



Sustaining scenarios: researcher-practitioner reflections on extending research beyond project boundaries

Chelsea Wentworth¹  · Rafael Lembi² · Amarachi Wachuku³ · Miles McNall⁴ · Jennifer Hodbod⁵ · Kelly McClelland⁶ · Samantha Farah⁷ · Lottie Ferguson⁸ · Robert E. Brown⁴ · Damon Ross⁸

Received: 3 July 2025 / Accepted: 22 May 2026
© The Author(s) 2026

Abstract

We evaluate the results of a food system scenarios workshop in Flint, Michigan designed to co-create actionable pathways toward desirable futures in the medium-term (20 years), alongside analysis from practitioners one year post workshop. The goal of the scenario planning process is to support the translation and usability of research findings beyond project boundaries through the engagement of diverse voices and perspectives, combining research with lived experience to outline steps towards preferred futures. However, for research to create meaningful change, community partners need the ability to revisit data to adapt to community needs, and researchers need to understand the effects of scenario planning. Bridging research and action is essential to sustainable solutions, yet few examples exist documenting research effects beyond the duration of the project or with analysis from community partners. Our research results—the initial scenarios and qualitative data on how community leaders engage with the scenarios one year later—illustrate how scenario workshops facilitate the broader structural changes required for partnership support. We identify two direct effects (outcomes) of our scenarios workshops: enhanced capacity and expanded networks. Cascading effects (impacts) occur beyond the project boundaries, yet are essential to document and evaluate. For researchers working with futures-oriented, community-engaged research, we call for pluralizing how impacts and outcomes are understood and emphasize that they need to be evaluated from the perspective of community partners and in local context. While we illustrate results from food systems research, the long-term evaluation of scenarios workshops can be applied to a range of sustainability topics.

Keywords Food system · Scenario planning · Sustainable futures · Boundary-spanning · Community-engaged research · Transdisciplinary research

Introduction

Crises of the Anthropocene, including climate change, biodiversity loss, intersectional inequalities, and food insecurity, highlight the necessity of systems-wide transformations (Díaz et al. 2019). Transformations refer to fundamental shifts in views, practices and structures that can steer current system trajectories towards just, equitable, and sustainable futures (O'Brien et al. 2025). Research can be relevant for transformations because it can contribute to filling knowledge gaps that can inform decision-making, inspire and guide individual and collective action, reframe

narratives and challenge the status quo, and build novel institutions (Chambers et al. 2022). Research is particularly useful when conducted through participatory processes that engage both academics and community partners to address practical problems (Doberneck et al. 2010; Reason and Bradbury 2013).

A broad array of theories and terminologies exist to describe systematic processes of inquiry conducted *with* people, rather than *on* people, aiming to bridge research and action (e.g., community-engaged research, participatory research, action research, transdisciplinary research, among other possibilities) (Cornish et al. 2023; Doberneck et al.

Handled by Garry Peterson, Stockholm University, Stockholm Resilience Centre, Sweden.

Extended author information available on the last page of the article

2010; Greenwood and Levin 2007; Lam et al. 2021; Vaughn and Jacquez 2020). Although each of these terms emerged from distinct scholarly traditions, they are united by an overarching goal of bringing about change that can contribute to sustainability transformations. In this paper, we frame our project as a community-engaged research effort, in alignment with the vocabulary that is most commonly used within our context. We define community-engaged research as a process in which academics and communities work together to co-create knowledge that informs and leads to action addressing a given problem or opportunity. We stress that participation and community engagement exist across a spectrum of varying forms and degrees, thus highlighting the necessity of being specific when describing who your community partners are and the ways in which they are involved (or not) (Arnstein 1969; Cornwall 2008; NRC 2008; Reed et al. 2024; Wentworth et al. 2023).

Futures-oriented approaches have been increasingly utilized within community-engaged research for sustainability. In particular, participatory scenario planning has been commonly adopted in place-based research (Galang et al. 2025a;

Oteros-Rozas et al. 2015). Participatory scenario planning is an engaged process in which researchers and community partners work together to explore potential future states of a system, imagine visions of desirable futures, and co-create actionable pathways towards positive transformations (Lembi et al. 2024; Peterson et al. 2003). While the transformative potential of participatory scenario planning is stressed throughout the literature in sustainability science, effects are challenging to monitor and track longitudinally (Cork et al. 2023; Oteros-Rozas et al. 2015). Indeed, studying the effects of research over time is beyond the scope and funding realities of most research projects (Wiek et al. 2014; Williams and Robinson 2020).

Understanding the effects of community-engaged research beyond the boundaries of the research project frames our analysis of project impacts over time. Here, we adopt the methodological framework proposed by Wiek et al. (2014) to capture societal effects of community-engaged research and adapt it to the specific context of participatory scenario planning. According to Wiek et al. (2014), there are four categories of potential effects of community-engaged research: (1) enhanced capacity to engage with complex problems through acquisition of new knowledge or enhancing of understandings; (2) network effects due to the creation or expansion of relationships and trust; (3) the creation of usable products (e.g., technologies, products, publications); (4) and structural changes and actions (e.g., concrete decision-making, implementation of plans and strategies).

The methodological framework by Wiek et al. (2014) highlights the value of community engagement, inclusive research processes, and relationship building for the creation of broader transformations. However, transformations, outcomes (direct effects), and impacts (cascading effects) are often intangible and difficult to measure, and the process of impact generation is mediated by numerous dimensions, including power and context (Reed and Rudman 2023; Williams and Robinson 2020). The operationalization of generic methodological assessments remains challenging for the particularities of place-based research. To ensure clarity in our applications of these concepts and terminology here, we provided our terms and definitions in Table 1. These terms are later applied in our novel model (Fig. 4) and explained further in the discussion.

Transformative potential of participatory scenario planning

Future-thinking approaches, such as participatory scenario planning, have been increasingly recognized as central to promoting transformations (Pereira et al. 2018; Preiser et al. 2024). Future-oriented approaches offer strategic insights by

Table 1 Lists of key terms, definitions, and references

Key terms	Definition	References
Transformations	Fundamental shifts in views, practices and structures that can steer system trajectories towards just, equitable, and sustainable futures (e.g., structural changes, changes in decision-making)	Wiek et al. (2014), O'Brien (2025)
Community-engaged research	Process in which academics and communities work together to co-create knowledge that leads to action addressing a problem or opportunity. Levels of engagement exist across a spectrum	Doberneck et al. (2010), Vaughn and Jacquez (2020), Wentworth et al. (2024)
Participatory scenario planning	Community-engaged process in which researchers and community partners work together to explore potential future states of a system, imagine visions of desirable futures, and co-create actionable pathways towards transformations	Lembi et al. (2024), Peterson et al. (2003)
Outcomes (direct effects)	Direct and intermediate effects of community-engaged research (e.g., network effects through expansion of networks, enhanced capacity)	Wiek et al. (2014)
Impacts (cascading effects)	Longer-term, contextual effects of community-engaged research, often resulting from outcomes, that can contribute to community-led transformation efforts (e.g., usable products such as strategic plans, implementation of actions)	Wiek et al. (2014), Reed and Rudman (2023)

We refer to these concepts again in our discussion illustrating how these key terms are applied to our model (Fig. 4)

creating visions of desirable futures and exploring pathways to concretely achieve them (Cork et al. 2023). Through structured reflection about current and desirable system states, it is possible to evaluate what types of resources, partnerships, values, governance arrangements, and paradigm shifts may be required to achieve positive futures (Cork et al. 2023; Vervoort and Gupta 2018). Empirical and review studies on scenario planning highlight how this approach has potential to contribute to: social learning (Galang et al. 2025a); integrating diverse types of data and ways of knowing (Chibwe et al. 2024; Terry et al. 2024); identifying leverage points for systems transformations (Zimmermann et al. 2025); enhancing empathy towards non-humans and future generations (Galang et al. 2025b); and addressing conflicts regarding natural resource management (Prado et al. 2024).

Although promising, several gaps remain in the literature and practice of participatory scenario planning. For example, participatory approaches in the development of positive futures are still less prevalent, in comparison to approaches that focus on predictive and explorative scenarios (Cork et al. 2023; Juri et al. 2025). Moreover, the evaluation of short- and long-term impacts of participatory scenarios workshops remains a key frontier in sustainability science (Cork et al. 2023). Most evaluations of participatory scenario planning are conducted at the immediate culmination of scenario workshops. It is less common to conduct follow-up evaluations to assess the direct and cascading effects of participatory scenario workshops (for exceptions, see Malmberg et al. 2022; Nieto-Romero et al. 2016). Importantly, evaluating the effects of participatory scenario planning can help clarify the mechanisms and pathways connecting research efforts to structural changes, thus illuminating how transformations unfold in practice and the role of research in this process. Further, evaluations can also provide a means to pluralize our understanding of impacts and ways to improve community-university partnership (Reed and Rudman 2023). We address these gaps and add to a growing body of scholarship that seeks to imagine and unpack alternative future trajectories that center sustainability, equity, and justice (Kuiper et al. 2024). In the next section, we describe how participatory scenario planning is a well-suited approach to contribute to community-led change in the context of our project.

Cultural, historic, and project context

Our community-engaged research project takes place within the city of Flint, Michigan, United States. Once a thriving industrial city, Flint endured major economic hardships and trauma over the past 50 years. Most notably these include the withdrawal of General Motors vehicle manufacturing industry beginning in the 1970s (Highsmith 2015), and the

ongoing Flint Water Crisis beginning in 2014 in which residents were poisoned by lead-contaminated water (Hanna-Attisha et al. 2016), all of which have been exacerbated by the COVID-19 pandemic (Jablonski et al. 2021; Wentworth et al. 2022a, b). Flint is considered a legacy city, characterized by its post-industrial, rust-belt past, experiencing population and economic contraction (Pauli 2019; Tighe and Ryberg-Webster 2019). Classifying Flint as part of a class of legacy cities “...evokes these cities’ positive heritage and assets as well as their continuing burdens and challenges” (Tighe and Ryberg-Webster 2019, 3). Flint’s economic collapse and crises coincided with decades of decline in the overall health of the population, which is majority Black (Wentworth et al. 2022a, b).

Despite these challenges, community-engaged research promotes strengths-based approaches to developing culturally tailored, environmental and systemic interventions that promote health, address food insecurity, and reduce disparities, specifically in African American/Black and Hispanic/Latino populations (Azevedo and Robinson 2015; Green and Haines 2016). In recognition of these health needs and the variety of strengths-based food system solutions implemented throughout Flint (Sadler et al. 2013; Sadler et al. 2017; Sadler and Highsmith 2016; Saxe-Custack et al. 2018, 2022), the Community Foundation of Greater Flint worked with researchers at Michigan State University to develop a proposal to the Foundation for Food and Agriculture Research (FFAR) to study the Flint food system. This funded research, the Flint Leverage Points Project (FLPP), represents a collaborative partnership between the Community Foundation of Greater Flint (CFGF) and Michigan State University (MSU) to better understand the Flint food system and identify leverage points for positive change.

The first step in the FLPP partnership was to create a Community Consultative Panel (CCP) comprised of Flint leaders working across the food system including leaders of non-profits, local government, business, emergency food services, education, and the faith community, to guide the research (Schmitt Olabisi et al. 2022). The CCP ensured the project stayed focused on outputs that met community needs and was responsive to and respectful of Flint residents, who because of past research harm, distrust researchers and are research fatigued. Additionally, we sought broader feedback from Flint residents at multiple points to share preliminary results, generate ideas for future components of the project, engage new participants, and facilitate discussions on next steps. The bulk of FLPP data collection occurred between 2019 and 2023. The project moved from qualitative governance, values, resilience, and nutrition security data to quantitative fuzzy cognitive mapping and system dynamics modeling to provide a more comprehensive picture of the

Flint food system (see: <https://www.canr.msu.edu/flintfood/resources-and-publications/>).

Our community-research partnership and the funding directive from FFAR was formed with the goal of producing final products useful to the community, and this framework shaped our approach to community-engaged research. Our goal was to produce documents accessible to community members to help communicate research results. The link above serves as an open-source repository for project data including: briefing notes, infographics, interactive maps, photo-elicitation data, workbooks, reports, and peer reviewed publications and presentations. Indeed, the FLPP ensured approval from both the MSU IRB (STUDY00000940) and the Flint Community Ethics Review Board (CERB). Identifiable data is kept confidential, but all results and non-identifiable data have shared ownership with the Community Foundation of Greater Flint and MSU. We complied with informed consent processes, and going further, clearly communicated the ways data would be available to community partners and the general public throughout the project.

Guiding questions, timeline, and outline of this paper

In synthesizing our body of research, we developed two guiding questions to shape our analysis of the participatory scenario planning workshop: What does it look like to facilitate a participatory scenario planning process that aims to create impacts beyond project boundaries? And, how do we document, evaluate, and analyze those impacts with community partners both at the time of the workshop and one year post workshop? This paper is co-written by researchers who designed and evaluated a scenario planning process, and community partners, who helped guide the full research process and participated in the scenario planning process as participants and co-facilitators. Authors reflect on the potential and limitations of scenarios as a methodological tool to co-produce actionable knowledge that can inform community-led change efforts. Thus, this project unites research and embodied knowledge (knowledge gained from lived experience) (Mascia-Lees 2011) to better understand the process and time required for effectuating change for sustainable futures. Our epistemological framework supports discussion of co-created processes as opposed to single-axis or linear understandings of knowledge generation (Cho et al. 2013) and change implementation.

Therefore, our goal with participatory scenario planning was to co-design a process and workshop that could simultaneously communicate previous research findings, provide a structured process to identify pathways towards

desirable futures, and co-create actionable guidance that can inform change efforts led by community partners in the food system. As a culminating activity of the FLPP, our workshop also provided a forum for researchers and community partners to strategize how to implement concrete transformations efforts after the completion of the project and the funding associated with it. Resulting scenarios illustrate desirable futures and actionable pathways for transformations in a medium-term time frame (20 years). However, there was still a need to assess whether our goal of producing impact beyond the boundaries of the project was actually being realized. Hence, our current evaluation focuses on how community partners utilize scenario planning insights one-year post-workshop. Our analysis revealed seven key findings about how practitioners incorporate insights from participatory scenario planning into their ongoing work. We adapted the framework proposed by Wiek et al. (2014) to illustrate and visualize pathways connecting research efforts to outcomes and impacts (presented in the discussion as Fig. 4).

In this paper we present the following results: (1) scenarios that emerged from the workshop, (2) the post-workshop evaluation, (3) longitudinal evaluation of the outcomes and impacts of the workshop based on reflective writing one-year post workshop, and (4) documentation of our process of collaborative analysis and writing. This iterative process reaches beyond the scope of the initial FLPP research project and is summarized in Fig. 1.

Methods

Participatory scenarios workshop

From 2019 to 2023, the Flint Leverage Points Project (FLPP) engaged in multiple research efforts, collecting a broad array of data that holistically described and analyzed the Flint food system (Belisle-Toler et al. 2021; FLPP 2023; Hodbod and Wentworth 2021; Knox et al. 2023; Lembi et al. 2024; Schmitt Olabisi et al. 2022). During engagement sessions and CCP meetings, some partners noted that the project was producing a significant amount of potentially useful research; however, concern remained regarding how to translate information into actionable decision-making. In response, the research team designed and facilitated a scenario workshop through a collaborative process in which the CCP provided input and feedback on the activity's structure and implementation. In fact, three partners engaged in the activity both as participants and co-facilitators due to their role in process development.

The workshop process utilized a workbook as a key supporting material for facilitation that synthesized previous

Timeline of FLPP Research, Scenarios Workshop, and Impact Evaluation



Fig. 1 Process timeline of Flint Leverage Points Project (FLPP) Research, Scenarios Workshop, and Evaluation. FLPP research efforts spanned from 2019 to 2023, with the scenario workshop held in Octo-

ber 2022, the subsequent evaluation conducted between October and December 2023, and paper writing and submission between 2024–2026. This figure provides an overview of the process



Fig. 2 Photographs of the scenario workshop activities (October 2022). **A** Setting up for the Workshop, photo credit Rafael Lembi, **B** Introductions to the activity, photo credit, Gregory Kohuth, **C** Recording notes for one of the groups, photo credit, Angel Hammon

research results on food system values, four descriptions of desirable futures, and a list of leverage points that could potentially foster change in Flint (Lembi et al. 2024; Wentworth et al. 2023). Building upon these findings, workshop participants engaged with a set of guiding questions aimed at co-producing actionable pathways in a narrative format that described strategies, plans, and actions that could bring about a transformative vision in a 20-year time frame. We adopted a 20 year time horizon to give space for significant change to occur, while avoiding longer, hard to imagine time horizons that lead to more unrealistic solutions (Nalau and Cobb 2022). Titled “Recipe for a scenario,” linking to our food system work, our scenarios workshop method is fully outlined in Lembi et al. (2024).

Invitations to participate in the workshop were distributed through existing community partner networks. Ultimately, we had a total of 29 people engaged in the workshop: 19 as participants and 10 as co-facilitators. Co-facilitators included researchers and CCP members. The workshop was held in the community room of the Food Bank of Eastern Michigan Flint offices over the course of a full day, included

breaks for snacks and lunch, and provided time for participants to engage with one another beyond the group activities (see Fig. 2).

Evaluation of scenarios workshop

To advance our understanding of how participatory scenario planning processes can lead to effects reaching beyond the boundaries of a research project, we conducted formative and summative evaluations. We conducted a formative evaluation, assessing the process as it was occurring, to identify the workshop’s strengths and weaknesses. Additionally, we conducted a summative evaluation, which assessed outcomes and impacts, focused on how participants leverage workshop insights to conduct their work in Flint. This framework is critical to the development of longitudinal methods analyzing *how* partners are engaging with results from participatory scenario planning.

To achieve this, we utilized two approaches to collect data and evaluate the scenarios workshop. We designed a post-workshop paper survey to gather feedback on the process

and the extent to which the workshop and workbook provided tools to generate scenarios and actions to transform the Flint food system. The post-workshop survey consisted of two open-ended and three Likert-scale questions and was administered at the conclusion of workshop activities (see Supplemental File 1).

Researchers continued to interact with community partners after the workshop in various ways (e.g. online meetings, local events, conferences and seminars). During some of these informal interactions, a few workshop participants shared stories about the ways in which co-creating scenarios had been useful for their work, and how the insights from the workshop were being incorporated into community-led action.

Inspired by these accounts, a year after the workshop (October–December 2023), the two lead authors reached out to CCP members who also participated in the workshop, and one participant with a newly prominent role in the Flint food system to formally assess potential impacts of the scenario workshop exercise one-year post-workshop. All of these individuals served as co-facilitators at the workshop. To foster self-reflection on lived experiences, partners were invited to participate in a reflective writing exercise (Marshall and Mead 2005). This consisted of answering four prompt questions (presented in Table 2), describing the usefulness of the community-engaged research and participatory scenario planning. We aimed to understand how people who are actively engaged in efforts to change the Flint food system use research findings from the FLPP and the scenario workshop.

We asked 8 community leaders who co-facilitated the workshop and/or were members of the CCP if they would participate in this reflective writing activity; six agreed and provided written responses to each of the four questions. Of the two who declined to participate, one stated she did not have time due to increased work demands and the other moved out of state and was no longer engaged in the community. Questions were shared via e-mail and partners used a flexible timeline without word-count constraints to respond.

Table 2 Prompts for reflective writing that were shared by research team with community partners a year after the facilitation of a participatory scenario planning workshop

Reflective writing prompts	
1.	Do you think research is useful for your work? Generally, what has your experience been like trying to use research to support your work?
2.	Thinking about the scenarios workshop, was it useful for you in any way? Why or why not?
3.	Have you been able to incorporate any learning from the workshop into your work? Why or why not? What learning from the workshop have you applied to your work?
4.	What can researchers do to help make research results more easily actionable for you?

While small, this sample of key informants was best suited to answer our research questions (Grant et al. 2024). This sample is not intended to be generalizable to what residents of Flint know about the food system, but reflective of food system leaders who participated in the workshop, who also hold broader knowledge of the Flint community and current efforts in food systems change. This key informant sampling strategy is essential to ensuring that participants in this evaluation had essential knowledge about *both* the participatory scenario workshop and the current and new efforts and initiatives impacting the Flint food system. This type of evaluation informs a variety of community-engaged transformative research by identifying impacts beyond project's boundaries. Such insights can serve to direct funding toward projects with demonstrated impacts, and enhance our understanding of the range, scope, duration, and cascading effects.

To further center community partners in reporting results, the lead researchers discussed co-authoring this manuscript with community partners so we could delve into the results of scenario planning in bridging research and action collectively. Two lead researchers from the FLPP, who also facilitated the workshop and structured the data collection, hosted a series of meetings to co-analyze the data, outline the paper, and finalize the manuscript. This collaborative process ensures the paper reflects the voices of both the research team and community partner, including representatives from Michigan State University, Community Foundation of Greater Flint, Greater Flint Health Coalition, Crim Fitness Foundation, Michigan State University Extension, City of Flint, and leaders of the recently formed Flint and Genesee County Food Policy Council.

Data analysis

Scenario workshop data

Facilitated discussions during the scenarios workshop were recorded and subsequently transcribed. During the event, participants worked in four small groups with the support of a facilitation team (comprised of one researcher co-lead, one community member co-lead, and one note taker/time-keeper) in each group. One facilitator from each of these groups was also responsible for subsequently analyzing both the transcripts and notes written by a notetaker. In this method, a workbook we call “Recipe for a Scenario” containing a set of eleven guiding questions is utilized as a supporting material for facilitation (Lembi et al. 2024). We utilized these questions to structure our codebook and deductively coded the data, which included transcripts, notes, and photos of group ideas written on sticky notes (Miles et al. 2014). Four coders worked independently and

then met to discuss findings and come to consensus about any discrepancies. For validation, a preliminary version of the findings was shared with participants, and they were given the opportunity to read the analysis made by the team of coders. Specific insights that were generated through the process of data analysis can be found in our workshop report (Wentworth et al. 2023).

Reflective writing exercise

After collecting the written responses from key informants one year post workshop, the first four authors worked together to analyze the results of the reflective writing prompts. Over a period of several weeks, this sub-team met via Zoom and used MAXQDA software. This data analysis process was structured by Wiek et al. (2014) framework for

deductively coding the effects of participatory sustainability research. We also utilized inductively generated codes collaboratively written by the research team and generated through several rounds of collaborative data analysis (see Table 3 for our codebook). Our team determined that inductively coding for key values and components specific to our set of research questions was also essential. Therefore, after reading all the data once, our team collaboratively wrote codes for transformative potential, community connection, and general workshop evaluation. This combination of deductive and inductive coding allowed the team to identify areas of impact as defined by the literature, alongside key features important to community-engaged evaluation. Over several meetings, the team completed a consensus-based coding process for each of the written responses (Barnes-Najor et al. 2024), thus we all collectively coded the entire

Table 3 Codes and definitions utilized to evaluate the scenario planning workshop one year after the event

	Code name	Our code definition and application	Code frequency	Code source
Qualitative data was collected through reflective writing from community partners who participated in the scenarios workshop. Code Frequency refers to the number of times the code was applied in the dataset. Code Source refers to whether the code and definition came from the literature or from the values of the team and illustrates how we designed the codebook to evaluate effects of participatory scenario planning and how they reach beyond the boundaries of a research project	Research usefulness	Overarching discussion on how research is useful to participant's work (not necessarily specifically referencing this utility of the scenarios workshop itself)	15	Team generated
	Quality of workshop	General feedback about the usefulness and quality of the scenario workshop	12	Team generated
	Enhanced capacity	Participants report enhanced capacity (e.g., acquired knowledge, anticipatory competence, new understandings, capacity for leaning, capacity to mobilize for collective action, capacity to garner resources) as an outcome of the scenario workshop	12	Wiek et al. (2014)
	Mechanism to achieving enhanced capacity	Participant mentions a pathway or tool that can support achieving enhanced capacity. This code was always double coded with the enhanced capacity code	2	Extension of Wiek et al. (2014), Team generated
	Potential Next steps	Participant lists ideas or suggestions for how to enact components of the scenario or use learning to achieve new goals	8	Team generated
	Key quotes	Sections of text that any one researcher wanted to highlight as exemplifying findings or significant lessons	7	Team generated
	Network effects	Participants report network effects (e.g., creation or expansion of networks and contacts, building new connections, meeting new people, creation of new relationships, coordination of stakeholders) as an outcome of the scenario workshop	5	Wiek et al. (2014)
	Community identity/voice	Speaks to the importance of ensuring the research process is a true partnership with community members, and centers community priorities	5	Team generated
	Limitations of workshop	Participant describes challenges, barriers, or problems with the workshop implementation or structure	5	Team generated
	Structural changes and decisions	Participants report structural changes and decisions (e.g., creation of policies, enhanced decision-making, creation of new organizations, or community momentum for change) as an impact of the scenarios workshop	3	Wiek et al. (2014)
	Legacy cities/historical context	References the importance of local or regional historical context in workshop implementation or scenario creation	3	Team generated
	Usable products	Participants report the creation of usable products (e.g., action plans, publications, reports, technologies) as an impact of the project or scenario workshop. Products could be created by the participants or the research team	2	Wiek et al. (2014)

data set negating the need for any inter-rater reliability checks. Codes were applied to all applicable sections of text, yielding significant sections that were co-coded. Codes are presented in Table 3 in descending order of frequency applied. For our analysis, we synthesize the coded text in a process of data condensation which yielded seven themes we present in the results (Miles et al. 2014).

Results

Scenarios

Four scenarios were co-created by participants through the scenario planning workshop (Fig. 3). Drawing from previous FLPP research, we utilized data on the current food system state and visions of desirable futures served as prompts. Combined with community-defined values and leverage points, these data informed discussions that led to the creation of actionable pathways for positive change (Belisle-Toler et al. 2021). Four scenarios were created and correspond to the work done in each of the four small groups that worked in parallel during the workshop. In Fig. 2, a summary of each scenario is presented, including a brief description of the current system, a description of a desirable future, and actionable pathways that could shift the system towards a positive future. A public report details all points that were discussed during the workshop (Wentworth et al. 2023).

Across all four scenarios, participants suggested many different strategies that could bring about transformations in the local food system. For instance, the “Community Unity” scenario suggests collaborations between multiple stakeholders to bring about a sense of community togetherness that can lead to a more localized food system that encourages small-scale production within the city. In the “Nutrition, Equity and Justice” scenario, participants detail how this collaboration should happen, including the relevance of “authentic collaboration” to support collective ownership within the food system. Collaborative processes should also consider residents, so the “Empowering Choices” scenario highlights the relevance of engaging with residents to foster healthy eating habits. In the “Peoples Market” scenario, participants emphasize the relevance of sharing power and centering diversity, inclusion and equity in actions that lead to a desirable future. Broadly, across all four scenarios, many strategies are offered, all united by a strong sense that collaboration between multiple actors and organizations is fundamental to systems level change. Although each scenario presents particularities and challenges, there is consensus that no single stakeholder can bring about transformations.

Post-workshop survey evaluation

Of the 19 participants attending the workshop, 13 (68.4%) completed the survey immediately following the event. None of the evaluations were completed by people whose primary job is in a research role affiliated with this project at Michigan State University. When asked what parts of the workshop process went well, participants responded that they enjoyed the small group discussions and felt the workshop was well-facilitated. When asked about parts of the workshop they would change, one participant responded that more Flint community members should have attended the event. Another participant suggested mixing participants into different groups after the first session to generate new conversations and ideas.

Regarding short-term workshop outcomes, participants agreed or strongly agree that the workshop provided them with (1) scenarios with specific actions that community members can take to transform the Flint food system (83% agreed or strongly agreed), (2) example scenarios that community members can work with or modify in their future work (100% agreed or strongly agreed), and (3) a workbook tool that community partners can use to create additional scenarios (83% agreed or strongly agreed). Overall, results indicate most participants felt the scenario workshop process went well, and they left the workshop with actionable ideas and tools they could incorporate into their food system work.

Practitioner reflections one-year post-workshop

A reflective writing exercise conducted one-year post-workshop allowed for an in-depth examination of the effects of co-creating scenarios that begins to reach beyond the boundaries of the research project. The reflexive writing was completed by CCP members and Flint community leaders, none of whom hold a primary role of researcher with the FLPP at MSU. Their responses are equally represented here. Overall, responses indicate that the scenario planning workshop was memorable enough to allow for a detailed recollection of the discussions that happened in the event. Across the categories examined through the coding process (Table 3), participants stressed two direct outcomes: enhanced capacity and network effects, described in more detail below.

To a lesser extent, the workshop also led to the creation of usable products, such as community-led replication of the scenario process internally within organizations who participated in the workshop, as well as framing for small grant mechanisms. Structural-level changes included using workshop insights to guide the direction of a newly formed Food Policy Council that emerged within Flint and Genesee County catalyzed by the FLPP results and co-led by some of



Fig. 3 Summary of scenarios that were co-created during the workshop. Information about current system state and desirable future were utilized as prompts, based on research efforts validated with community partners. During the workshop, participants utilized these prompts, and additional information about values and leverage points,

to create actionable pathways that describe plans, strategies and efforts needed to effectuate change. Four small groups worked in parallel during the workshop, leading to the creation of four scenarios. For a full overview of the scenarios, see report by Wentworth et al. (2023)

the community partners involved in the CCP for the FLPP. Beyond outcomes and impacts discussions, respondents also offered insights into the quality of the process, how research could be useful for practitioner work, and how this scenario workshop was useful. Analyzing written responses and coded data indicated seven key themes. Themes are presented below in order from general workshop description to direct effects, and finally cascading effects of the workshop. This structure is also presented in Fig. 4 in the discussion. We discuss each theme below illustrated by quotes from participant reflective writing. When presenting these results and exemplar quotes, we ensure that all participants' writing is presented in equal frequency, and that the same individual is not represented in more than one quote for a particular theme.

Theme 1: overall quality of the workshop

The first theme is reflection on the overall quality of the workshop itself. This often included a summary of the strengths of scenario planning and why this approach was useful. For example, one participant wrote:

Scenario planning provides a practical process for community members to use hard data, guiding analysis with qualitative as well as quantitative assumptions and forecasts. In short, scenario planning provides a means to translate research findings into community action through the engagement of diverse voices and perspectives. It is a way to combine research with lived experience to move towards a preferred future. These are the main learnings I take from this process.

The reflective writing helped solidify participants' understanding of what a scenario workshop is, while also articulating the benefits of engaging in the workshop process. Beyond this higher-level thinking about scenario workshops as a practice, this theme also revealed reflections on why this workshop was important to participant thinking. Illustrating this, one participant explained:

The scenario workshop was very useful because it synthesized a large number of findings into manageable pieces to plan for an uncertain future by exploring multiple possibilities of what might happen. The practice guided community members and other partners through considerations of various regional food system futures and how we might collectively and effectively respond to and plan for them. When coupled with other tools, such as Strategic Doing, it helps to focus direct and collaborative action that can occur in open networks.

Here the participant links the scenario development process to the previous work and data collection of the FLPP, articulating that the scenario workshop was an essential component to data synthesis. We purposefully planned the scenario workshop as a culminating activity of the research project, and participants found the activity a useful tool for synthesizing a large amount of data.

Theme 2: usefulness of research

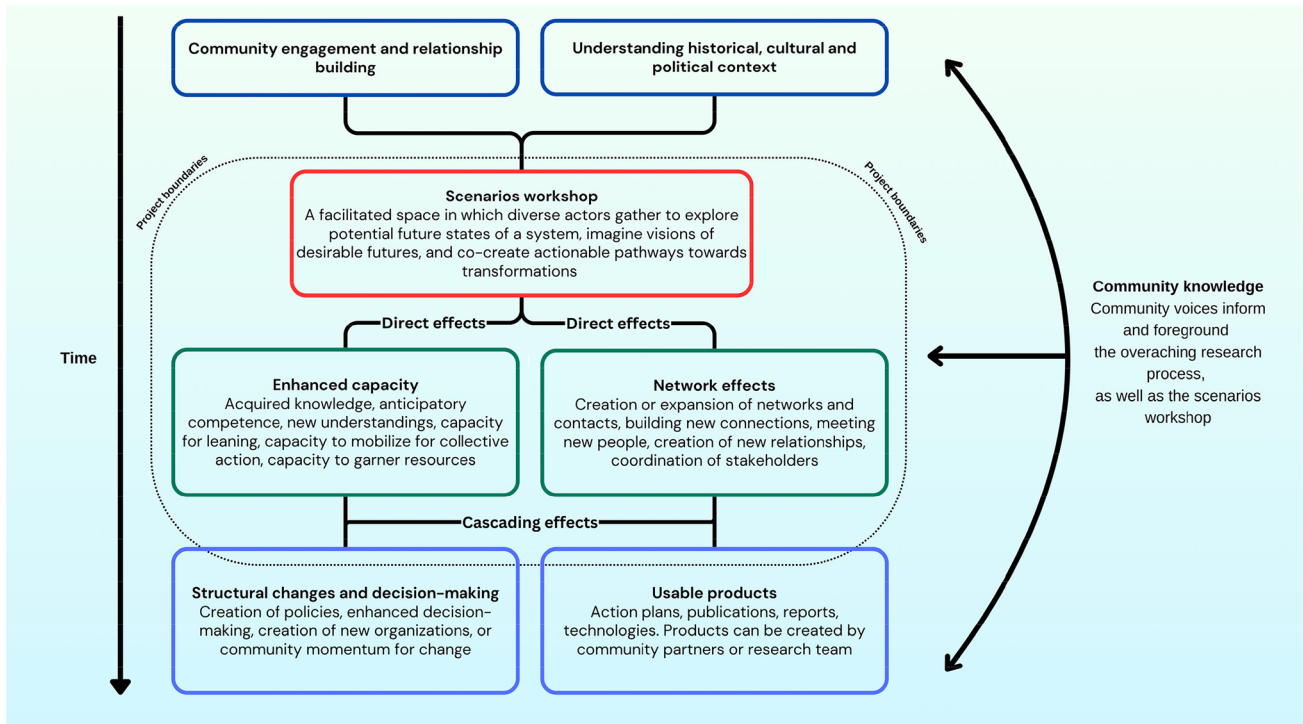
Permeating participant feedback, the second theme focused on the usefulness of research itself. Critically, participants discussed both the importance of access and efficacy in using research results. Community members viewed the engaged process of the scenario workshop as an important step in ensuring research results are useful to the community. As one participant wrote, "Researchers can help make research results more actionable by understanding that they alone cannot translate research findings for community consumption. When community partners are involved in the process, there is fidelity to both the research and the lived experience." As a community-engaged research project, many members of our CCP worked to ensure that community voices and experience remained central throughout the research process, indeed, our team views this as a critical component of the production of usable research products. The scenario workshop plays an important role in purposefully facilitating community engagement in accessing usable research data.

Another key component of this theme is the critical evaluation of research results in the context of developing actionable solutions. Participants need to work through the strengths and weaknesses of ideas for the implementation of research findings, and scenario workshops helped facilitate this process. Explaining this, a participant stated, "... research that includes exploration of potential solutions, in addition to the identification of disparities or inefficiencies, has been most actionable to inform community development and food system coordination work." The scenario workshop process enabled community members to apply a strengths-based lens to consider diverse ways of implementing interventions (Emery et al. 2006), and think about the strengths and weaknesses of interventions, rather than just focusing on the intervention itself. Ultimately, this ensures research results are useful to community partners.

Theme 3: network effects

Focused on the daily work of supporting community food systems interventions, participants are not often able to step back and think about how their work interfaces with other organizations. While participants were aware of other

A



B

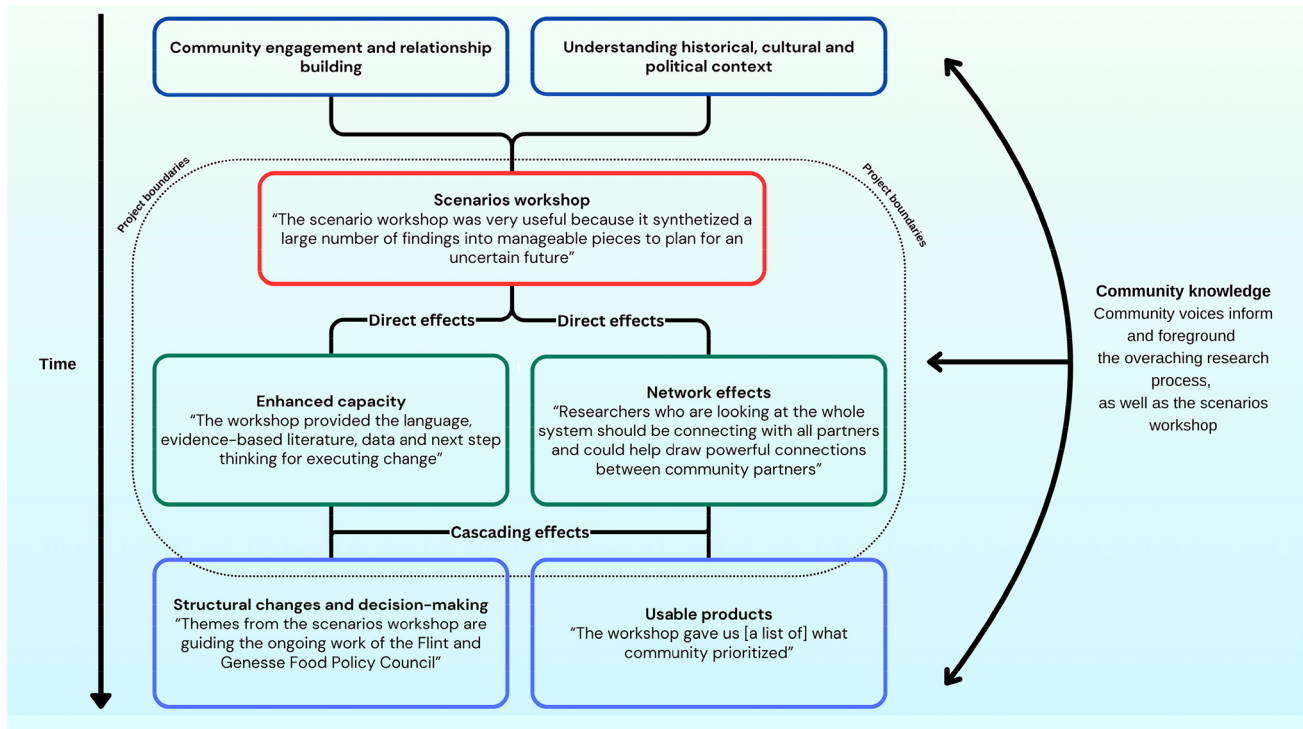


Fig. 4 **A** Our framework describes the outcomes (direct effects) and impacts (cascading effects) of the scenario workshop, situating the workshop within the context of a larger community-engaged research project, and defining terms (modified from Wiek et al. 2014). **B** To apply our model, we took the framework in Figure 4A and added data. Quotes from participants are included between quotation marks and serve as examples from our data. Both figures illustrate that as a direct

outcome of the exercise, participants experience enhanced capacity by exchanging knowledge and network effects by creating connections between actors working in multiple parts of the system. Cascading effects represent potential future impacts of the workshop, which are frequently beyond the scope of research projects impacts, yet critical if we aim to understand the efficacy of evidence-based scenario planning

stakeholders' activities, the scenario workshop offered the time and space to think about the bigger picture of how organizations work together and across spaces, a theme we call network effects. As one participant reflected:

The scenarios provide a forum for stakeholders to determine what's important. From there, creative ways to tackle issues, structure programming, and engage colleagues are established. Most local stakeholders are connected, but the intentional nature of scenario workshops is the mechanism to share ideas and work together.

Beyond a space for sharing work, some participants found the scenario workshop useful for articulating how researchers can support the integration of work across a broader network. For example, a partner explained:

Researchers can help us navigate who is doing what work. I might have a lot of great connections in the school food and nutrition space, and others might have connections and expertise with the emergency food system, and others have agricultural connections. Researchers who are looking at the whole system should be connecting with all partners and could help draw powerful connections between community partners.

Theme 4: enhanced capacity

The fourth theme, enhanced capacity, refers to acquisition and sharing of knowledge and skills at the individual and collective level (Wick et al. 2014). Participants reflected on what enhanced capacity looked like for them in several ways including improving community engagement practices, "...working *with* communities, rather than *on* communities..." incorporating historical context and key parts of community identity in their work. For several participants, the workshop expanded their efforts, as one explains:

The scenarios workshop provided a new landscape of thinking, problem solving, and innovation to the food system in Flint. Though the issues of the Flint food system were well known by first the community, programs, and organizations – having a clear layout of the "levers" that could assist in pivoting the food system for the good, was enlightening. It provided a level of simplicity to at times, complex system.

In this reflection, the participant illustrates how the scenario workshop enhanced their capacity to work across systems by providing clear and concrete levers for change. Part of this

reflection on enhanced capacity included participants recognizing that, "...there is no simple panacea at hand. No single organization—much less a single individual—can play the superhero role to bring about a happy ending." Thus, participants recognize the need to think across sectors for systems change. Overall, the scenario workshop enhanced their capacity to think across networks, with a variety of stakeholders to solve these "wicked" problems (Rittel and Weber 1973). Situating their efforts in this larger context, one participant described their enhanced capacity as follows:

The workshop provided the language, evidence-based literature, data and next step thinking for executing change in the sector of food system I work in. Though, the goal would be to execute upstream for larger impact and change—I recognized by taking time to review some of the work that can be done "downstream" I (and our community) can still be as effective, if not do more promising work, in next 5 to 10 years in Flint.

Therefore, by thinking both upstream (addressing root causes and policy drivers) and downstream (managing immediate needs and services), recognizing the various ways that other organizations are working across the food system, scenario planning revealed how the food system functioned as a whole. This process of holistic analysis led participants to reflect on ways they can harness insights from the workshop in thinking about broader systems change and their role in supporting these changes across the food system in the future.

Theme 5: usable products

Building on enhanced capacity, the fifth theme, usable products, documents specific ways that individuals plan to use the results of the scenario workshops. For some, this included reflecting on how their enhanced capacity supported next steps in their work, including needs assessments and funding decisions. Research supports the documentation of best practices and community priorities to inform program planning and design. Thinking about prioritizing funding for projects or considering next steps in process planning, "the workshops gave us what community prioritized- and that's the lens through which we evaluated projects." In addition to the scenario workshop conveying community priorities, participants explained how providing the scenario workshop framework was also a useful tool. Because we shared the workbook (Wentworth et al. 2022a, b), documented our processes (Lembi et al. 2024), provided a workshop report (Wentworth et al. 2023), and trained community partners to help facilitate and co-lead the workshop, the workshop

itself also became a useable product. As one partner wrote, “We plan to replicate some aspects of the scenario workshop with [named partner] in the future as new scenarios and challenges arise in the community.”

Theme 6: structural changes and decisions

The sixth theme focused on structural changes and decisions that partners were able to document that reached beyond the level of usable products for an individual or organization to support broader structural-level change. Indeed, participants explained, “There are promising practices, innovative ideas and community momentum in the charitable food sector in particular that is influenced by the findings of FLPP.” Building on the data from the FLPP project as a whole and the practice of generating scenarios for the future during the workshop, provided a space for partners to envision how individual-level change can lead to structural changes via collective action. The most notable example is through the reinvigorated efforts of the Food Policy Council. Several participants are engaged with the Food Policy Council at some level and referenced the organizations’ efforts. One participant described how:

Some themes from the scenarios workshop are guiding the ongoing work of the Flint and

Genesee Food Policy Council. The Food Policy Council is working to support coordinated action of individuals and organizations to support a more resilient and reliable food system in Genesee County, and the themes from the scenario workshop and broader Leverage Points Project have helped guide this coordination.

At its core, the Food Policy Council aims to facilitate structural level change by taking a systems approach, and this workshop supports those efforts.

Theme 7: potential next steps and limitations

Importantly, participants also reflected on challenges and limitations to the scenario workshop. Time, capacity, and funding are all limitations identified by participants, which are also common barriers to research expansion. One participant articulated, “There was an idea to use the workshop framework to host duplicate sessions throughout the community, however that has not taken off due to lack of capacity from partners and lack of knowledge of how to utilize the tools.” While we made the workbook available freely online (Wentworth et al. 2022a, b), and trained several community partners in workshop facilitation, capacity to continue this process in multiple settings over time is still a challenge.

The immediate steps required to ignite work on achieving scenarios is a challenge discussed across systems change literature (Oteros-Rozas et al. 2015; Totin et al. 2018), and our workshop was no exception. One participant explained, “The scenario workshops generated a lot of ideas, but I didn’t necessarily walk away in my session with an action plan or the resources to act on those ideas.” This also illustrates funding and capacity limitations that participants face in engaging with research beyond project boundaries. They developed short and long-term steps to achieving scenarios, but not necessarily the components needed to launch those plans, which often require intermediary steps and funding. Nevertheless, participants did reflect that even a year later, they could still identify action steps from the workshop. One partner articulated several next steps writing:

“Perhaps inviting and/or presenting to Michigan policy makers and emphasizing the relevance and importance of the Flint Leverage Points Project. The nuances of this project provide a higher level of insight into the unique needs, circumstances, and traumas the Flint community has endured and overcome in the last decade. This may support purposeful, meaningful upstream action steps, and lead to efficient changes in the Flint food system as a whole.”

While actively working toward an improved future food system, there are limitations to what can be achieved with scenario workshops alone. Creating a more explicit framework that people can use to organize future actions was beyond the scope of this workshop but might be worth considering for inclusion in future workshops. Describing limitations to participants upfront is important to setting expectations, and an essential component to successful engagement and facilitation.

Discussion

Co-creating scenarios for sustainability transformations

Through our experiences, we illustrate how scenarios workshops can be a space for transdisciplinary exchanges that integrate multiple ways of knowing to discuss how transformations could concretely happen. In our work, all of the resulting scenarios touch on what Weber et al. (2020) describe as “ingredients for food systems change,” namely, political action, collaboration between stakeholders, education, and shifts in values. Food system transformations can be defined as “significant reconfigurations of the assemblage of food system activities, actors, outcomes, and

relationships (dynamics) to move away from the current globalized industrial model and ensure sustainable, resilient, and just models of production and consumption” (Juri et al. 2024, p. 10). It is possible to observe in the narrative scenarios (presented in Fig. 3) that, although *what* needs to be done remains a key theme of discussion, participants also emphasized the description of *how* actions should be implemented. For instance, the scenarios suggest how multi-actor engagement should occur, focusing on values of togetherness, collective action, and inclusion (Fig. 3). Thus, scenario planning is most effective when it is attentive to multiple dimensions of *what* and *how* in order to allow for scenarios to engage with their transformative potential (Bentz et al. 2022). Furthermore, our results illustrate how the scenario workshop facilitated the creation of actions and strategies that build upon community assets and strengths (Emery et al. 2006). This is essential in the context of legacy cities like Flint that are often described in the language of health disparities and inequities. Given that transformations are plural and there are multiple desirable futures and pathways, the four distinct scenarios widened the scope of alternative futures and strategies for change, allowing all participants to acknowledge that transformation requires multiple, simultaneous interventions (Falardeau et al. 2019; Martin et al. 2022; Raudsepp-Hearne et al. 2020).

Assessing impact of scenarios workshops over time

Although the post-workshop survey evaluation indicated the usefulness of the exercise, we still questioned the extent to which scenario planning played a role in enabling food system change. We questioned—would participants be able to enact change in the future? Based on the results from the reflective writing exercise, conducted one year after the workshop, we utilized the methodological framework proposed by Wiek et al. (2014) to visualize the effects of community-engaged research in sustainability and modified it to our case study. Figure 4 illustrates our new framework (Fig. 4A), highlighting the results of the scenarios workshop (Fig. 4B). We illustrate components of our research project, while also emphasizing important precursor steps including engagement, relationship building, and learning the cultural and historic context prior to engaging in the research. Within the project boundaries, marked by dashed lines, a scenarios workshop takes place that guides participants in exploring desirable futures. In the case of our project, the scenarios workshop built on previous research findings including community-defined values and leverage points, allowing for the communication of academic and partnership insights as sources of actionable knowledge that could be used to explore desirable futures. Quotes from participants are

included in each box to represent the voices of food system leaders in Flint and exemplify each category.

As a direct outcome of the scenarios workshop, participants experience enhanced capacity by exchanging knowledge and network effects by creating connections between actors working in multiple parts of the system. This is an immediate effect that is experienced during the event, as emphasized by the reflective writing exercise. Indeed, other studies also point out to the relevance of scenario planning in building networks between participants (e.g., Oteros-Rozas et al. 2015; Totin et al. 2018). Ideally these are activities that start in the workshop and continue beyond the boundaries of the project. Cascading effects represent potential future impacts of the workshop, including the creation of usable products (e.g., reports) and structural changes (e.g., changes in the local food policy council). However, as noted in the figure, most of the work involved in cascading effects takes place beyond the boundaries and timelines of the research project because they require extra time, effort, and community-led action often unrelated to grant-funded research. Indeed, it would be beneficial to have multiple iterations of grant funding to a project to facilitate the completion and document the cascading effects of research processes. To observe cascading effects, long-term monitoring and evaluation is necessary to track these effects, and assess the full impact of research (Waylen et al. 2015).

As standalone exercises, scenarios workshops are unlikely to achieve the transformative potential they aspire to achieve (Nieto-Romero et al. 2016; Totin et al. 2018). Indeed, our epistemological framework considers participatory scenario planning as a way to inform and influence the work of community partners—who are already experts engaged with food system change—rather than empty vessels in need of knowledge dissemination. This stems from practice theory, as West et al. (2019) explain:

...from a practice perspective, the initial task of the actors involved in a transdisciplinary research project is not to apply knowledge but to devise a productive form of practice within which the problem can be addressed....A practice approach therefore highlights the distinctive value of transdisciplinary research: rather than developing “knowledge outputs,” its value lies in establishing generative forms of inquiry within which new ways of knowing and doing (and more useful knowledge) may emerge. Knowledge is a product of practice. (pg. 543)

We do not consider the evaluation of scenarios workshops as a linear process, but rather part of a more fluid knowledge exchange with community partners in which the scenario workshop catalyzes potential interventions aimed at

transforming the food system. We report on community partners' descriptions on workshop effects, while acknowledging that impacts and outcomes unfold within a larger system of simultaneous changes that influence community partner actions. A practice-based approach reminds us this is another strength of scenario workshops as they can facilitate interventions building on existing actions.

Therefore, in our framework, we emphasize the importance of situating scenario planning within the context of larger projects guided by community voices throughout, illustrated in the arrows on the right (Fig. 4A and B). Community ownership of data and scenarios is essential for community members to feel empowered to continue to work with data and scenario results. Moreover, long-term impact is best assessed via multiple methods over time. We argue for methodological pluralism when evaluating impacts of scenarios workshop combining both qualitative and quantitative methods, situated within the broader process of community-engaged projects over time (Nieto-Romero et al. 2016; Norström et al. 2020). In our work, we utilized post-workshop surveys, and one-year later reflective writing, which is useful for understanding the broader lived experiences of community partners and workshop participants. In this way we begin to see how participants are using research insights from the scenario workshop one year later. Figure 4B illustrates some of these cascading effects illustrated from our data. It is important to revisit this again in the future and continue to monitor impacts of scenarios workshops to understand their full efficacy and impact.

Limitations and needs

While the scenarios workshop generated useful impacts for community partners who engaged with the activity, we recognize important limitations based on our structure and framework. Resulting scenarios clearly represent transformations to the local food system in Flint. However, discussions devoted little time on potential negative impacts, shocks, and crises that could emerge (Blythe et al. 2018). The scenario process emphasized the relevance of building alliances and community power but did not explicitly address how other power relations may shift or even impede the realization of transformations (Rutting et al. 2022). Scenarios also focused primarily on changes in the social dimensions of the local food system and had a limited engagement with ecological and technological dimensions (McPhearson et al. 2022) or with national food system policy. Since we focused on a medium-term (20 year) future, there was a lesser focus on more radical changes (McPhearson et al. 2021). We used narrative storylines to represent scenarios, however, artistic approaches to scenario development could enrich our process by creating boundary objects that create

concrete visualizations of desirable futures (Gianelli et al. 2024).

Another limitation to this approach is the time and money required to both prepare for, lead, participate, and evaluate effects of scenarios workshops. We hosted this over one day, providing a small cash thank you gift. However, additional time for structured discussions about implementation might have generated additional cascading effects. One partner reflected, "I do think a dedicated time to discuss immediate next steps and responsible organizations/individuals based on the scenarios would have been helpful to keep the workshop momentum going." Managing the tension between hosting an agile futures workshop that is attentive to the time constraints of participants, while being mindful of the necessity of having in-depth discussions, is a key challenge for facilitation of scenario planning activities (Lazurko and Keys 2022). Regarding continued assessment and evaluation, this remains beyond the scope and funding of most research projects. Dedicated funding and teams for assessment of research impacts, which is importantly, distinct from program evaluation, is desperately needed for the advancement of evidence-based research. Finally, there is a continued need for development and empirical application of evaluation frameworks designed for specifically for complex systems, where change is inherently relational, co-produced, and emergent. While the adapted framework by Wiek et al. (2014) supported our focus on the lived experiences of food system leaders and change-makers, it is primarily a qualitative tool. Future research should integrate systems-level metrics and indicators to assess change over time across diverse levels.

A call to action

In complex systems, such as the urban food system of Flint, it is challenging to assess the effects of scenarios workshops, in part because emergent, relational, and long-term change is difficult to monitor and attribute within typical project timelines and funding structure. Here, we describe how scenarios workshops, when embedded in larger community-engaged research projects, completed in collaboration with community partners, and building on community defined values, offer the potential to create impacts reaching beyond the boundaries of a research project. Evaluating how scenario planning contributes to transformations, particularly from the perspective of practitioners, is essential to demonstrate the relevance of futures research. Nonetheless, since grants end before impacts can be assessed, we know far less about the mechanisms through which research influences structural changes and usable products. Therefore, we make a call for funders and grant-making organizations to

consider and embed longer-term evaluation into their funding mechanisms, or fund subsequent small grants to study cascading effects, particularly within the context of community-engaged research.

Our results indicate that scenarios provide a strengths-based framework that help community members use research results to shape their practice and work within the food system, demonstrating effects beyond the boundaries of the research project. This is achieved due to our workshop design that: built on synthesis results of a larger research project, invited diverse experts to participate, confirmed participation from representatives of different parts of the food system, ensured the process addressed needs and strengths of the community, and integrated insights and data on community values to inform the workshop design and discussions. Participants in our scenarios workshop emphasized that the workshop helped them take a large amount of data and synthesize it into manageable and actionable components, foster connections across diverse stakeholders working within a same system, inform on-going discussions of the nascent Flint Food Policy Council. A key element that community partners stress is how the scenarios workshop introduced a novel way of thinking and strategizing to expand upon community-led change efforts¹. Important to community-engaged research is building and maintaining relationships over time, and we further call on researchers to commit to working with community partners on broader implementation science research (Bluebird Jernigan et al. 2020; Damschroder et al. 2009) that examines how we can better support communities (Luger et al. 2020; Ross et al. 2010) as they enact changes that result from research.

Reflecting on questions of causality between our workshop and cascading effects leading to systems change, reveals a fundamental point: rather than directly attributing our workshop to community-led transformations, we understand that scenarios workshops are productive in introducing new ways of thinking about problems that can guide the practice of change. The workshop is as a space in which diverse actors can gather, exchange ideas, and devise new forms of practice in their action-oriented careers and projects. Hence, research impacts can be better understood depending on whether it introduces productive forms of reflection and thinking that community partners can draw upon, produce and use to find workable solutions for the challenges they face in leading sustainability transformations (West et al. 2019). For researchers working with

futures-oriented, community-engaged research, we call for pluralizing how impact is understood and emphasize that it needs to be evaluated from the perspective of community partners and in local context.

To solve our most challenging societal problems, there is a need to build relationships with community partners to create evidence-based, strengths-based research that can facilitate community partners' long-term success in building a sustainable future. Ultimately, we hope that our findings can inform scholars and practitioners on impact evaluation of participatory scenario planning, while also contributing to broader literature on ways to enhance the relevance and usefulness of community-engaged research beyond the usual duration of a project. Footnote 1: In the time spent analyzing these data, writing the manuscript and navigating peer review, further community-based work based on these scenarios emerged. Notably, drawing on the People's Market scenario, the Flint Social Club launched Kickback a pop-up designed to support small businesses and chefs navigate the process of setting up food businesses. At the time of publication, five food businesses operate out of Kickback's space on a rotating basis.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s11625-026-01863-3>.

Acknowledgments First, we thank members of the Flintcommunity, without whom this research would not be possible. The authors would like to thank the broader members of the Flint Leverage Points Project research team who participated in the scenario workshop event, and helped with logistics and planning, and other components of research that informed the development of the workshop. We would also like to thank the Foundation for Food and Agriculture Research, and particularly John Reich, for both financial and broader support in building academic/community partnerships and providing us the space for innovation in collaboration.

Funding The funding was provided by Foundation for Food and Agriculture Research, Grant No.: 560827. Compliance with Ethical Standards Statement: We have no conflicts of interest to declare. Research activities were approved by the Michigan State University IRB STUDY00000940. Informed consent from all participants was obtained, including a release for the use of photos during workshop activities and other research related events.

Declarations

Compliance with Ethical Standards Statement: We have no conflicts of interest to declare. Research activities were approved by the Michigan State University IRB STUDY00000940. Informed consent from all participants was obtained, including a release for the use of photos during workshop activities and other research related events.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the

¹ In the time spent analyzing these data, writing the manuscript and navigating peer review, further community-based work based on these scenarios emerged. Notably, drawing on the People's Market scenario, the Flint Social Club launched Kickback a pop-up designed to support small businesses and chefs navigate the process of setting up food businesses. At the time of publication, five food businesses operate out of Kickback's space on a rotating basis.

source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

- Arnstein SR (1969) A ladder of citizen participation. *J Am Inst Plann* 35(4):216–224
- Azevedo KJ, Robinson TN (2015) Anthropology in the design of preventive behavioral health programs for children and families living in disadvantaged neighborhoods. *Ann Anthropol Pract* 39(2):176–191. <https://doi.org/10.1111/napa.12078>
- Barnes-Najor J, Stonefish B, Wentworth C, Gartner D, Saucedo JS, Howard-Bobiwash H, Koval P, Burnett R, Martin L, Leask M, Schneider R, Hopps C, Gordon C, Cameron A (2024) Stories and reflections on Gikinawaabi: recentering Indigenous Knowledge in early childhood development through food- and land-based practices. *Early Child Res Q* 69:S102–S117. <https://doi.org/10.1016/j.ecresq.2023.12.014>
- Belisle-Toler R, Hodbod J, Wentworth C (2021) A mixed methods approach to exploring desirable food systems. *Sustain Sci Pract Policy* 17(1):362–376. <https://doi.org/10.1080/15487733.2021.1996768>
- Bentz J, O'Brien K, Scoville-Simonds M (2022) Beyond “blah blah blah”: exploring the “how” of transformation. *Sustain Sci* 17(2):497–506. <https://doi.org/10.1007/s11625-022-01123-0>
- Blue Bird Jernigan V, D'amico EJ, Keawe'aimoku Kaholokula J (2020) Prevention research with indigenous communities to expedite dissemination and implementation efforts. *Prev Sci* 21(Suppl 1):74–82. <https://doi.org/10.1007/s11121-018-0951-0>
- Blythe J, Silver J, Evans L, Armitage D, Bennett NJ, Moore M, Morrison TH, Brown K (2018) The dark side of transformation: latent risks in contemporary sustainability discourse. *Antipode* 50(5):1206–1223. <https://doi.org/10.1111/anti.12405>
- Chambers JM, Wyborn C, Klenk NL, Ryan M, Serban A, Bennett NJ, Brennan R, Charli-Joseph L, Fernández-Giménez ME, Galvin KA, Goldstein BE, Haller T, Hill R, Munera C, Nel JL, Österblom H, Reid RS, Riechers M, Spierenburg M, Tengö M, Bennett E, Brandeis A, Chatterton P, Cockburn JJ, Cvitanovic C, Dumrongrojwathana P, Paz Durán A, Gerber J-D, Green JMH, Gruby R, Guerrero AM, Horcea-Milcu A-I, Montana J, Steyaert P, Zaehner JG, Bednarek AT, Curran K, Fada SJ, Hutton J, Leimona B, Pickering T, Rondeau R (2022) Co-productive agility and four collaborative pathways to sustainability transformations. *Glob Environ Change* 72:102422. <https://doi.org/10.1016/j.gloenvcha.2021.102422>
- Chibwe B, Terry N, Noumonvi KD, Carpenter-Urquhart L, Tcheton S, Pereira L (2024) African futures: a review of scenarios for Indigenous and local people and nature in Africa. *Ecol Soc*. <https://doi.org/10.5751/ES-15322-290332>
- Cho S, Crenshaw KW, McCall L (2013) Toward a field of intersectionality studies: theory, applications, and praxis. *Signs J Women Cult Soc* 38(4):785–810. <https://doi.org/10.1086/669608>
- Cork S, Alexandra C, Alvarez-Romero JG, Bennett EM, Berbés-Blázquez M, Bohensky E, Bok B, Costanza R, Hashimoto S, Hill R, Inayatullah S, Kok K, Kuiper JJ, Moglia M, Pereira L, Peterson G, Weeks R, Wyborn C (2023) Exploring alternative futures in the Anthropocene. *Annu Rev Environ Resour* 48(1):25–54. <https://doi.org/10.1146/annurev-environ-112321-095011>
- Cornish F, Breton N, Moreno-Tabarez U, Delgado J, Rua M, de-Graft Aikins A, Hodgetts D (2023) Participatory action research. *Nat Rev Methods Prim* 3(1):34. <https://doi.org/10.1038/s43586-023-00214-1>
- Cornwall A (2008) Unpacking “participation”: models, meanings and practices. *Commun Dev J* 43(3):269–283. <https://doi.org/10.1093/cdj/bsn010>
- Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC (2009) Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implement Sci* 4:50. <https://doi.org/10.1186/1748-5908-4-50>
- Díaz S, Settele J, Brondizio ES, Ngo HT, Agard J, Arneth A, Balvanera P, Brauman KA, Butchart SHM, Chan KMA, Lucas AG, Ichii K, Liu J, Subramanian SM, Midgley GF, Miloslavich P, Molnár Z, Obura D, Pfaff A, Zayas CN (2019) Pervasive human-driven decline of life on Earth points to the need for transformative change. *Science*. <https://doi.org/10.1126/science.aax3100>
- Doberneck DM, Glass CR, Schweitzer J (2010) From rhetoric to reality: a typology of publically engaged scholarship. *J High Educ Outreach Engagem* 14(4):5–35
- Emery M, Fey S, Flora C (2006) Using community capitals to develop assets for positive community change. *CD Pract* 13:1–19
- Falardeau M, Raudsepp-Hearne C, Bennett EM (2019) A novel approach for co-producing positive scenarios that explore agency: case study from the Canadian Arctic. *Sustain Sci* 14(1):205–220. <https://doi.org/10.1007/s11625-018-0620-z>
- FLPP (2023) Flint Leverage Points Project: Final report. Michigan State University. <https://doi.org/10.17613/X984M-1V988>
- Galang EINE, Bennett EM, Hickey G, Baird J, Dale G, Sherren K (2025) Co-imagining future scenarios can enhance environmental actors' empathy toward future generations and non-human life-forms. *Sustain Sci*. <https://doi.org/10.1007/s11625-024-01607-1>
- Galang EINE, Bennett EM, Hickey GM, Baird J, Harvey B, Sherren K (2025) Participatory scenario planning: a social learning approach to build systems thinking and trust for sustainable environmental governance. *Environ Sci Policy* 164:103997. <https://doi.org/10.1016/j.envsci.2025.103997>
- Gianelli I, Trimble M, Juri S, Beretta NA, Torená D, Acosta M, Acosta R, Bó MD, Fuster JA, González V, Kurta D, Kurta M, López T, Marfetan ME (2024) Envisioning desirable futures in small-scale fisheries: a transdisciplinary arts-based co-creation process. *Ecol Soc*. <https://doi.org/10.5751/ES-14869-290120>
- Grant AK, Felner JK, Castañeda Y, Pratap P, Hebert-Beirne J (2024) Leveraging key informant interviews to inform intervention development: The Greater Lawndale Healthy Work Project. *Commun Health Equ Res Policy* 44(4):429–438. <https://doi.org/10.1177/2752535X231196395>
- Green PG, Haines A (2016) Asset building and community development. SAGE Publications
- Greenwood DJ, Levin M (2007) Introduction to action research: social research for social change, 2nd ed. Sage Publications
- Hanna-Attisha M, LaChance J, Sadler RC, Champney Schnepf A (2016) Elevated blood lead levels in children associated with the Flint Drinking Water Crisis: a spatial analysis of risk and public health response. *Am J Public Health* 106(2):283–290. <https://doi.org/10.2105/AJPH.2015.303003>
- Highsmith AR (2015) Demolition means progress: Flint, Michigan, and the fate of the American metropolis. The University of Chicago Press
- Hodbod J, Wentworth C (2021) Assessing Panarchy in food systems: cross scale interactions in Flint Michigan, USA. *Appl Panarchy* Davis 2001:352

- Jablonski BBR, Casnovsky J, Clark JK, Cleary R, Feingold B, Freedman D, Gray S, Romeiko X, Olabisi LS, Torres M, Van Den Berg AE, Walsh C, Wentworth C (2021) Emergency food provision for children and families during the COVID-19 pandemic: examples from five U.S. Cities. *Appl Econ Perspect Policy* 43(1):169–184. <https://doi.org/10.1002/aep.13096>
- Juri S, Marais-Potgieter A, Achieng T, Gianelli I, Kabisa M, Nkgothoe B, Ojino J, Tcheton S, Carpenter-Urquhart L, Pereira LM (2025) Transforming towards what? A review of futures-thinking applied in the quest for navigating sustainability transformations. *Environ Res Lett* 20(5):053006. <https://doi.org/10.1088/1748-9326/adcbe4>
- Juri S, Terry N, Pereira L (2024) Demystifying food systems transformation: a review of the state of the field. *Ecol Soc*. <https://doi.org/10.5751/ES-14525-290205>
- Knox C, Gray S, Zareei M, Wentworth C, Aminpour P, Wallace RV, Hodbod J, Brugnone N (2023) Modeling complex problems by harnessing the collective intelligence of local experts: new approaches in fuzzy cognitive mapping. *Collect Intell* 2(4):26339137231203582. <https://doi.org/10.1177/26339137231203582>
- Kuiper JJ, Carpenter-Urquhart LR, Berbés-Blázquez M, Oteros-Rozas E, Fredström L, Psiuk K, Savu C, Kautsky R, Guerry AD, Carpenter SR, Green CE, Meacham M, Remme RP, Ravera F, Wankmüller F, Arkema KK, Pereira LM, Peterson GD (2024) Biosphere futures: a database of social-ecological scenarios. *Ecol Soc*. <https://doi.org/10.5751/ES-14795-290119>
- Lam DPM, Freund ME, Kny J, Marg O, Mbah M, Theiler L, Bergmann M, Brohmann B, Lang DJ, Schäfer M (2021) Transdisciplinary research: Towards an integrative perspective. *Gaia* 30(4):243–249. <https://doi.org/10.14512/gaia.30.4.7>
- Lazurko A, Keys PW (2022) A call for agile futures practice in service of transformative change: lessons from envisioning positive climate futures emerging from the pandemic. *Ecol Soc*. <https://doi.org/10.5751/ES-13531-270310>
- Lembi R, Wentworth C, Hodbod J (2024) Recipe for a scenario: moving from vision to actionable pathways towards sustainable futures. *Prog Environ Geogr* 3(2):89–114. <https://doi.org/10.1177/27539687241253616>
- Luger TM, Hamilton AB, True G (2020) Measuring community-engaged research contexts, processes, and outcomes: a mapping review. *Milbank Q* 98(2):493–553
- Malmborg K, Wallin I, Brukas V, Do T, Lodin I, Neset T-S, Norström AV, Powell N, Tonderski K (2022) Knowledge co-production in the Helge å catchment: a comparative analysis. *Ecosystems People* 18(1):565–582. <https://doi.org/10.1080/26395916.2022.2125583>
- Marshall J, Mead G (2005) Editorial: self-reflective practice and first-person action research. *Action Res* 3(3):235–244. <https://doi.org/10.1177/1476750305055999>
- Martin A, O'Farrell P, Kumar R, Eser U, Faith DP, Gomez-Baggethun E, Harmackova Z, Horcea-Milcu A-I, Merçon J, Quaas M, Rode J, Rozzi R, Sitas N, Yoshida Y, Ochieng TN, Koessler A-K, Lutti N, Mannetti L, Arroyo-Robles G (2022) Chapter 5. The role of diverse values of nature in visioning and transforming towards just and sustainable futures. (Version 03). [object Object]. <https://doi.org/10.5281/ZENODO.6522326>
- Mascia-Lees FE (ed) (2011) A companion to the anthropology of the body and embodiment, blackwell companions to anthropology. Wiley-Blackwell, Oxford, UK
- McPhearson T, Cook EM, Berbés-Blázquez M, Cheng C, Grimm NB, Andersson E, Barbosa O, Chandler DG, Chang H, Chester MV, Childers DL, Elser SR, Frantzeskaki N, Grabowski Z, Groffman P, Hale RL, Iwaniec DM, Kabisch N, Kennedy C, Markolf SA, Matsler AM, McPhillips LE, Miller TR, Muñoz-Erickson TA, Rosi E, Troxler TG (2022) A social-ecological-technological systems framework for urban ecosystem services. *One Earth* 5(5):505–518. <https://doi.org/10.1016/j.oneear.2022.04.007>
- McPhearson T, Raymond C, Gulsrud N, Albert C, Coles N, Fagerholm N, Nagatsu M, Olafsson A, Soininen N, Vierikko K (2021) Radical changes are needed for transformations to a good Anthropocene. *npj Urban Sustain*. <https://doi.org/10.1038/s42949-021-00017-x>. (in press)
- Miles MB, Huberman AM, Saldaña J (2014) Qualitative data analysis: a methods sourcebook, Third edition. SAGE
- Nalau J, Cobb G (2022) The strengths and weaknesses of future visioning approaches for climate change adaptation: a review. *Glob Environ Change* 74(April):102527. <https://doi.org/10.1016/j.gloenvcha.2022.102527>
- Nieto-Romero M, Milcu A, Leventon J, Mikulcak F, Fischer J (2016) The role of scenarios in fostering collective action for sustainable development: lessons from central Romania. *Land Use Policy* 50:156–168. <https://doi.org/10.1016/j.landusepol.2015.09.013>
- Norström AV, Cvitanovic C, Löf MF, West S, Wyborn C, Balvanera P, Bednarek AT, Bennett EM, Biggs R, de Bremond A, Campbell BM, Canadell JG, Carpenter SR, Folke C, Fulton EA, Gaffney O, Gelcich S, Jouffray JB, Leach M, Le Tissier M, Martín-López B, Louder E, Loutre M-F, Meadow AM, Nagendra H, Payne D, Peterson GD, Reyers B, Scholes R, Speranza CI, Spierenburg M, Stafford-Smith M, Tengö M, van der Hel S, van Putten I, Österblom H (2020) Principles for knowledge co-production in sustainability research. *Nat Sustain* 3(3):182–190. <https://doi.org/10.1038/s41893-019-0448-2>
- NRC (2008) Public participation in environmental assessment and decision making. National Academies Press, p 12434. <https://doi.org/10.17226/12434>
- O'Brien K, Garibaldi LA, Agrawal A, Bennett E, Biggs R, Calderón Contreras R, Carr ER, Frantzeskaki N, Gosnell H, Gurung J, Lambertucci SA, Leventon J, Chuan L, Reyes García V, Shannon L, Villasante S, Wickson F, Zinngrebe Y, Périanin L, Zaccagnini ME (2025) IPBES transformative change assessment: summary for policymakers (version 10.2.0). Zenodo <https://doi.org/10.5281/ZENODO.11382230>
- Oteros-Rozas E, Martín-López B, Daw TM, Bohensky EL, Butler JRA, Hill R, Martín-Ortega J, Quinlan A, Ravera F, Ruiz-Mallén I, Thyresson M, Mistry J, Palomo I, Peterson GD, Plieninger T, Waylen KA, Beach DM, Bohnet IC, Hamann M, Vilardy SP (2015) Participatory scenario planning in place-based social-ecological research. *Ecol Soc* 20(4):32
- Pauli BJ (2019) Flint fights back: environmental justice and democracy in the Flint water crisis. The MIT Press
- Pereira LM, Hichert T, Hamann M, Preiser R, Biggs R (2018) Using futures methods to create transformative spaces: visions of a good Anthropocene in Southern Africa. *Ecol Soc*. <https://doi.org/10.5751/ES-09907-230119>
- Peterson GD, Cumming GS, Carpenter SR (2003) Scenario planning: a tool for conservation in an uncertain world. *Conserv Biol* 17(2):358–366. <https://doi.org/10.1046/j.1523-1739.2003.01491.x>
- Prado DS, Martins IM, Christofolletti RA (2024) Participatory scenario planning as a useful method for transforming ocean conflicts: insights from a small-scale fishing conflict in São Paulo coast, Brazil. *Mar Policy* 160:105922. <https://doi.org/10.1016/j.marpol.2023.105922>
- Preiser R, Hichert T, Biggs R, Van Velden J, Magadzire N, Peterson G, Pereira L, Mayer K, Benessaiah K (2024) Transformative foresight for diverse futures: the Seeds of Good Anthropocenes initiative. *Dev Policy Rev* 42(S1):e12791. <https://doi.org/10.1111/dpr.12791>
- Raudsepp-Hearne C, Peterson GD, Bennett EM, Biggs R, Norström AV, Pereira L, Vervoort J, Iwaniec DM, McPhearson T, Olsson P, Hichert T, Falardeau M, Aceituno AJ (2020) Seeds of Good

- Anthropocenes: developing sustainability scenarios for Northern Europe. *Sustain Sci* 15(2):605–617. <https://doi.org/10.1007/s11625-019-00714-8>
- Reason P, Bradbury H (eds) (2013) *The SAGE handbook of action research: participative inquiry and practice*, Second edition. SAGE Publications
- Reed MS, Merkle BG, Cook EJ, Hafferty C, Hejnowicz AP, Holli-man R, Marder ID, Pool U, Raymond CM, Wallen KE, Whyte D, Ballesteros M, Bhanbhro S, Borota S, Brennan ML, Carmen E, Conway EA, Everett R, Armstrong-Gibbs F, Jensen E, Koren G, Lockett J, Obani P, O'Connor S, Prange L, Mason J, Robinson S, Shukla P, Tarrant A, Marchetti A, Stroobant M (2024) Reimagining the language of engagement in a post-stakeholder world. *Sustain Sci*. <https://doi.org/10.1007/s11625-024-01496-4>
- Rittel HWJ, Webber MM (1973) Dilemmas in a general theory of planning. *Policy Sci* 4:155–169
- Ross LF, Loup A, Nelson RM, Botkin JR, Kost R, Smith GR, Gehlert S (2010) The challenges of collaboration for academic and community partners in a research partnership: points to consider. *J Empir Res Hum Res Ethics* 5(1):19–31. <https://doi.org/10.1525/jer.2010.5.1.19>
- Rutting L, Vervoort J, Mees H, Pereira L, Veeger M, Muiderman K, Magnus A, Winkler K, Pergher BB, Olsson P, Lane R, Hichert T, Christiaens L, Bansal N, Hendriks A (2022) Disruptive seeds: a scenario approach to explore power shifts in sustainability transformations. *Sustain Sci*. <https://doi.org/10.1007/s11625-022-01251-7>
- Sadler RC, Highsmith AR (2016) Rethinking Tiebout: the contribution of political fragmentation and racial/economic segregation to the Flint Water Crisis. *Environ Justice* 9(5):143–151. <https://doi.org/10.1089/env.2016.0015>
- Sadler RC, LaChance J, Hanna-Attisha M (2017) Social and built environmental correlates of predicted blood lead levels in the Flint Water Crisis. *Am J Public Health* 107(5):763–769. <https://doi.org/10.2105/AJPH.2017.303692>
- Sadler R, Gilliland J, Arku G (2013) A food retail-based intervention on food security and consumption. *Int J Environ Res Public Health* 10(8):3325–3346. <https://doi.org/10.3390/ijerph10083325>
- Saxe-Custack A, Lofton HC, Hanna-Attisha M, Victor C, Reyes G, Ceja T, LaChance J (2018) Caregiver perceptions of a fruit and vegetable prescription programme for low-income paediatric patients. *Public Health Nutr* 21(13):2497–2506. <https://doi.org/10.1017/S1368980018000964>
- Saxe-Custack A, Todem D, Anthony JC, Kerver JM, LaChance J, Hanna-Attisha M (2022) Effect of a pediatric fruit and vegetable prescription program on child dietary patterns, food security, and weight status: a study protocol. *BMC Public Health* 22(1):150. <https://doi.org/10.1186/s12889-022-12544-y>
- Schmitt Olabisi L, Wentworth C, Key K, Wallace RV, McNall M, Hod-bod J, Gray SA (2022) Defining success in community-university partnerships: lessons learned from Flint. *J Respons Innov*. <https://doi.org/10.1080/23299460.2022.2102567>
- Terry N, Castro A, Chibwe B, Karuri-Sebina G, Savu C, Pereira L (2024) Inviting a decolonial praxis for future imaginaries of nature: introducing the Entangled Time Tree. *Environ Sci Policy* 151:103615. <https://doi.org/10.1016/j.envsci.2023.103615>
- Tighe JR, Ryberg-Webster S (eds) (2019) *Legacy cities: Continuity and change amid decline and revival*. University of Pittsburgh Press
- Totin E, Butler JR, Sidibé A, Partey S, Thornton PK, Tabo R (2018) Can scenario planning catalyse transformational change? Evaluating a climate change policy case study in Mali. *Futures* 96(February 2017):44–56. <https://doi.org/10.1016/j.futures.2017.11.005>
- Vaughn LM, Jacquez F (2020) Participatory research methods—choice points in the research process. *J Particip Res Meth* 1(1):1–13. <https://doi.org/10.35844/001c.13244>
- Vervoort J, Gupta A (2018) Anticipating climate futures in a 1.5 °C era: the link between foresight and governance. *Curr Opin Environ Sustain* 31(June 2017):104–111. <https://doi.org/10.1016/j.cosust.2018.01.004>
- Waylen KA, Martin-Ortega J, Blackstock KL, Brown I, Avendaño Uribe BE, Basurto Hernández S, Bertoni MB, Bustos ML, Cruz Bayer AX, Escalante Semerena RI, Farah Quijano MA, Ferrelli F, Fidalgo GL, Hernández López I, Huamantínco Cisneros MA, London S, Maya Vélez DL, Ocampo-Díaz N, Ortiz-Guerrero CE, Pascale JC, Perillo GME, Piccolo MC, Pinzón Martínez LN, Rojas ML, Scordo F, Vitale V, Zilio MI (2015) Can scenario-planning support community-based natural resource management? Experiences from three countries in Latin America. *Ecol Soc*. <https://doi.org/10.5751/ES-07926-200428>
- Weber H, Poeggel K, Eakin H, Fischer D, Lang DJ, Wehrden HV, Wiek A (2020) What are the ingredients for food systems change towards sustainability?—insights from the literature. *Environ Res Lett*. <https://doi.org/10.1088/1748-9326/ab99fd>
- Wentworth C, Doberneck DM, Barnes-Najor JV, Smith M, Hirsch J, Reid MR (2024) Feminist community engagement disrupted: pathways for boundary spanning and engagement during disruption. *J High Educ Outreach Engagem* 28(3):59
- Wentworth C, Hammon A, Hodbod J, Lembi R, Zareei M (2023) Scenarios for the future of the Flint food system: visions for 2024. *Knowledge Commons*. <https://doi.org/10.17613/6HEC0-6QM91>
- Wentworth C, Hodbod J, Gerard A (2022) Blurring the boundaries: cross-scale analyses of food systems. *Ecol Soc* 27(4):art35. <https://doi.org/10.5751/ES-13460-270435>
- Wentworth C, Lembi R, Hodbod J (2022) Scenario planning work-book: leveraging food system change in Flint. *Knowledge Commons*. <https://doi.org/10.17613/N9542-A4X09>
- West S, Van Kerkhoff L, Wagenaar H (2019) Beyond “linking knowledge and action”: towards a practice-based approach to transdisciplinary sustainability interventions. *Policy Stud* 40(5):534–555. <https://doi.org/10.1080/01442872.2019.1618810>
- Wiek A, Talwar S, O'Shea M, Robinson J (2014) Toward a methodological scheme for capturing societal effects of participatory sustainability research. *Res Eval* 23(2):117–132. <https://doi.org/10.1093/reseval/rvt031>
- Williams S, Robinson J (2020) Measuring sustainability: an evaluation framework for sustainability transition experiments. *Environ Sci Pol* 103(October 2019):58–66. <https://doi.org/10.1016/j.envsci.2019.10.012>
- Zimmermann S, Dermody BJ, Wassen MJ, Fried RL, Bennett E, Divine LM, Padula VM, Dorresteyn I (2025) Leveraging value-based pathways for Indigenous food security through participatory scenario planning: a case study from St. Paul Island, Alaska, USA. *Futures*. <https://doi.org/10.1016/j.futures.2025.103610>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Authors and Affiliations

Chelsea Wentworth¹  · Rafael Lembi² · Amarachi Wachuku³ · Miles McNall⁴ · Jennifer Hodbod⁵ · Kelly McClelland⁶ · Samantha Farah⁷ · Lottie Ferguson⁸ · Robert E. Brown⁴ · Damon Ross⁸

✉ Chelsea Wentworth
Wentwo21@msu.edu

Rafael Lembi
lembi@msu.edu

Amarachi Wachuku
Wachuku1@msu.edu

Miles McNall
mcnall@msu.edu

Jennifer Hodbod
J.E.Hodbod@leeds.ac.uk

Kelly McClelland
Mccle100@msu.edu

Samantha Farah
sfarah@crim.org

Lottie Ferguson
lferguson@cfgf.org

Robert E. Brown
Brown23@msu.edu

Damon Ross
dross@cfgf.org

¹ Department of Family Medicine, College of Human Medicine, Michigan State University, East Lansing, USA

² Department of Community Sustainability, Michigan State University, East Lansing, USA

³ Charles Stewart Mott Department of Public Health, Michigan State University, Flint, USA

⁴ University Outreach and Engagement, Michigan State University, East Lansing, USA

⁵ Sustainability Research Institute, University of Leeds, Leeds, UK

⁶ Community Food Systems Educator, Michigan State University Extension, Flint, USA

⁷ Director of Community Impact, Crim Fitness Foundation, Flint, USA

⁸ Community Foundation of Greater Flint, Flint, USA