [USDA]. (n.d.). *Definitions: Sustainability and food systems.*

<https://www.usda.gov/oce/sustainability/definitions>

*USDA. (2016). *SNAP-ED Evaluation Framework: Nutrition, physical activity, and obesity prevention indicators.*

<https://snapedtoolkit.org/app/uploads/SNAP-EdEvaluationFramework.pdf>

USDA Economic Research Service [ERS]. (2020). *Agricultural productivity in the U.S.*

<https://www.ers.usda.gov/data-products/agricultural-productivity-in-the-us/>

von Braun, J., Afsana, K., Fresco, L., Hassan, M., & Torero, M. (2021). *Food systems – Definition, concept and application for the UN Food Systems Summit.* Scientific Group of the UN Food Systems Summit.

https://knowledge4policy.ec.europa.eu/publication/food-systems-definition-concept-application-un-food-systems-summit-paper-scientific_en

White House, The. (2021, January 20). *Executive order on advancing racial equity and support for underserved communities through the federal government.* <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-advancing-racial-equity-and-support-for-underserved-communities-through-the-federal-government/>

Appendix. Keywords Organized into the Whole Measures for Community Food Systems Framework Plus Three Additional Domains (Food Supply Chain, Food Access, and Racial Equity)

| Justice and fairness | Strong communities | Vibrant farms | Healthy people | Sustainable ecosystem | Thriving local economies | Food access | Food supply chain | Racial equity |
|----------------------|---------------------------------|---------------------------------|---------------------------|-----------------------|--------------------------|---------------------------|-------------------|----------------------|
| access | access | agriculture | access | air quality | acquisition | access | acquisition | African American |
| adult | affordability | animal | air quality | by-product | advertise | affordability | citizenship | Black |
| affordability | assessment | beef | anemia | carbon | affordability | assistance | consumer | discriminate |
| African American | assistance | berries | blood mercury | carbon dioxide | board member | benefit | convenience store | discrimination |
| age | benefit | by-product | BMI | cattle | budget | cost | distribution | disparity |
| assistance | board member | carbon | body mass index | chemical | business | evaluation | evaluation | ethnicity |
| benefit | budget | carbon dioxide | cholesterol | climate change | CEO | federal nutrition program | food store | evaluation |
| Black | business | cattle | diabetes | CO2 | communication | food insecurity | food venue | justice and fairness |
| child | CEO | cereal | diet | conservation | compensation | hunger | grocery store | monitoring |
| citizenship | citizenship | chemical | diet quality | cow | control | income | manufacturer | Native American |
| community of color | community | climate change | disparity | crop | cost | low income | manufacturing | owner of color |
| compensation | community-supported agriculture | CO2 | evaluation | dairy | customer | monitoring | market | people of color |
| control | control | community-supported agriculture | federal nutrition program | emission | development | poverty | marketing | race |
| cost | crisis | cow | food | energy | director | | monitoring | racial equity |
| cultural competency | cultural competency | crop | food access | environment | earning | | processing | racial justice |
| demographic | development | CSA | food deficit | erosion | economic | | processor | racism |
| demographics | director | dairy | food insecurity | evaluation | economy | | procurement | residents of color |
| discriminate | disaster | erosion | food preparation | fertilizer | employee | | producer | white |
| discrimination | discriminate | evaluation | health | GHG | employer | | production | |
| disparity | discrimination | farm | healthy food | greenhouse gas | employment | | snack store | |
| employee | disparity | farm box | hunger | land | evaluation | | supply chain | |
| employer | earning | farm share | illness | livestock | executive | | transport | |
| employment | economic | farmer | inequality | locally grown | expenditure | | waste | |
| equality | economy | farmers market | inequity | manure | expense | | | |

| Justice and fairness | Strong communities | Vibrant farms | Healthy people | Sustainable ecosystem | Thriving local economies | Food access | Food supply chain | Racial equity |
|---------------------------|--------------------|---------------|---------------------|-----------------------|--------------------------|-------------|-------------------|---------------|
| evaluation | education | fertilizer | infant | meat | facility | | | |
| federal nutrition program | employment | fruit | injury | monitoring | finance | | | |
| food access | equality | goat | labor protection | organic | financial | | | |
| food deficit | ethnicity | grain | meal | pesticide | funding | | | |
| food desert | evaluation | hog | medical | pollution | GDP | | | |
| food environment | executive | immigration | monitoring | recycling | Gross domestic product | | | |
| food insecurity | food access | lamb | mortality | resilience | growth | | | |
| food loss | food deficit | land | nutrition | soil | institution | | | |
| food movement | food desert | livestock | obesity | sustainable | job | | | |
| gender | food environment | local | occupational health | tribal area | labor | | | |
| hunger | food hub | locally grown | occupational injury | waste | labor protection | | | |
| immigration | food movement | manure | overweight | water | local | | | |
| income | funding | meat | racial equity | water quality | locally grown | | | |
| inequality | garden | melon | racial justice | wind | manager | | | |
| inequity | gender | milk | racism | | market | | | |
| infant | government | monitoring | recall | | marketing | | | |
| internet access | grant | nut tree | recovery | | monitoring | | | |
| jail | healthy food | organic | safety net | | ownership | | | |
| job | housing | pesticide | SNAP | | payroll | | | |
| justice and fairness | hunger | pig | socially vulnerable | | resilience | | | |
| labor protection | immigration | pork | stunted | | trade association | | | |
| loan | incentive | poultry | underserved | | work condition | | | |
| low income | income | produce | value added | | worker | | | |
| mobility | inequality | producer | water | | worker of color | | | |
| monitoring | inequity | profit | water quality | | workforce | | | |
| Native American | infrastructure | protein | WIC | | | | | |
| occupational health | institution | rancher | work condition | | | | | |
| occupational injury | internet access | regional | | | | | | |
| owner of color | labor protection | resilience | | | | | | |

| Justice and fairness | Strong communities | Vibrant farms | Healthy people | Sustainable ecosystem | Thriving local economies | Food access | Food supply chain | Racial equity |
|----------------------|--------------------|---------------|----------------|-----------------------|--------------------------|-------------|-------------------|---------------|
| ownership | law | root | | | | | | |
| pay | leadership | soil | | | | | | |
| payment | legislation | sustainable | | | | | | |
| payroll | loan | tree nut | | | | | | |
| people of color | manager | vegetable | | | | | | |
| policy | mobility | water | | | | | | |
| population | monitoring | water quality | | | | | | |
| power | municipal | | | | | | | |
| profit | owner of color | | | | | | | |
| race | ownership | | | | | | | |
| racial equity | poverty | | | | | | | |
| racial justice | power | | | | | | | |
| racism | preparedness | | | | | | | |
| regulation | profit | | | | | | | |
| residents of color | resilience | | | | | | | |
| rights | school | | | | | | | |
| safety | stability | | | | | | | |
| safety net | sustainable | | | | | | | |
| sex | trade association | | | | | | | |
| SNAP | transit | | | | | | | |
| socially vulnerable | transport | | | | | | | |
| underserved | transportation | | | | | | | |
| union | tribal area | | | | | | | |
| vulnerable | underserved | | | | | | | |
| wage | union | | | | | | | |
| white | white | | | | | | | |
| WIC | zoning | | | | | | | |
| women | | | | | | | | |
| work condition | | | | | | | | |
| worker | | | | | | | | |
| worker of color | | | | | | | | |
| youth | | | | | | | | |