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DISCUSSION PIECE

Building capacities in regional food systems: mapping change towards transformation

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Abstract

This paper makes the case for the regional scale as a space for resilient, sustainable food system transformation. Drawing from the literature and using the example of the Food Learning and Growing (FLOW) Partnership, we propose a hybrid methodology to explore, monitor and track enablers, barriers and changes over time. FLOW includes ten food regions where we are tracking various dimensions of transformation. The regional food systems capacities framework introduced herein is the theoretical basis for our work and frames our research. This framework underpins our research approach that includes developing multi-actor groups to guide our research and using collective visioning and impact pathways to map changes. Impact pathway maps help identify indicators to monitor and track changes and follow the paths to transformation. The indicators are brought to life through stories of change that will be shared across the research project to inform and catalyze ideas between regions. The stories will also be shared outside the FLOW partnership to inform and inspire others who seek to transform their food systems. Our goal is to understand the socio-ecological, economic, human and governance capacities that facilitate transformation from industrial food systems to ones that realize fair livelihoods, the right to food, food security, and ecological integrity.

Keywords Food systems · Region · Capacity · Transformation · Impact pathway mapping

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Introduction

The growing momentum over the last decades to globalize food supply chains and increase corporate profits has had significant repercussions on our food systems (Clapp 2025). Global-industrial food systems have resulted in more than 3 billion people unable to afford a healthy diet and nearly 1 billion people living with food insecurity (HLPE 2020; HLPE 2025). Environmentally, the current global-industrial food system is linked to 80% of biodiversity loss, more than 37% of GHG emissions, and soil and water degradation (IPBES 2019; IPCC 2021; Pörtner et al. 2022). Economically and politically, the system has contributed to the loss of livelihoods, shrinking the number of family and small-holder farms, eroding the autonomy of countries over their national food systems, increasing corporate hegemony and human rights violations. Finally, and perhaps most egregiously, it has exacerbated the ravages of war, displacement, genocide and colonization (Canfield et al. 2021; Clapp 2021, GIST

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Impact 2023; Lacerda et al. 2020; Bayha and Spring 2020; Kaiser et al. 2021; Lang and McKee 2022).

At the same time, addressing the damaging outcomes of the global-industrial food system offers opportunities for alternatives to emerge that can simultaneously address these multiple challenges. For example, a more resilient food system such as agroecology can at once protect biodiversity and water, mitigate GHG emissions, build soil, value livelihoods and human rights, diversify ownership and control, and decolonize relations (Pretty 1998; Kerr et al. 2021; Knezevic and Blay-Palmer 2015; Gliessman 2016; Clapp 2025; Anderson 2024; HLPE 2025). Simultaneous attention to environmental resilience, equitable livelihoods, circular economies, food security and nutrition, and democratic governance could help achieve transformational benefits for people and the planet (Valentini et al. 2019; Wezel et al. 2020; Anderson and Rivera-Ferre 2021; Wilkes 2022). Through such a food systems lens we can see interconnected socio-ecological transformations as food moves from seed to table to waste and back again (Hipel et al. 2010; Morgan et al. 2006; Klassen and Wittman 2017).

Food system examination and deliberation must include how we understand power – both power over and power to – as we work to transform the political economy of the globalized food system so it is more equitable and inclusive (Anderson and Rivera-Ferre 2021, 2021). Understanding where change is taking place can help inform what we know about the potential for transformation and reveal cracks in the structure where the absolutism of the globalized food system can be fractured and reconfigured (Clapp 2025; Leyshon et al. 2003). To some extent, this process has been on-going for generations – led by hundreds of millions of small-scale farmers, Indigenous Peoples and local communities worldwide who steward the land, water, and biodiversity, while also growing nutritious food for themselves and their communities (IPBES 2019; Nicholls and Altieri 2019; Nimmo et al. 2020; Knezevic et al. 2023) all the while maintaining a wide diversity of practices, innovations, and knowledge essential for food system resilience.

From the authors' perspectives, food system transformation entails significant structural shifts from power being held by corporations and government towards power being accountable to and centered with producers and eaters. This shift could be possible by embracing food sovereignty principles to fundamentally re-envision and re-design how we govern, produce food and gain our daily sustenance, to, "ensure sustainable, resilient, and just models of production and consumption … Food system re-design should therefore be seen as an ethical-political process that needs to be collectively stewarded and nurtured in an adaptive, engaged, and creative way. This also means that strategies (pathways) and tools need to respond to and resonate with current contextual needs and features, while also being future-proof and proactive (anticipatory)" (Juri et al. 2024, p. 12).

In our attempt to shed new light on how we can move towards this transformation and respond to the growing calls to reverse the negative impacts of the global-industrial food system, we argue that the regional scale is an appropriate entry point to monitor, understand, generate new knowledge and bring about sustainable food system transformation. Gathering and disseminating more information about these food systems can extend and refine theories and practices that build regional capacities and allow us to challenge the dominant political economy of food that prioritizes profits over people and the health of the planet (Schutter and Olivier 2017; Wezel et al. 2020).

To lay out the rationale and then our approach, we first define regional scales and address their role in providing insight into food systems transformation. We then discuss the FLOW project and our regional capacities framework. Finally, we discuss our research approach including tools and conclude with next steps.

The regional scale

For our purposes, regions are defined as eco-socio-political geographies that demonstrate common or interlinked locally-focused foodway practices (e.g., ethnocultural territories, bioregions, food bowls, foodsheds, extended metropolitan areas) (Clancy and Ruhf 2010; Kloppenberg et al. 1996; Sheridan et al. 2015). We think about regions as similar to territories described in the work of, for example, Valette et al. (2024), Caron (2020), Lacerda et al. (2020), and Valette et al. (2017), where territories include material/physical, organizational, relational and institutional dimensions (Larrère 2015 in Angeon et al. 2024; May et al. 2022) that typically operate at a sub-national scale.

The region offers an alternative to local, national and global perspectives that can limit how we understand and enact transformation (Clancy et al. 2017; Keegan et al. 2024). On the one hand, research at a community, case study scale provides crucial insights into good practices and lessons learned on the road to transformation in households, projects or communities. However, it doesn't help us understand how to scale up and embed sustainable food systems so they offer a viable alternative to the global-industrial food system. On the other hand, food system analysis at the national or global scale cannot address "widely differing landscapes, societies, cultures, and levels of economic development, and how equitably the food is available. In the end, 'the world' is not fed, in aggregate, and there is no collective 'we' doing the feeding" (Wise 2013 in Gemmill-Herren 2021, p. 191). As a middle ground, regional/territorial research offers the space where transformations crucial

to our collective sustainable food futures *can* and *do* occur (Anderson and Rivera-Ferre 2021; Dengerink et al. 2021; Trippl et al. 2024; Harris et al. 2016). As Clancy and Ruhf (2010) explain, "a regional food system is greater than the sum of its 'locals'" (p. 4) and so can provide the context for understanding and bringing about the transformational shifts we need.

The FLOW Partnership includes institutional and community partners in ten regions in six countries. Each FLOW region has a unique focus on food system transformation and engages groups of people who are systematically underserved across multiple and intersecting forms of exclusion and oppression. There are four FLOW regions in Canada, each with unique but complementary foci: Vancouver Island, British Columbia centres on bioregional food systems; Ottawa, Ontario concentrates on community farm impacts, agroecological adaptations to climate change, and food strategy innovations; Montreal, Quebec focuses on food security, food policy, strategic planning and citizen engagement; and the Northwest Territories explores community-based research to support Indigenous communities and others as they build regional food systems in the wake of floods and fires. As well, there are six international partners focused on the following: southern Brazil on traditional crops and agroforestry; Veracruz State, Mexico on organic citrus supply chains; Migori County, Kenya on Indigenous crops with women and youth; Sri Lanka on multi-scale food governance; Andhra Pradesh, India on policy supports for agroecological farming practices; and, Melbourne, Australia, on municipal and regional food policy. The diversity of the FLOW regions enables partners to explore, co-create, share and learn from the many capacities and related impacts in both the Global South and North.

Food learning and growing (FLOW) and our regional food systems capacities framework (RCF)

To help understand the reality of and potential for the regional scale, we apply our Regional Food System Capacities frameworks (Figs. 1 and 2) to document and monitor the evolution of capacities via our Food Learning and Growing (FLOW) Partnership. Fig. 1 captures the increasing transformational impact of food systems as change gathers momentum and the catalytic iteration that happens between scales. The bottom of Fig. 1 depicts the households, communities, and individuals that engage in and repeat activities and practices that result in small, incremental changes. These changes accumulate, iterate and interact to generate collective impacts that can ultimately result in transformation at the regional scale. These transformations then feed back to communities and households where they can provoke more change.

Seed saving provides a good illustration of this process. It has been the tradition in countless communities around the world for farmers to save their seeds year after year. Oftentimes, at the community scale, farmers share and trade these seeds so that collectively the community has access to seeds that are better adapted to local growing conditions and potentially have access to a more diverse range of varieties and crops (Montúfar and Ayala 2019). Typically, seed saving in communities is participative, co-created, patterned and repeatable (Phillips 2006). As these acts of seed saving aggregate beyond the community scale, they can become institutionalized and more robust as co-operatives, training programmes and seed-saving collectives ultimately shift towards food sovereignty (Pimbert 2022; Garzón et al. 2020). Regions with seed-saving resources also foster the sharing of Indigenous and traditional crops – helping to ensure more diverse diets, and preserve cultures and genomes (Gliessman 2015). Such practices, in turn, can be anchored in policy and programmes that protect and enable the right to save and trade seeds – augmenting regional capacity. This regional capacity feeds back to communities and individuals to reinforce and strengthen local capacities, helping communities overcome barriers to change. In this context, capacities enable a "system to self-organize, to maintain diversity and redundancies, and to co-evolve in relation to change. This shift describes the need to move away from the conventional static approach in sustainable development focused on natural and anthropogenic capitals to one centred on understanding the dynamic capacities that shape responses to change" (Reyers et al. 2022, p. 658). Capacities can help systems persist, adapt or transform in the face of change. In this context, transformation is "breaking down existing systems or specific system dynamics and building alternatives" (Reyers et al. 2022, p. 658) so that we move from the dominant global-industrial food system to one that protects the environment, ecosystems and biodiversity, values livelihoods and human rights, diversifies ownership and control, decolonizes food system relations and realizes the rights of nature and humans (HLPE 2025). This on-going flow between the region/territory, communities and individuals enhances and amplifies changes and impacts that ultimately result in transformations through regional institutionalization. The incorporation of resilient structures can flow back to communities to enable and empower them to bring about additional changes. The accumulation of change that results in transformation is represented by the regional scale at the top of Fig. 1. Equally important, barriers arise. For example, seed saving runs up against corporations that privatize seed and germplasms previously in the commons, and legally pursue people for seed saving.

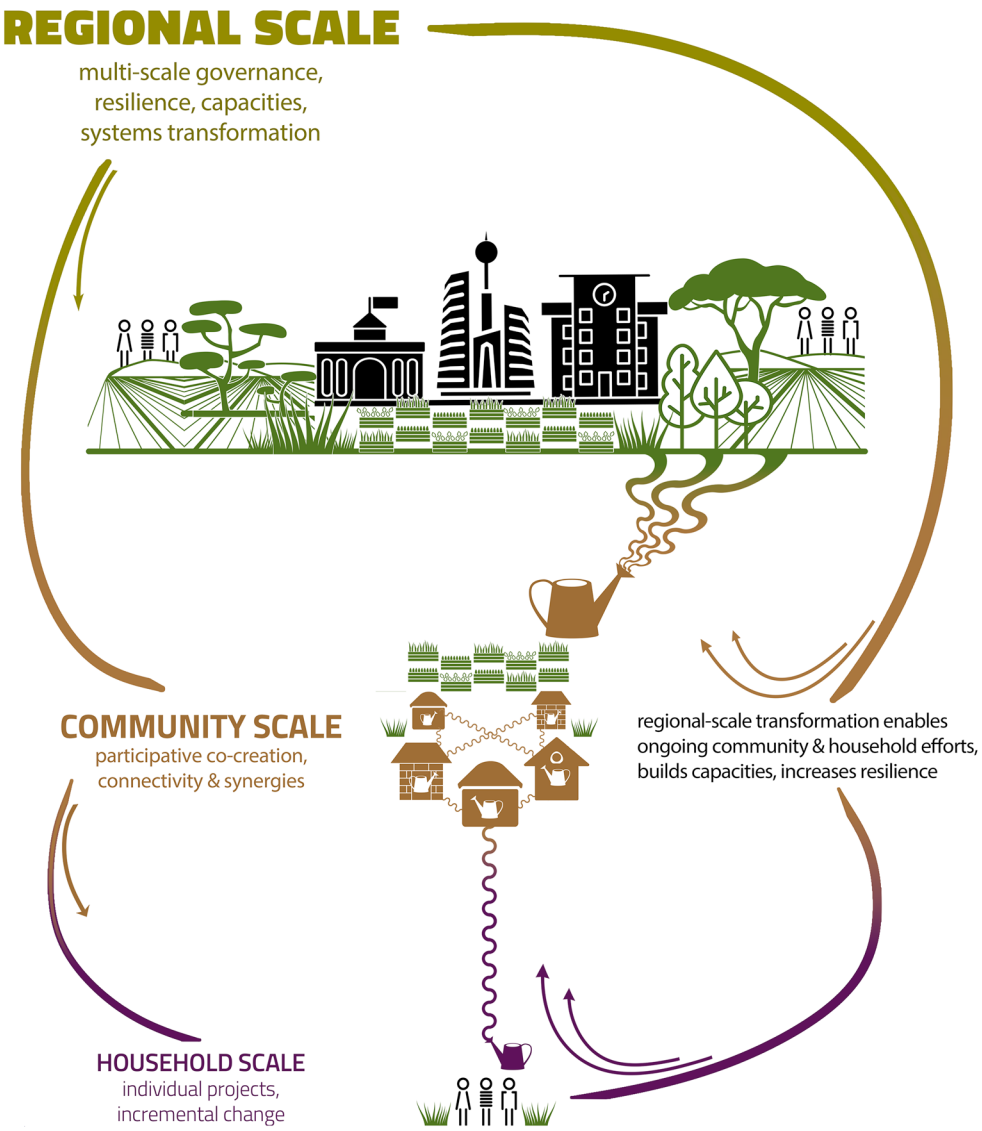

Fig. 1 From the household to the regional scale, incremental change can build towards systems transformation through participation and connectivities. At the same time, transformation at the regional scale can feed back to community and individual efforts, building capacities across all scales

Through FLOW, the regional lens can help us understand and provide evidence about good practices and lessons learned regarding how to spiral from individual and community scale interventions to regional impacts and ultimately transformation (Fig. 1) as regions grapple with pressures and opportunities that exist at national and global scales. The goal is to explore how to amplify, accelerate and catalyze change from discrete individual actions and community changes to regionally transformative impacts (Anderson and Rivera-Ferre 2021; Caron et al. 2018; Valette et al. 2023).

Applying and testing the Regional Food Systems Capacities Frameworks (Figs. 1 and 2) allows us to compare capacities across regions and determine whether there are sustainable improvements, or not, over time. The regional scale offers a space to agglomerate resources from the many community initiatives and develop robust opportunities to contest the global industrial food system (Gasselin et al. 2021). Engagement with the regional scale provides a basis to compare governance capacities and impacts from, and with, the local to the global. It can also provide insights about the potential for more integrated, collaborative and coherent policy based on a food systems lens. Together this may make food systems increasingly resilient.

FLOW project partners are gathering data using a hybrid approach that combines multi-actor engagement, collective visioning, and impact pathway mapping to understand activities and identify indicators. This approach allows our regional academic and community partners to co-develop indicators, monitor changes and impacts, and identify stories of change at a 'greater than local' scale (Clancy 2014). What we add through this paper and our partnership is to explicitly: 1. use the region as the basis for multi-year research on food systems transformation; 2. document the

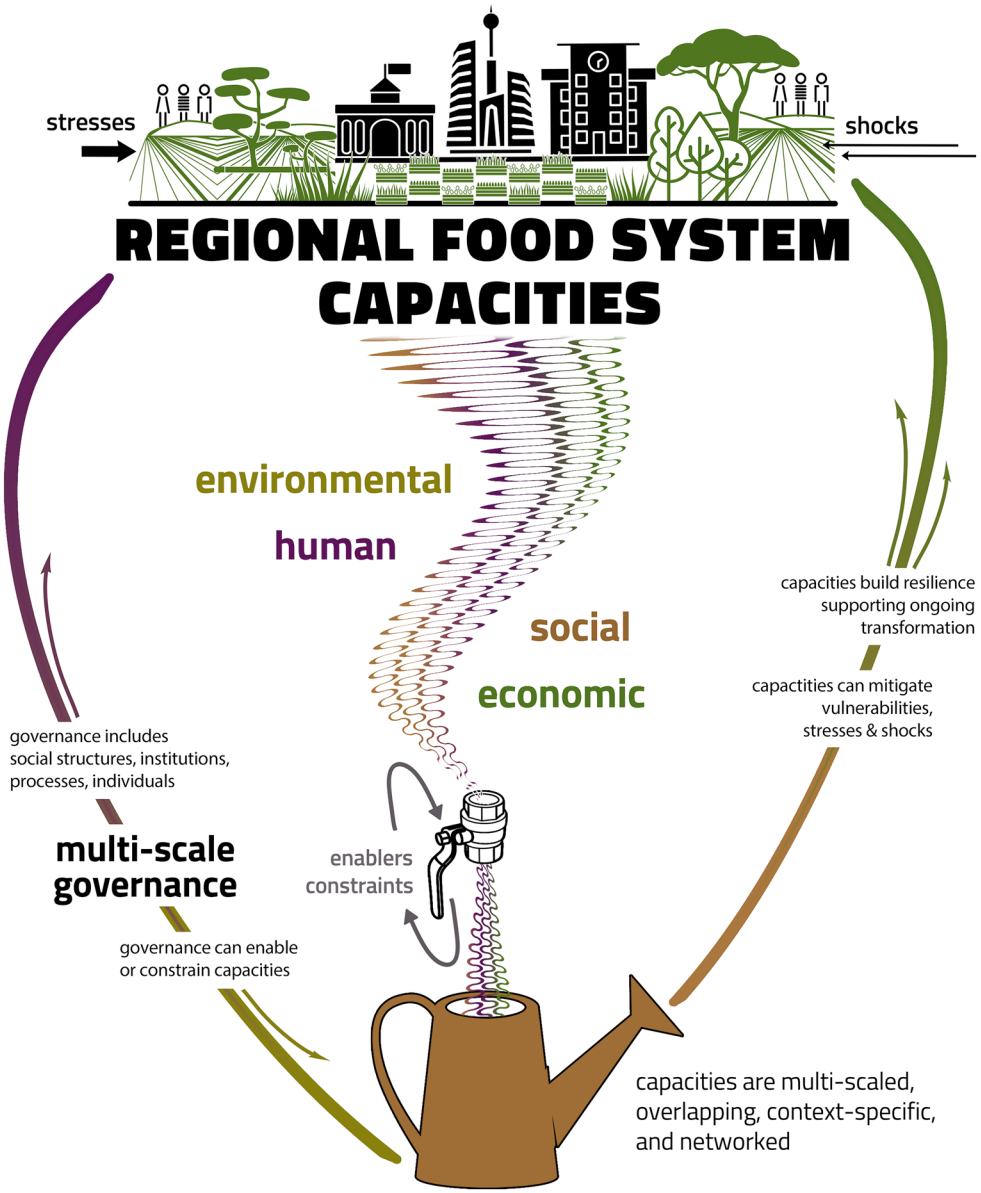

Fig. 2 Environmental, human, social, and economic regional capacities develop and flow within a context of multi-scale governance including the national and global scales which can work together to enable or constrain capacities. While this figure focuses on dynamics at the regional scale, Fig. 1 shows how all scales are related. Capacities also develop and flow at the household and community scale (see Fig. 1), and stresses/shocks may be produced and have effects at all scales from global to local

capacities and conditions that enable or impede resilient regional transformation to provide insights about how lasting impacts can be activated including how to scale up from the local (Gemmill-Herren et al. 2021); and, 3. analyze and enable these insights to support food systems transformation and the actors undertaking these important efforts.

Regional capacities framework

The Regional Capacities Framework (RCF) (Fig. 2) builds on and integrates the Sustainable Livelihoods Framework (SLF), the Community Capitals Frameworks (CCF) and research on valuing food system dimensions (GIST 2023; HLPE 2019; Spring 2018; Serrat 2017; 2016; Spring et al. 2021). The SLF work by Serrat (2017) provides insights into how livelihoods that are people-centred, multi-scaled, sustainable, dynamic, responsive and participatory can help develop programs and approaches to improve livelihood opportunities (Serrat 2017, p. 22). We also draw from the CCF developed by Flora (Emery and Flora 2020) and more recently elaborated by Spring (2018). While the SLF centres iteration between livelihood strategies and outcomes and the CCF focuses on community capital assets and deficits, the RCF is based on human, socio-cultural, economic, environmental and governance capacities building across regions. These influence and are influenced by societal structures including policies and institutions with assets and vulnerabilities underpinning supports and weaknesses.

The Regional Capacities Framework has been developed to understand more about scaling up from the community/

project scale to the regional scale. With this in mind, the seven CCF capitals (physical, cultural, political, social, financial, built, and natural) have been consolidated into five capacities (environment, social, economic, and human, with governance as an overarching capacity). These capacities are context specific and overlapping to capture the synergies possible through integrated systems. Each capacity can be further broken down based on regionally-specific realities to allow researchers and practitioners to draw parallels and more readily compare capacity characteristics between regions. For the FLOW partnership, our common framework helps identify and compare the factors that contribute to or inhibit change. As a result, while each region establishes indicators for each capacity, we can still assess and compare overall trends in capacities between each region (and over time) supporting evidence-based decision making. For example, if the indicators for the human capacity dimension show an increase and deepening of networks as part of the transformation process, policy-makers would know to support policies and programs that enable networks and related activities to enhance transformation.

As we move from the community to the regional scale, it is expected there will be increasing complexity in capacities as the region is more than the 'sum of its locals' (Clancy 2014). This increasing complexity includes shifts towards systemic integration, relational interactions, a deepened understanding of process and increasingly open, porous networks (Reyers et al. 2022). As these dynamic and fluid interactions shape change in capacities, we need to consider multiple scales to enable "co-ordinated decision-making, collective action, innovation and experimentation" (Reyers et al. 2022, p. 659). For example, as regions scale up from community initiatives to aggregate at regional scales, crop diversity and related diverse dietary options can result in improved biodiversity and increased food security within the region (Papargyropoulou et al. 2024). This insight helps policy-makers develop policies and programs to support regional capacity building across several integrated considerations including health and urban/rural development and can also expand economic opportunity within the region which translates to greater economic impact at the community and household levels.

We now turn our attention to the various components of the Regional Capacities Framework to provide more details about the capacities, including how we build toward resilience, and the transformation process that is realized.

Regional food system capacities

The capacities (governance, human, social, economic and environmental) discussed in this section are intended as a starting place for transformative and regenerative food system analysis and are not meant to be comprehensive or prescriptive. The goal is to use these and other capacities to identify changes and impacts that scale up from community or individual projects. It is understood that this takes place within the context of multi-scale governance pressures and opportunities including the global-industrial food system. As stated before, capacities are place-based and will likely vary from region to region. As well, there is overlap between capacities so that environmental, social-cultural, economic and human capacities are not discrete but interactive and generative.

Environmental capacities include ecosystem integrity and function, environmental well-being and the regeneration of material resources at the regional scale. This includes, but is not limited to: ecosystem biodiversity and agri-biodiversity; climate change impacts; soil health including nutrient recycling, air and water quality; land use; and, input needs including compost, local seeds and the extent of fossil fuel inputs (Gliessman et al. 2022; Anderson et al. 2022; Harder et al. 2021a, b). *Social capacities* refer to cultures, traditions, relationships, networks and related identities. These capacities include social dynamics, gender equity and the availability of healthy, diverse, and appropriate food. These capacities can be captured more specifically as access to healthy, culturally appropriate food for women, children and youth, or regional events using or celebrating culturally appropriate food (e.g. Brown et al. 2024; Trott and Mulrennan 2024). *Human capacities* describe the extent that groups and organizations have power to engage their food systems, and whether there is the necessary knowledge to act on behalf of communities through supportive social networks. This capacity is closely linked to the six dimensions of food security which include availability, access, utilization, stability, agency and sustainability (HLPE 2020). These capacities can be further broken down to include the agency within regional networks to support food security, or the number of women in leadership roles (Bryan et al. 2024; Fernandez-Wulff 2019). *Economic capacities* include attention to fair livelihoods, economic diversification, equity-driven financial investment as well as scale-appropriate infrastructure, technologies and innovation. There is an emphasis on fair work from farm to waste heap, as well as closed-loop circularity that keeps money and materials in regional economies and creates regional multiplier effects (Benedek et al. 2020; Jablonski and McFadden 2019; Kłoczko-Gajewska et al. 2023; der Ploeg et al. 2022). For example, from Curitiba to São Paolo, Brazil, The Circuit regional supply chain sells agro-ecological products for the same price or less than conventional products in supermarkets. Given the extent of their market network, they can offer 95 fresh and minimally processed products providing stable demand for farmers while consumers can access local,

diverse, affordable food. The markets are linked through a distributed network of small, medium and long routes with small hubs enabling flexible distribution using trucks and vans owned by members of The Circuit. Food is distributed across 73 municipalities and includes 5400 small-scale producers through 165 markets. The Circuit achieved annual average sales of 3000 metric tonnes (MT) in 2016. In 2019, they sold 150 MT of food weekly and delivered 7500 metric tonnes of food annually – an 1800 percent increase in 11 years (der Ploeg et al. 2022; HLPE 2025).

Human, environmental, social, and economic regional capacities emerge and evolve in the context of multi-scale governance that includes public, private and civil society structures, institutions and related processes that are influenced by individual, community, local, municipal, state/provincial, national and global institutions. As such, *governance* can enable or constrain each of the regional capacities together or in isolation. Many of the barriers and/or enablers to building sustainable food systems capacities connect directly to governance, so it is important to explicitly consider these factors (Serrat 2017). Power is embodied within governance structures and institutions and is a determinant of equitable transformation (HLPE 2025). Regional indicators of multi-scale governance could include the implementation, strengthening, or retention of supportive policy, the degree to which there is meaningful engagement with policy-makers, or agency and resourced support for associations that represent marginalized communities.

Resilience

Multi-scale governance and capacity building happens within the constraints of existing uncertainties (Scoones 2024). Together, capacities interact to address, or not, uncertainties that mediate shocks and stresses to build resilience and move toward transformation. While shocks can be defined as acute disruptions (usually associated with an event), and stresses can be defined as longer-term pressures, there is often a dynamic interaction between the two (Zurek et al. 2022). In some cases, acute circumstances lead to chronically compromised systems; for example, an extreme weather event such as a flood can result in the displacement of communities and compromise food security over the long-term as people are uprooted from their lives (Week and Wizor 2020). Individuals who are more food insecure due to livelihood precarity or other underlying stresses that precede the shock can be more severely impacted (Hart 2009). The concept of resilience as a way to mitigate and adapt to shocks and stresses has been evolving. According to the 2025 HLPE report, Building Resilient Food Systems, while resilience can include bouncing back to the previous pre-perturbation state or adapting and improving by bouncing forward (UNDP 2024), transformative resilience requires attention to interconnected principles founded on equity, ecological integrity and human rights so that underlying structures and differentiated vulnerabilities founded on colonial and other extractive histories can be addressed and reversed (Folke 2016; Reyers et al. 2022; Scoones 2024; HLPE 2025). Equitably transformative resilient (ETR) food systems shift structures, enable agency, build capacities and values and realize beneficial synergies from socio-ecological interdependencies (Scoones et al. 2020; HLPE 2025). Resilience is manifested differently at various scales, is context specific and dependent on adaptive capacity. As the HLPE 20 report notes, resilience requires that governance structures engage with multi-actors in a way that follows the PANTHER principles (i.e., participatory, accountable, non-discriminatory, transparent, respects human dignity, and the rule of law) (Anderson 2015; Nicolétis et al. 2019; HLPE 2025). The Right to Food and food sovereignty principles, when meaningfully activated, strengthen food security and nutrition and can amplify all capacities leading to enhanced resilience within regions (Sampson et al. 2021; Fakhri 2025).

Building capacities to increase resilience can begin with small step incremental change to existing food systems that accelerate and develop new changes through participation, co-creation, the development of synergies and connectivity to realize food system impacts and ultimately transformation (Valette et al. 2022). Examples of incremental change include increasing energy efficiency, reducing waste and substituting materials such as compost for synthetic fertilizers. In comparison, transformation is long-term, impactful, embedded and resilient. Transformative changes can include policies that support waste management infrastructure and collection returning the waste as compost to farmers, or co-operatives that aggregate and sell sustainable local food providing livelihoods to women and youth and that address food insecurity, or new local food policies that improve access to healthy food for marginalized communities and create new markets for farmers such as school food programmes. This conceptualization helps us recognize the interactions across various scales as capacities either enable or impede regional transformation. As noted earlier, transformation of the industrial food system requires that enough communities across a region adopt and aggregate nested alternative systems within and across human and eco-systems that result in impacts across multiple food system capacities (Spring et al. 2018; Pereira et al. 2020; Hipel et al. 2010; Hinrichs 2014; Anderson et al. 2019; Felici and Mazzocchi 2022; Leeuwis et al. 2021). In the end, functions, structures, identities and feedback from regional food system impacts support food system resilience and sustainability and may precipitate momentum toward transformation

(Zurek et al. 2022). Converging points of comparison from FLOW regions that are moving food systems towards ETR include policy interventions and related programmes, crop and dietary diversity, benefits from socio-ecological interdependencies and increased agency through robust social networks for knowledge sharing and capacity building.

FLOW research approach and tools

FLOW weaves together and adapts existing tools into a hybrid approach that envisions, documents, identifies indicators, monitors longitudinal changes and tells the stories of sustainable, resilient food system transformation. FLOW builds primarily from the FLEdGE Partnership (Blay-Palmer 2021), the RUAF-FAO-Laurier City-Region Food System (CRFS) pilot project (2105–2018) and the Urbal (Urban-driven innovations for sustainable food systems) initiative that developed an impact mapping approach for understanding how activities inhibit or enable change and impacts (Blay-Palmer 2021; Valette et al. 2022). The FLOW methodology includes five steps: establishing a multi-actor group, co-creating a vision, engaging in impact pathway mapping, developing indicators to benchmark and monitor changes and impacts, and telling the stories of change. This approach is flexible, so that regions can enter and engage in the process where and how it makes sense for them. It is also iterative, so that people can build and learn from their research and each other.

These flexible tools are being adapted to the diverse contexts of each FLOW region providing indicators that enable FLOW researchers to track and compare sustainability activities including changes and impacts over several years. Comprehensive monitoring helps FLOW regions understand more about the outcomes of food system interventions and how they impact resilience, identify specific follow-up interventions, and articulate research findings in ways that are directly relevant to project participants as well as funders, policy- and decision-makers. Region-specific data enables FLOW regions to generate public-facing food system snapshot reports, make adjustments and uncover areas for comparative work. By using a combination of qualitative and quantitative data-gathering and analytical tools, we capture systematic information about the real-world impacts of food system practices and interventions. In parallel, we will animate the data with stories that deepen our understanding of regional transformation.

FLOW multi-actor groups and visions

The CRFS initiative provides both a framework as well as practical tools FLOW regions are using to engage multi-actors across sectors and scales (Blay-Palmer et al. 2018, 2021). Each FLOW region has established a multi-actor engagement group (MAG) that provides guidance, insights, information and data throughout the research, knowledge mobilization and policy-impact phases. Ideally, MAGs are intersectional teams of farmers, food processors, distributors, marketers, policy-makers, media, researchers, civil society organizers, co-operative organization officials, among others. MAG participants provide input to help identify research priorities and also participate in strategy development. The MAG helps build permanent networks and bridge communication gaps between actors. As the research progresses, the MAG facilitates the uptake of research results into policies and programs by acting as conduits to other research and policy development processes as they collaborate with initiatives and groups beyond the scope of FLOW. Regions will likely have more than one MAG. For example, in the case of Melbourne, there is a core group that meets regularly to guide the research and a larger group that gathers for workshops to provide policy guidance and/or to identify indicators. It is also expected that MAG composition will change over time as the needs of the project evolve and shift (Blay-Palmer et al. 2021). Through multi-actor engagement within FLOW regions, we identify and work with people who have been historically excluded from change-making processes and fill these gaps through deliberate multi-actor engagement (Gray et al. 2022). For example, in Kenya, researchers are working with women and youth associations to build capacity and share knowledge in underserved populations. Through participation in MAGs, FLOW research aims to enable action that amplifies the voices and builds agency for those who have been systematically disadvantaged.

Once the multi-actor group is brought together, members co-create a collective sustainability vision for their regional food system (Blay-Palmer et al. 2021; Anderson 2019). This shared vision provides a starting point to improve regional capacities. The visioning process helps build consensus within multi-stakeholder groups by making the overall project goal(s) explicit. Researchers have used backcasting to support their visioning process (Fig. 3). Backcasting begins with a region's vision and then establishes where the group is in the present. With current realities identified and the vision articulated, the next step is to determine what activities are being or could be undertaken to work from the present toward the vision. The collectively defined vision and participation of the MAG brings together a range of different perspectives and provides a more holistic picture of what a better future might look like. The shared vision captures the types of changes or new elements for the future. The vision expresses the direction in which the actors want to take their food system, and explores why and how capacities and

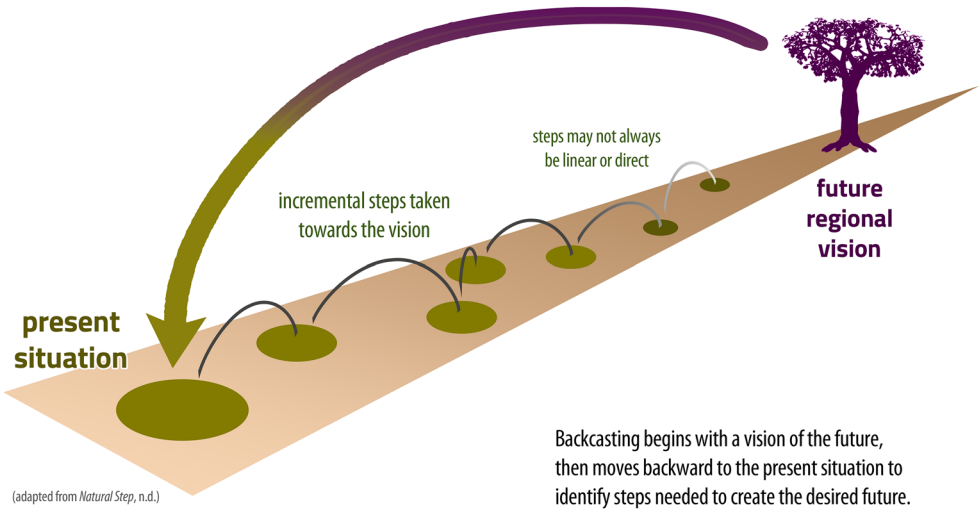

Fig. 3 Backcasting is a process for achieving a future state by identifying and moving through a series of progressive steps that connect the present to the future. (adapted from natural Step, n.d.)

resilience will be enhanced in the future. The vision also begins to capture ideas for action and provides a sense of group priorities.

Impact pathway mapping: monitoring change and impacts

FLOW regions are using the Impact Pathway Mapping (IPM) process to identify the activities needed to build regional capacities based on their regional vision (Valette et al. 2023). IPM allows each region to define existing or potential activities that have moved (or can move) a region towards resilience. It is based on where the region is and what the actors in the region want to do, and tracks activities through to outputs, outcomes and impacts (Fig. 4). Outputs are direct, short-term results associated with a project. Outcomes are the medium-term changes linked to project goals while impacts are the long-term consequences of a project – linked to transformation (Valette et al. 2022).

The IPM identifies enablers and barriers to change and can use these to help identify indicators that can be used to benchmark and monitor change. Fig. 4 provides an example of how a region can move from its vision and related capacities to specific activities, outputs, outcomes and ultimately impacts. In this example, the vision is to enhance traditional food systems. To realize this vision one goal could be to increase the availability of more traditional food. This goal could translate to the activity of planting more traditional crops which could in turn result in the increased availability of more traditional crops. Outcomes from this activity could be the increased availability of local, diverse, healthy food, more knowledge about traditional crops and increased processing, distribution and marketing of these crops. Long-term impacts could include improved ecosystems, increased knowledge, the revitalization of traditional knowledge and increased income along the supply chain. These impacts can be mapped onto the related environmental, human, social, economic and governance capacities. For the environmental capacity, there could be an increase in biodiversity, both ecosystem and agri-biodiversity. For human capacity, there could be improved food literacy as people in the region are exposed to and learn more about traditional foods. Social capacity could be enhanced through richer and more extensive community connections. There could also be an improvement in health as people have access to more diverse diets. For economic capacity, there could be an increase in incomes along the regional food chain. On the policy side, this could lead to more supportive local economic development initiatives to reinforce the availability of traditional crops. Finally, this could loop back to the original vision which may be adjusted to better reflect the new reality and help set new goals.

In addition to adding to what we know about regional capacities, the IPM can also provide insights about potential indicators by identifying the enablers and barriers to achieving the activities. In Fig. 4, a barrier to planting more traditional crops is the lack of seeds – represented in the diagram as a red 'x'. This barrier could be tracked over the course of the project based on the quantity and diversity of seed available. To understand more about how food distribution works, an enabler to making more traditional food available could be the existence of farmers' markets with related indicators as both the value and number/amount of traditional foods sold at the market. This indicator is represented in Fig. 4 as the green 'plus' sign. Both indicators would help to monitor change over time and could be gathered using interviews and/or field observation.

Finally, as part of the on-the-ground work in each region, academics and practitioners are identifying stories to elaborate how change is happening – with a focus on processes. Rich qualitative data that amplifies the voices and experiences of regional food system practitioners, and

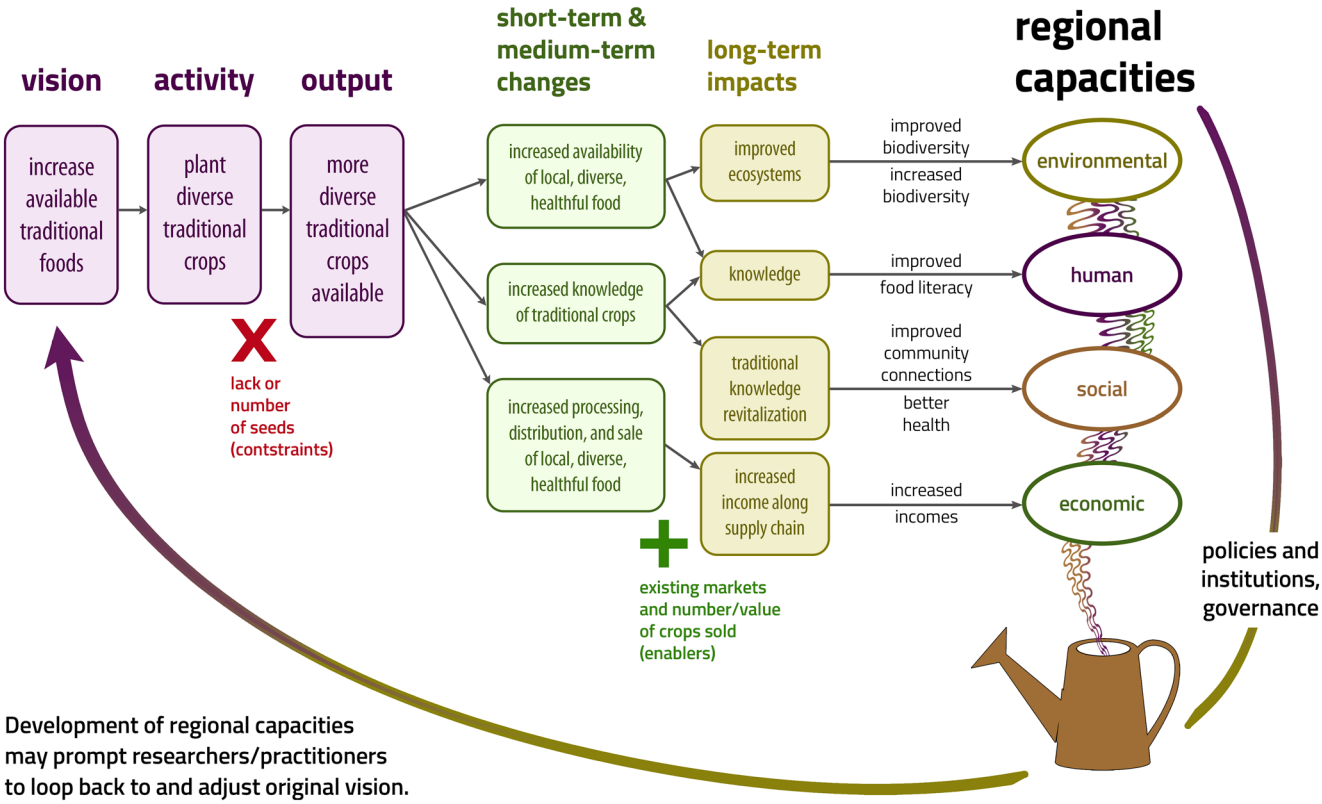

Fig. 4 An example of impact pathway mapping, starting from visioning and moving through indicator identification and capacity building, then back to visioning. Identifying potential constraints and enablers along the pathway can suggest options for modifying or adapting to on-the-ground realities

narratives co-constructed with community partners will be shared alongside data collected through regional food system indicators. Putting our expertise into action, we are using approaches including digital storytelling (Flicker et al. 2020), environmental oral history (Nimmo et al. 2020), photovoice (Pabani et al. 2020), and podcasting (Mark and Di Battista 2017) to enable engagement, co-create sustainable food systems knowledge, generate new insights, and share research findings across and beyond our international network. All of this loops back to inform the regional vision and transformation.

Applying the regional capacities framework

This section makes a preliminary attempt at applying the regional capacities frameworks to on-going and emergent FLOW work (Table 1). It illustrates the value of considering capacities to identify good practices and lessons learned on the path to transformation. It is important to consider that as we are dealing with food systems, there are overlaps across capacities for all the examples, illustrating the complexity of food systems work and the opportunities this can provide in addressing multiple challenges simultaneously. In particular, the table provides examples of how co-creation and co-learning are enabling transformation. It also points to the potential for multi-scaled policy to further enable regional initiatives.

Next steps and concluding thoughts

The FLOW Partnership aims to add to what we know and how we understand regional transformation by identifying human, environmental, social, economic and governance capacities that can increase or block regional food system resilience. As we identify parallel issues and place-based responses, we build co-created knowledge across regional partners. This includes, for example, insights into livelihood opportunities such as cooperatives, policymaking innovations, improved food access to more diverse food, greater inclusivity and representation, biocultural food traditions, and climate change mitigation (HLPE 2020; Pimbert 2016). By aggregating stories and data, the Regional Capacities Framework provides a jumping off point to understand how transformative change can happen at the regional scale through the lens of existing and needed capacities. The framework allows researchers to explore the range of sustainability dimensions that can and do build resilience in the context of shocks and stresses.

Table 1 Examples of existing and emergent FLOW regional initiatives by capacity, noting that the FLOW food systems approach means there is significant overlap between capacities

Capacity building	
Governance	**Andhra Pradesh, India:** The FLOW team is learning from farmers and staff at Rythu Sadhikara Samstha (farmer empowerment organization RySS) about how change happens at the state level through grassroots networks and enabling government support. As one of the largest agroecological transitions, over 1 million farmers have turned to natural farming methods in Andhra Pradesh to help bolster livelihoods, improve nutrition, enhance agency, and build resilience to extreme weather events. The successes built by RySS and others have inspired nation-wide support for natural farming across India as well as in countries around the world. Community Natural Farming represents how change can happen by scaling out and empowering those most affected within the food system. **Melbourne, Australia**: There is significant food production in the peri-urban areas around the city, which is vulnerable to urban encroachment, declining water availability and climate shocks such as fires and floods. The FLOW work aims to foster regional level collaboration between key stakeholders including civil society organizations and local governments in Melbourne's city region to build resilient food systems through policy and planning initiatives, and the development of shared regional indicators to track progress toward food system transformation.
Environmental	**South of Paraná state, Brazil:** To support the recent Globally Important Agricultural Heritage System designation in the Atlantic Forest of Southern Paraná, the FLOW project aims to monitor traditional agro-ecological production of erva-mate and related agro-forestry food systems. The team is working to identify scale appropriate innovations that promote food security, environmental regeneration and improved well-being, and document the regional impacts of sustainable territorial development. **Veracruz state, Mexico**: Farmers, researchers, and community leaders work together to scale up agroecological citrus (and associated) production in northern Veracruz State. Through in-field training, technical assistance networks, demonstration plots, and agroecological "lighthouses"—farms with solid track records of success—FLOW partners document capacity building in the region to record the transition from agrochemical inputs to methods that prioritize local inputs and long-term ecosystem health.
Socio-cultural	**Northwest Territories, Canada**: On-going work supports action focused on traditional food systems and climate change adaptation. Research relationships have grown over the past 10 years, expanding to multiple partners in diverse regions across the Territory. As interest in growing food increases, agricultural practice, policy, and funding needs to uphold Indigenous ways of being on the land through approaches such as agroecology as a traditional knowledge system of growing food rooted in Indigenous values systems and ways of life. As part of the FLOW partnership monitoring, agroecology capacity building can support co-created research with local communities to protect local ecosystems while also growing food systems that build on existing relationships with the land and waters. **Sri Lanka**: As an agriculture-based country with a rich heritage of sustainable food systems, the FLOW team is exploring the role of participatory governance in food system transformation to identify pathways toward more resilient and sustainable food production. These efforts occur in the context of unsuccessful government attempts to move farmers away from chemical inputs, and interest in supporting local farmers through agroecological initiatives.
Economic	**Migori County, Kenya**: Partners in Migori County, Kenya focus on bolstering livelihoods through sustainable growing methods more resilient to climate change. As part of the FLOW partnership, the project trains graduate students and registered farmer organizations, mostly women and youth, on essential skills for sustainable farming, value-addition, and post-harvest management. The training aims to improve yields of staple crops and diverse traditional vegetables and fruits, enhance livelihoods and support household and community food security and nutrition. **Ottawa region, Canada**: Just Food's work, centred at the Just Food Community Farm, focuses on regional economic development of all new farmers, with tailored support for New Canadian farmers. Just Food facilitates Food Communities Network to advance collaboration of community farms across Indigenous Territories/Canada, supporting shared practices and new farmer policy development across municipal and federal levels.

The indicators, however, only provide snapshots in time. To understand how the indicators fit together, we engage in an iterative analysis and share results across the partnership. Making the capacities in regional food systems apparent provides evidence of regional change over time, facilitates cross-FLOW regional comparisons, and enables sharing of good practices and lessons learned within and beyond the Partnership. Understanding at a more granular level how change and impacts come into being helps to advance the implementation of food systems change in situ and elsewhere. Knowledge exchange among FLOW regions and knowledge sharing beyond FLOW regions is providing a clearer picture of how capacities create regional resilience and where additional interventions could help. To enable this uptake, insights and knowledge gained through the research are being shared out in audience-specific ways to other academics, food system practitioners, NGOs and community organizations, Indigenous and traditional communities, and policymakers focused on governmental/intergovernmental organizations.

This work is the basis for building Global Communities of Practice (CoP). Currently, we have a CoP focused on food production and agroecology (NWT, Kenya, Mexico, Brazil, Sri Lanka, Andhra Pradesh, Zimbabwe and the Ottawa region), and another focused on city regions and policies (Montreal, Vancouver Island, Melbourne, and the Ottawa region). These two CoPs emerged as we worked through identifying indicators and points of intersection

between the regions. By sharing FLOW research, we will help shift the discourse in support of more sustainable, resilient regional food systems, providing a counter-narrative to the dominant bias that privileges industrial, global scale solutions (Anderson 2024). This co-creation process enables place-based problem-solving from a collective pool of understanding (HLPE 2020; Levkoe et al. 2021). Our Global CoPs offer a space for co-learning and to build solidarity between regions. These Global CoPs also enable the transfer of knowledge from South to North, South to South, and between excluded communities where Indigenous, traditional, and small-scale food systems foster sustainability (Blay-Palmer et al. 2016). The need to integrate sustainability dimensions and develop a complex understanding of power dynamics as part of a regional perspective about how to support transformation—and opportunities to build Global CoPs – require we monitor, tell the stories of, and compare changes from sustainability interventions within and between regions over time to accelerate change towards increasingly sustainable food systems (Ilieva and Hernandez 2018; Mert-Cakal and Miele 2020; Sellberg et al. 2020). This process allows for the co-creation and sharing of narratives that elaborate the stories behind the numbers and put regions in conversation with each other to reinforce regional and global CoPs (Turetta et al. 2021). Together, we will gain a better understanding of the possible transformation within and across regions and examine how knowledge sharing amplifies and accelerates transitions toward more sustainable food systems (Dolinska and d'Aquino 2016).

Our mixed methods approach honours different forms of co-creation, prioritizes and amplifies community partner knowledge and voices of those often excluded from conventional research and policy circles. FLOW foregrounds the lived experiences of those who are responsible for much of global food production as well as maintaining ecosystems and agrobiodiversity. Our evolving work will continue to explore the regional/territorial dimension to uncover what this scale adds to how we understand and work towards equitably resilient food system transformations. After all, the ways in which we gain our daily sustenance is, perhaps, the most primal expression of our humanity.

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Declarations

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