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Critical praxis and the social imaginary for sustainable food systems

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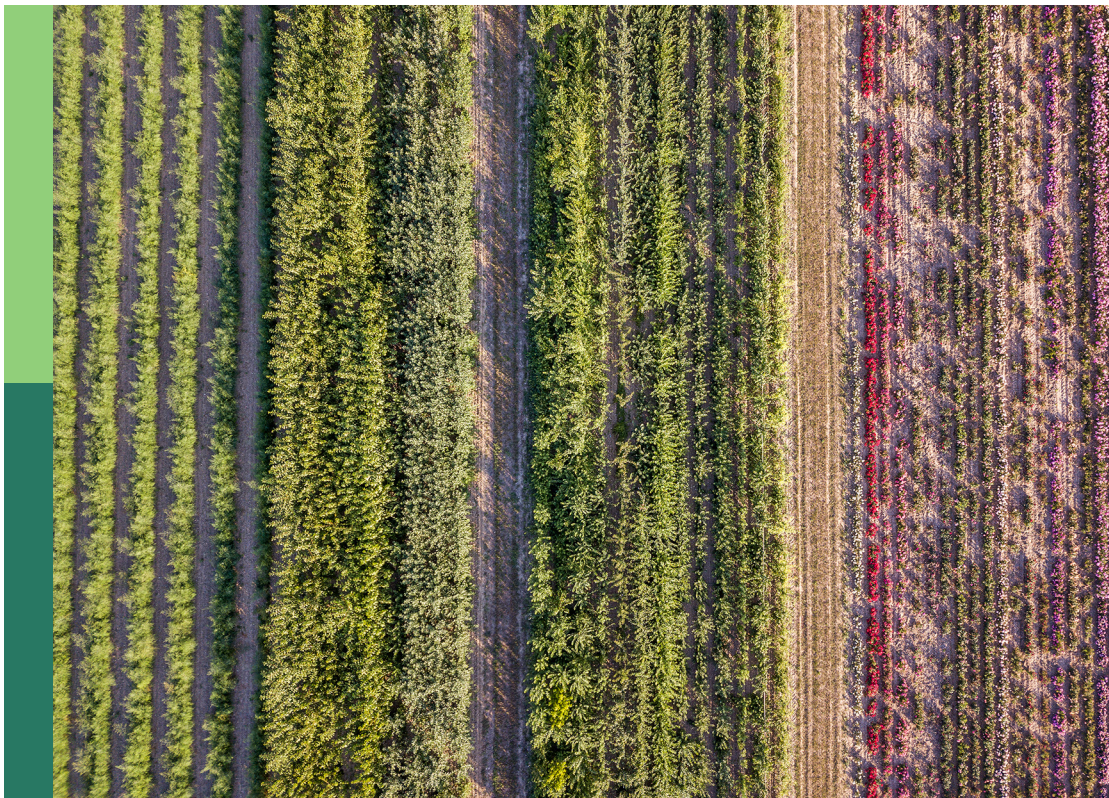

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Critical praxis and the social imaginary for sustainable food systems

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Editorial: Critical praxis and the social imaginary for sustainable food systems

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Editorial on the Research Topic
Critical praxis and the social imaginary for sustainable food systems

The premise of this Research Topic is that the challenges confronting contemporary food systems necessitate a fundamental reimagining of how individuals and broader social collectives understand their roles—both personal and professional—within them. The dominant neoliberal and technical-rational perspectives that have long governed a globalized approach to food systems are deeply intertwined with other systemic inequities, entrenched privileges, and extractive practices including settler colonialism, white supremacy, ableism, patriarchy, and heteronormativity. Together these forces shape how knowledge is produced and how action occurs within our food systems. These forces and frameworks have created the systemic concerns that characterize our current food system, and those structures and processes have demonstrated marked resistance to change. Our call for this volume emphasized that a shift away from the way of knowing that legitimates and underpins this situation is imperative.

Freire (1972) concept of critical praxis offers an illuminating frame for navigating the epistemological and ontological assumptions and thinking that shape the current food system. His conceptual framework offers analysts a way to reconsider and reframe practices dynamically; that is, in a fashion in which they are not only enacted, but also continuously theorized, evaluated, and reimagined as they evolve. The iterative character of that process highlights the importance of understanding the active operation of power via individual and collective agency. More importantly, it moves scholars beyond efforts to capture "what is happening" and toward identifying generative ways that interested stakeholders may participate actively in the creation of more just and sustainable food systems.

In our view, this Research Topic resulted in a fruitful set of responses to this overarching challenge. As a group, these articles critically engage with various relevant onto-epistemic questions and frameworks. These include, among others, agroecology, regenerative agriculture, Black agrarianism, radical pragmatism, decolonizing strategies, and urban ecology. Collectively, these analyses question the dominant thinking in which today's food systems are entrenched and highlight perspectives that can help to disrupt their dominant meta-narrative that is today driven foremost by efficiency and technology claims, and to explore policy interventions, justice-centered strategies, community-engaged collaborative efforts, and the deep reflexivity that can reveal alternate ways of thinking to those now prevailing. The analyses collected here call on food system scholars,

practitioners, and policymakers to work actively toward realizing a future in which such structures and processes are ecologically and socially sustainable and equitable for all.

Beyond these core concerns, these analyses are characterized by at least four major cross cutting themes concerning the steps that may be necessary to secure significant change in the West's regnant food system narrative. These illustrate the remarkable social, political, economic and cultural complexity implicit in attaining meaningful change in this domain. Perhaps first among these themes is the need to recognize the wide range of actors with stakes in food systems. These include growers, who may be subsistence farmers or operators of gigantic farms and ranches alike, those who transport and provide storage of their products for wholesale markets, those who prepare and offer those foodstuffs and meats for retail sale, political decision-makers, and the broader population served, which may be located locally or in distant global locales. More, wholesale and retail product, storage and transportation markets may be local, regional, national or international in scale. Notably too, nations are variably equipped to provide the physical and social infrastructures necessary to permit growers awareness and latitude to contemplate change from their existing knowledge. Indeed, each of these elements should be considered as reflecting a point on a spectrum with actors arrayed on a continuum of scale and capacities of various sorts. Perhaps the most elemental competence necessary for systemic change is actor (read individual and collective) awareness of currently shared beliefs and sufficient information and common determination to imagine and realize current food system processes differently. This Research Topic of articles suggests that can be a difficult challenge to meet, especially for subsistence farmers.

Second, the fact that today's neoliberal food system narrative is intertwined with a variety of perspectives that work to enervate shared social belief in human equality based on capitalism as well as racialized, patriarchal, religious or ethnic claims of superiority is often a profound impediment to changing the story underpinning its current dominance. This is so because truly democratic change in food systems that will result in improved prospects for social justice for all demands that all within them be treated with dignity and respect and be compensated justly for their work. Such cannot occur when colonialist, ethnic, racial, or religious hierarchies continue to operate amidst economic exploitation of any actor in the system based on relative capacities or perceived inferior social or political standing.

Third, the ongoing cruelty of systemic injustice rooted in racialized or gender social hierarchies in diverse national contexts suggests that food system change is unlikely to result from logistical/supply chain or alternate planning/planting/irrigation or harvesting improvements alone. That is, one might successfully equip a subsistence farmer, for example, with a knowledge of different crops or of ways to plant and grow them as well as with ways to store and transport them to new markets, but much of that information dissemination might not matter if social and structural ostracism continues de facto to usurp the realization of those possibilities in practice. This fact in turn suggests that long-term systemic changes in food systems to ensure they treat all within them equitably and do not continue to despoil the earth's environment, will not occur simply with technical changes. Instead, as Freire understood, and these articles demonstrate afresh, they will need to be constructed on a foundation foremost of shared social belief in human dignity and equality. Ensuring widespread acceptance of those values will require changes in broadly held hierarchical social norms or in long standing social cruelty targeted to specific groups in the West and in many other nations. While the character of these varies across countries, their results are everywhere the same for affected food system actors—diminished rights and life possibilities.

Finally, these observations suggest that scholars should continue aggressively to explore not only how to build the technical capacities and rights awareness of those working within food systems now structurally disadvantaged within them, but also to devise democratic processes to encourage the populations now oppressing them to adopt alternate ways of knowing that celebrate their common humanity with those they had previously victimized. While the technical project of sustainable farming at scale for a growing global population in forms different from those now polluting and exhausting waterways and soils world-wide is daunting, the human project of equipping those affected by these, positively or negatively, with the capacities to meet those challenges by creating new and more equitable food systems is still more difficult. This Research Topic demonstrates that this project is doubtless a major intellectual undertaking, but one well-worth undertaking.

Author contributions

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From Polanyi to policy: A tool for measuring embeddedness and designing sustainable agricultural policies

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Agricultural systems are deeply enmeshed in complex social processes and institutions, something Polanyi called embeddedness. Designing policy for sustainable agricultural activity requires understanding and measuring such embeddedness. Due to the difficulty of measuring complex social dynamics, however, most policy is aimed at measurable metrics such as price and production. The focus on these metrics imports the rational actor conceptualization of economic activity and fails to incorporate the values, motivations, and socio-cultural components of agricultural decision-making. This paper develops a tool for measuring embeddedness called the Embeddedness Type Matrix (ETM). The tool utilizes survey responses to elucidate economic actors' instrumentalism (decisions motivated by self-interest) and marketness (decisions motivated by market factors). Instrumentalism and marketness are considered together along perpendicular axes to determine the embeddedness quadrant of economic actors. The ETM allows researchers and policy-makers to better understand producers and consumers and design sustainability policies that are aligned with their values and motivations.

KEYWORDS

embeddedness, agriculture, economic sociology, methodology, neoclassical economics, values

Introduction

Agricultural systems are deeply embedded in social processes and the institutions that govern them. Measuring these processes and understanding the extent of that embeddedness is critical to crafting policy for sustainable agricultural systems. The bulk of measurement in sustainability research, however, focuses on economic and environmental indicators such as farm profitability and environmental quality. Since policy is most often aimed at what is measured, it tends to focus on issues like price, production, and market access. While price and economic return are critical

components, they are not the only important variables in sustainable agricultrual systems. Policies aimed at social issues such as community reciprocity are often outside the scope of policy design. And when policies *are* aimed at social issues, they tend to rely upon price or environmental metrics.

The theoretical backdrop of the focus on price and production is an economic model, known as the rational actor model, in which individuals are perfectly rational and asocial, and make decisions based solely on maximizing individual utility. This model forms the basis of the neoclassical economic thought that has dominated economic policy since WWII, with its focus on price and supply supports, and demand creation.

Producers and consumers, however, are deeply connected to one another, hold values that are outside the scope of individual utility maximization, and make decisions based upon values and culture. Policies that are aimed at price, profits, and market penetration, while important, often fail to address the values, motivations, and cultural and social components of real-world decision making. The institutions governing these social processes and the degree to which individuals and businesses are embedded in society are incredibly important, yet poorly understood and measured.

The problem is that, while understanding embeddedness is critical, policy is most often enacted on what is measured. Without tools to measure embeddedness, what is measured are outcomes such as profit, production, and price that are easily quantified. Policy thus includes price and production supports and market access, while missing the embeddedness that is essential to agriculture.

This gap between social measurement and policy is not for lack of care. The importance of people, their institutions, and the relationships between and among them and the environment have been explicitly recognized for decades. In its conceptualization of sustainable development, the Brundtland Commission's report for the United Nations (Brundtland, 1987) identified social sustainability as one of three core pillars. Attempts to capture the social dimensions of sustainability include the popular sustainable livelihoods and social capital frameworks. Nevertheless, social sustainability has received little attention, especially compared to economic and environmental sustainability (Kandachar, 2014). This is largely due to the difficulty of measuring complex social systems—*How does one measure values, social cohesion, or decision-making?* Because of this difficulty, more straightforward economic and environmental measures dominate research and policy (Boström et al., 2015).

These policy and methodological difficulties present a problem: measurements import the theoretical framing of their intellectual development. If a measurement tool is based in an economic framework of maximization, it will fail to explain factors outside of economic maximization and reinforce the assumptions of that model. When our measurements are partial, our understanding of systems is weak; and when our understanding is weak, our policy proposals will be limited in their effectiveness.

A policy's effectiveness is largely determined by how well it matches the motivations of the people for whom its benefits are intended (Long, 2001). Policies that seek to activate self-interest in a set of individuals with more complex goals than maximizing their gain are likely less effective than those that incorporate a more nuanced approach.

We argue that better sustainability outcomes require a new theoretical model that will inform a more comprehensive sustainability policy framework that understands and measures factors outside of price and profit to include the values and motivations of agricltureal producers and consumers. This paper outlines a theoretical framing for understanding these complex social processes and develops a methodology for measuring social embeddedness. Coined by sociologist Polanyi (1971), embeddedness is the extent to which economic systems like markets are governed by non-economic systems such as culture and social cohesion.

The concept of embeddedness provides a theoretical framework for engaging with sustainability policy in a way that captures the complex social and culture dynamics that shape economic activity. Embeddedness conceives of all economic activity as deeply embedded in social context including rules, norms, beliefs, community, and institutions. This means that rational choice frameworks, and the policies they inform, fall short of explaining how social life functions because institutional contexts, and thus people's behavior, are diverse and culturally specific. While the rational actor of asocial markets maximizes utility and profit, embedded economic actors make decisions based upon a set of values and are motivated by considerations including but not limited to maximization.

This paper synthesizes the embeddedness literature to develop a measurement tool that can characterize the social context of food system actors and their values and motivations. The tool uses Likert scale surveys to understand the degree to which producers and consumers are motivated by self-interest—what we call Instrumentalism—and the extent to which they are market-oriented—what we call Marketness. Survey responses are analyzed using a Factor Analysis to generate Instrumentalism and Marketness scores for each survey respondent on a scale of −1 to 1. Those scores are then plotted along instrumentalism and marketness axes on the Embeddedness Type Matrix to generate an embeddedness type for each economic actor. Plotting all producers and consumers of a particular industry on the Embeddedness Type Matrix provides an understanding of the motivations, values, actions, and interactions of the individuals in that industry.

This embeddedness measurement tool offers a new method for studying agricultural systems and allows policy makers to increase sustainability efficacy by replacing the rational actor theoretical framing with a social embeddedness framing

that integrates values, social context, and behavior alongside price and profit considerations. This will allow policy makers to more closely align sustainable agricultural policies with the motivations of producers and consumers to generate sustainable outcomes.

The rational actor Trojan horse of sustainability

The rational actor

Current measures of sustainable agricultural systems largely rest upon a flawed model of human society and individual motivations, and therefore, policy prescriptions that address those measurements are equally flawed. This chasm between policy, measurements, and reality has critical implications for sustainability outcomes.

The rational actor model of neoclassical economics dictates that producers and consumers are atomistic actors who make decisions based solely on selfish utility, or wellbeing, maximization. Society is simply a collection of "homogenous globules of desire" (Veblen, 1898) without values who operate in an anonymous market. In fact, prominent economist Gary Becker argued that social dynamics are so inconsequential in economic action and analysis that individuals in his models produced children without mating (Becker and Tomes, 1979; 1161).

These assumptions about how people and markets operate, however inaccurate, were made in order to measure otherwise immeasurable systems (Ament, 2019). Additionally, since wellbeing is impossible to objectively measure and cannot be compared between individuals, neoclassical economists used price as a proxy for wellbeing (Farley et al., 2015) by assuming that individuals would perfectly express their desires through buying and selling on the market.

The utility-revealing price mechanism became the hegemonic centerpiece of the supply and demand model that dominates agricultural policy today. In this model, price allows producers to maximize profit and consumers to maximize consumption given budget constraints. Price, therefore, in economic models and the policies they inform, is assumed to stand in for all other motivations and values and is the central organizing principle of economic activity. This has critical implications for how we measure outcomes and design policy for sustainable agriculture.

The social side of production

Markets reveal value through the price mechanism by commodifying labor and resource productivity. Labor and resources are treated as economic inputs (Mellor, 2006) and are remunerated according to their marginal productivity. Markets accordingly separate productive processes from the re-productive processes that make productivity possible (Biesecker and Hofmeister, 2010) such as relationships with friends and family, emotional care, and biological and metabolic processes like eating and sleeping. This process leads to the externalization of the re-productive and social processes as those processes are categorized in the realm on non-value and unremunerated since they are not for sale on the market, i.e., one cannot buy rest or metabolism.

Viewing production as critically dependent upon reproduction informs the notion that agricultural sustainability is an *outcome* of underlying *processes*. Those processes involve more than what is for sale in a market. This includes reproductive labor in the home (Mellor, 1997), the role of the civic apparatus in communities (Lyson, 2004), and the role of ecological structure (Farley and Daly, 2011, 61), among other processes that are critically important yet invisible to the market. Sustainable agricultural practices, therefore, must recognize all processes that makes production possible as valuable, including both productive and re-productive, and consider the social and civic context within which production operates (Perkins, 2007). That those processes—and not simply the outcomes they generate—must be measured is the central argument of this paper.

Social measures that imply a rational actor framework

Much of the literature and organizational reports that measure and advocate policy related to the social dimensions of sustainable agriculture, at both the international and local levels, considers social topics such as food security and nutrition, sustainable food systems, sustainable livelihoods, and social capital. The measurements employed in this literature include poverty and income, mobility, caloric intake, and access to assets.

While these social categories and metrics are indeed cognizant of social dynamics, they nevertheless rest upon a low-level rational actor model in which individuals are calculative agents who weigh their individual interests against collective interests (Bridger and Luloff, 2001). Importantly, many of these social indicators treat "social" as a static outcome, a thing that can be measured, as opposed to a process underlying many of the social outcomes in question.

The sustainable livelihoods framework offers measures of resilience. Livelihoods, in this context, is defined as "the means of gaining a living" (Chambers, 1995). Doing so sustainably includes utilizing capabilities and assets in a way that can cope with shocks while not "undermining the natural resource base" (Scoones, 1998). Similar discussions of self-sufficiency center

around metrics including economic performance, access to non-aid finance, institutional performance, aid dependence, and vulnerability (Reynolds et al., 2017).

These approaches tend to miss the broad social contexts that influence the ability of individuals to gain a living (Scoones, 2009). Similar to the rational actor model of asociality, the sustainable livelihood framework tends to overlook the influence of power and politics in livelihood outcomes (Scoones, 2009; Serrat, 2017). A sustainable livelihood is treated as an outcome, but the processes leading to that outcome lack attention.

The sustainable livelihoods approach focuses on using five capital assets—human, social, natural, physical, and financial—to achieve livelihood outcomes. Accordingly, the framework approaches the world as a series of resources to be leveraged for individual, rational gain. Even social capital, which considers things like trust, shared values, and networks of connections (Serrat, 2017) is conceptualized as an input to be leveraged for increased production.

Social capital is a widely used framework that conceives of networks of social relations that bind people as a community. These relations are as "essential for…the production of…goods…[as] other forms of capital" (Farr, 2004). The social capital framework aims to use social dynamics to improve productive efficiency (Robert, 1993, 167; Hyun-soo Kim, 2016, 233) much like financial or physical capital might (Putnam, 2001, 21).

Social capital finds its roots in the works of neoclassical economists Alfred Marshal and John Hicks who used the term to distinguish between different types of capital stocks (Woolcock, 1998). In a modern formulation of social capital, Coleman (1988) sought to embed the rational actor into social conditions. Importantly, social capital frameworks focus on how investments in social networks deliver market access or resource mobilization (Lin, 2002).

The social capital framework is more about how relationships allow economic actors to gain access to resources than about the relationships themselves (Acquaah et al., 2014). In action, rather than drawing upon a network analysis, social capital draws upon an accounting framework in the employment of returns (Xin and Qin, 2011). It is, again, outcomes based: one increases productive capacity by investing in a social network.

Further, social capital has become one of the "trendiest terms" in the development literature (Farr, 2004). The way it tends to be used conflates social outcomes and the productive capacity that social capital can generate with the embedded processes upon which those outcomes rely (Hyun-soo Kim, 2016; Tregear and Cooper, 2016; Gretzinger et al., 2018, 24). As Portes and Sensenbrenner (1993) write, "social capital is the result of embeddedness". Czernek-Marszałek (2020) writes similarly, arguing that interpersonal relationships that generate group-level benefits stem from an actor's social embeddedness.

The failures of social outcome measurements

Sustainable agriculture must be thought of in terms of both processes and outcomes. As processes lead to outcomes (Himes and Muraca, 2018), simply addressing outcomes such as social capital or sustainable livelihoods—the focus of mainstream social frameworks—conflates the processes that lead to outcomes with the outcomes themselves.

This is not to say that outcomes like profitability are not important or should not be measured. But using those measures as proxies for underlying processes fails to address social dynamics and thus defaults to familiar policy solutions such as price, market access, production increases, and capital infusions. Considering labor practices again, understanding the role of family and volunteer labor in the social fabric of a community may inform alternative policy solutions such as labor subsidies, basic income for farm workers, or tuition deferment for student farmers.

Measuring the social dynamics of agricultural systems, not as a productive input, but as a dynamic process, is critical. We must measure and understand shared norms, not simply the outcomes of shared norms.

At the same time that farmers make decisions based upon price, production, and profit, they also make decisions outside of those confines because, for many, the goal of farming and the values that inform farming decisions are not solely profit based (Bell, 2004). While the price and production approach to assessing agricultural systems is limited to the activity observable in markets and reflected in traditional economic measurements, significant economically-invisible agricultural processes exist that are critical to successful sustainable agricultural initiatives (Müller and Sukhdev, 2018). Similarly, agricultural processes are not contained solely within agricultural policy and practice but are embedded within a larger system that includes the social, cultural, and environmental processes of society. The following section explores those processes.

Embeddedness

What is embeddedness?

Sociologist Karl Polanyi pioneered the idea of embeddedness by arguing that "the human economy…is embedded and enmeshed in institutions, economic and non-economic" (Polanyi, 1957, 250). In stark contrast to the rational actor model in which atomized actors make selfish decisions to maximize utility, embeddedness is often thought of as the degree to which economic activity is constrained by non-economic factors (Chen and Scott, 2014) such as friendship, aesthetics, affection, loyalty and reciprocity (Kloppenburg et al., 1996, 37). Economic activity, in this view, exists within an extensive web of

social relations, institutions, and norms in which the individual actor is embedded. Importantly, embeddedness differentiates economic outcomes, such as material need satisfaction, from the social and environmental processes that create those outcomes (Jones and Tobin, 2018, 70).

Polanyi described how human society transformed from economies of reciprocity and redistribution to market society. In those former systems, economic activity was organized through deeply embedded traditions of gift exchange, debt payment and cancellation, and trust (Mauss, 1990; Dodd, 1994; Graeber, 2014). In market economies all production and distribution is organized through the price mechanism of the market. This transition is historically novel: "instead of economy being embedded in social relations, social relations are embedded in the economic system" (Polanyi, 2001, 60).

Since, in a market economy, all production and distribution occurs within the market, all production must be produced for sale on the market. This implies that all income is derived from the market. Since all production requires land and labor, and all distribution requires money, the key distinction of a market economy is that the price mechanism must exist, not only for the commodities that are sold, but for land, labor, and money as well; their prices being, rent, wage, and interest, respectively (Polanyi, 2001, 72). Polanyi called these "fictitious commodities" because, while they are critical to the functioning of markets, their production does not take place on market, and they are not produced for sale. Land is nature; labor is human activity; and money is a social relation (Ingham, 1996; Ament, 2020). Commodification disembeds these "commodities" from their social, biophysical, and environmental contexts and aligns them unnaturally with the mechanism of the market. It is the commodification of land, labor, and money that allows all production and distribution to be organized through the market and what distinguishes a market economy from an economy with markets. For example, the restructuring of land from a cultural and productive resource into speculative commodity is largely responsible for the 1980s Midwest farm crisis (Barnett, 2000) and the social dislocation, unemployment, and health issues that followed (Meyer and Lobao, 2003).

Values and social context

While market economies are distinct from reciprocal and redistributive economies, markets are nevertheless infused with norms and values and are deeply embedded in the social context within which they operate, even if that context is individualistic. The values of economic actors can be divided into instrumental and relational values (Jax et al., 2013) and drive the economic processes that occur within society (Jones and Tobin, 2018). Instrumental values concern individual needs and desires (Arias-Arévalo et al., 2017), while relational values concern relationships with individuals and the environment. These values are a function of the benefits that actors seek: while instrumental values concern individual benefits, relational values concern generating benefits for multiple parties (Jones and Tobin, 2018, 69).

Individual values exist on a spectrum from instrumental to relational and are spatio-temporally malleable. Economic decisions involve a negotiation between these individual values and the social context within which decisions are made. In the context of a market society, individuals justify market exchanges in relation to the social and environmental values they hold (Kloppenburg et al., 1996; Galt et al., 2016, 348).

These negotiations constitute not just individual, but society-level negotiations as well, and frame how this paper proposes to measure embeddedness. Values are not individually subjective, nor are social structures objective in a positivistic sense (Berger and Luckmann, 1967). Rather, individual values—and the benefits that individual actors seek—and social structures interact constantly to form the macro social context within which economic decisions are made (Krul and Ho, 2017, 844). An individual farmer cannot operate a farm that is outside of the commodity food system while borrowing money for land and paying labor according to its productivity. It is this context that determines which values individuals can express in economic activity.

Instrumentalism and marketness

Just as the market economy does not follow the dictums of self-interested economic actors operating in an anonymous market, "embeddedness does not entail the complete absence of market sensibilities" (Hinrichs, 2000, 297). Rather, individual economic transactions take place according to degrees of marketness and instrumentalism (Block, 1990).

Instrumentalism concerns the nature of individual motivation in an economic action and ranges from altruistic to egoistic (de Groot and Steg, 2007; Steg et al., 2011). Economic actors with high levels of instrumentalism prioritize individual economic goals while those with low levels prioritize concerns for friendship, family, community, or morality (Hinrichs, 2000, 297). Marketness concerns the extent to which price is the dominant consideration in how individual motivations are expressed. High levels of marketness indicate that price considerations dominate economic decision making, while at low levels of marketness, non-price considerations such as trust, identity, and social connection take on greater importance (Block, 1990, 51).

Instrumentalism and marketness are spectrums that together help to explain the negotiation between and among instrumental and relational values and the macro social context discussed above. The concepts also illuminate how

economic behavior can be simultaneously price conscious and community-minded (Mariola, 2012, 578) as the expression of individual values such as care for environmental resilience is constrained by a social context in which markets dominate exchange. Accordingly, embeddedness on the one hand, and instrumentalism and marketness on the other are not diametrically opposed but rather, coexist in degree to form the complex social texture within which economic decisions are made.

Embeddedness: Negotiating market and non-market motivations

Embeddedness exists at the relational scale in which economic agents interact with one another, but also at the structural scale in which individuals negotiate actions according to the context within which they exist (Granovetter, 1985). It is this interplay between relations and structure, and motivations and values that highlights that embeddedness is not distinct from markets and prices and does not imply qualities like good or bad. Farmers are embedded in their communities while selling into markets and fetching a price for their goods. Embeddedness does not imply a friendly antithesis to markets, and prices are not the iniquitous alternative to a virtuous embeddedness. Even amidst strong communal ties, prices and self-interest are apparent.

Embeddedness, then, concerns the context in which actions take place, the values that drive those actions, and the manner in which the two affect and are affected by one another. In the embedded market, it is the expression of coexisting instrumental and relational values that drive the degree of instrumentalism or marketness that plays out in economic activity at the relational and structural scales. Price and individual goals are important in the context of embeddedness, but their full expression is limited by relational values [(Migliore et al., 2014b), 551]. Similarly, relational values are limited in their full expression by price and individuals' goals and the structural context within which those values are held (McKee, 2018).

This give and take is important when considering sustainable agricultural systems in a market society where profit and prices are essential components of decision-making. Mortgages must be paid, wages must be earned, capital must be borrowed, and prices must be competitive. Farmers who are deeply embedded in their social communities must nevertheless earn a profit to continue their operation. And consumers whose values are communal still make decisions based on price. Prices and profit are embedded in market systems and are part of the complex social fabric in which decisions are made. This negotiation, the continuous jostling of values and contexts, is tremendously important when developing indicators of sustainable agriculture.

Embeddedness and sustainability

While the above sections have discussed how social connection, trust, and community are essential to economic life in general, understanding those values and systems is critical to alternatives such as sustainable agriculture (Sage, 2003; Payán-Sánchez et al., 2018).

Sustainable agricultural processes require relationships, trust, and connection to the environment (Brinkley, 2017, 315; Payán-Sánchez et al., 2018) and the individualist motivations of the rational actor model are negatively correlated with social and environmental concerns (Steg et al., 2011; Raymond and Kenter, 2016). Communities with stable populations and strong community relationships have been shown to be more conducive to transitions to sustainable agriculture (Lorendahl, 1996; Huggins, 2000; Laschewski et al., 2002; Phyne et al., 2006; Ring et al., 2010; Tregear and Cooper, 2016).

For agriculture to be sustainable, producers and consumers must be motivated by community and environmental values and act in ways that reflect those values. This includes everything from farming and labor practices to market access and sales techniques. Accordingly, embeddedness is an important piece of sustainable food systems. This does not mean that embedded food systems are sustainable. But if sustainability is a goal for a food system, it must actively recognize agricultural production as deeply embedded in social, cultural, and environmental processes.

In achieving sustainable outcomes, it is necessary to value inputs from the perspective of their embeddedness in these processes rather than their contribution to commodity production (Jochimsen and Knobloch, 1997). This means, for example, viewing soil as part of a complex ecosystem that supports food production rather than a medium in which to grow food. Such a view requires stewardship and decision making based on relational values and motivations outside of price *despite* the context and instrumentality of the broader system.

Policy has an important role in ensuring that sustainable processes lead to sustainable outcomes due to its ability to actively recognize embeddedness and align the organizational principles of the system with the values and motivations of those within the system. This includes increasing equitable access to land, regulating non-sustainable production, and supporting sustainable labor and farming practices. Measuring those values and motivations, and the dynamics inherent in values and actions is thus critical to sustainability. We turn to that now.

Developing a tool for measuring embeddedness

The rational actor model upon which much agricultural policy—price, profit, market access—is rooted fails to consider

the social nature of producers and consumers in markets. Those frameworks that do include social considerations often imply a low-level rational actor framework and fail to consider complex social dynamics of agricultural processes—including values and motivations—and thus measure outcomes in much the same way economic models do.

It is necessary to measure the embeddedness of individuals in order to incorporate the embedded nature of social processes into sustainable agricultural policy. Yet, due to the complexity of embeddedness—including negotiating values and motivations between individuals and society across space, time, and context—no tools for measuring embeddedness currently exist. This section develops a tool for measuring embeddedness that includes the development of an embeddedness matrix (Section The Embeddedness Type Matrix), creation of marketness and instrumentalism scores (Section The embeddedness scores), and a strategy to use the matrix and scores to inform policy (Section Operationalizing the embeddedness tool).

The Embeddedness Type Matrix

Developing an Embeddedness Type Matrix

The Embeddedness Type Matrix (ETM) is designed to assess how farmers, consumers, and agricultural industries in general are embedded. As discussed, embeddedness is not a quality, but, rather, a characteristic. Embeddedness is neither positive nor negative and does not exist on a continuum of more or less embedded. Importantly, embeddedness is not a characteristic that exists in opposition to markets; markets are deeply embedded in social context. Distant commodity grain markets and local farmer's markets are both embedded, though in different ways. Accordingly, it is more appropriate to consider embeddedness, not in degree, but in type. This is consistent with (Sage, 2003; Velvin et al., 2016; Pinna, 2017; Kitsos et al., 2019).

The framework for embeddedness draws upon Block's (1990), Hinrichs' (2000), and Galt's (2013) discussions of instrumentalism and marketness—specifically that neither instrumentalism nor marketness exist in opposition to embeddedness. Instead, the framework conceives of embeddedness as framed by degrees of instrumentalism and marketness. Block (1990) argued that economic activity exists in degree along a spectrum of marketness. Importantly, economic activity also exists in degree along the spectrum of instrumentalism. Thus, instrumentalism and marketness define two axes in a matrix to develop the four embeddedness type quadrants in Figure 1.

The quadrants in Figure 1 draw upon Akgün et al.'s (2010) approach to categorizing embeddedness that incorporates local embeddedness (Kalantaridis and Bika, 2006), social embeddedness (Block, 1990; Uzzi, 1996), ecological embeddedness (Whiteman and Cooper, 2000; Penker, 2006), and spatial embeddedness (Sonnino and Marsden, 2006; Sonnino, 2007) to create a typology with four types of embeddedness along the instrumentalism and marketness axes: Type I, Type II, Type III, and Type IV. Numerical embeddedness "types" were chosen as quadrant names in order to avoid any assumptions, qualifications, or "ideal types" that could accompany descriptive quadrant names.

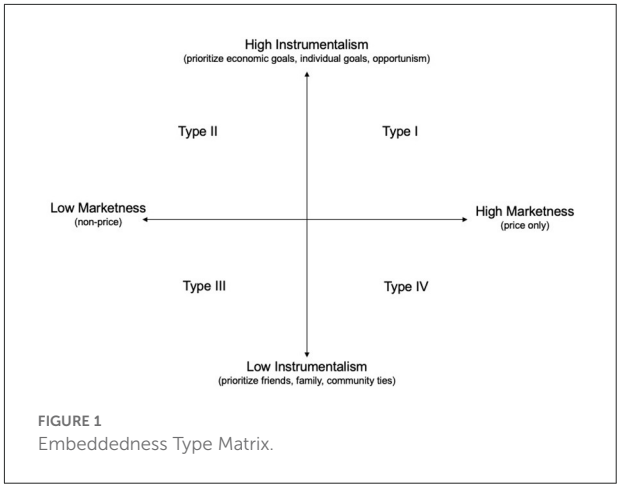

FIGURE 1
Embeddedness Type Matrix.

These embeddedness types do not imply quality as processes are always and everywhere embedded. Rather, they represent the extent to which values and behaviors are oriented toward and engage with embeddedness. For example, the values and behaviors of individuals in the Type I quadrant, while embedded in a specific social context, are oriented away from and disengaged with that embeddedness. An industrial farm that sells corn on the global commodity markets is embedded in the community in which it operates but may perceive itself outside of, and therefore disengage from, that community.

The Embeddedness Type Matrix places each embeddedness type within an instrumentalism/marketness quadrant. Figure 1 shows how embeddedness in this matrix is not a degree in itself, but, rather, a function of the degree of instrumentalism and marketness. Since all market interactions are embedded, the ETM provides a framework for considering values and motivations of economic actors, and understanding how, not if, they are embedded.

Understanding the Embeddedness Type Matrix

The ETM determines embeddedness type as a function of how an individual's degree of instrumentalism or marketness interact. For example, a Type II producer is motivated by individual economic goals but expresses those goals in a non-price manner. This section explores ETM to understand how this paper proposes to measure embeddedness.

The Instrumentalism axis identifies the values that drive individual motivation. Actors with high levels of instrumentalism prioritize economic goals based on

	Marketness	Instrumentalism	Primary Motivator	Goals	Characteristics	Example
Type I	High	High	Price	Individual	Profit/Utility Maximizers	Industrial dairy funded with non-local capital
Type II	Low	High	Non-Price	Individual	Profit 'Sufficers'	Community Supported Agriculture
Type III	Low	Low	Non-Price	Community/ Environment	Shock Sensitive, Access to Alterantive Inputs	Roadside farm stand
Type IV	High	Low	Price	Community/ Environment	Conscious Maximizers	Indistrial organic production

FIGURE 2
Summary of embeddedness type quadrants.

instrumental values with benefits intended for themselves (Jones and Tobin, 2018). Individuals with low levels of instrumentalism prioritize family and community ties based on relational values whose benefits are intended for multiple parties (Jones and Tobin, 2018). While high levels of instrumentalism undermine social ties, low levels strengthen those ties (Hinrichs, 2000, 297).

The Marketness axis identifies the relevance of price in expressing values. Individuals with high levels of marketness prioritize price and profit when making decisions. Individuals with low levels of marketness prioritize quality, community, and environment when making decisions. At low levels of marketness where price is a less important driver of action, values are expressed in a more complex web of social relations (Block, 1990, 53).

In the high marketness/high instrumentalism, "Type I" quadrant, price is the primary motivator and individual goals drive actions. In this quadrant producers are profit maximizers and consumers are utility maximizers. This is not to say that these actors are not embedded, but rather, hold values and express those values in a way that is individual-based, for example large scale dairy operations or industrial maple production funded by non-local venture capital.

In the low marketness/high instrumentalism "Type II" quadrant, price is not a primary motivator and individual goals are driven by individual values. Type II producers may be described as "profit sufficers" (Sage, 2003) who pursue economic success by way of factors other than price, while Type II consumers prioritize individual health or taste in alignment with their values. The prioritization of economic goals in this quadrant may include the use of non-local markets to sell a product using local inputs and labor (Sage, 2003, 53; Akgün et al., 2010, 541).

The "Type III" quadrant includes individuals for whom price is not a primary motivator and the values that drive actions are communal. While actors in this quadrant are limited in their success by their social closure (Akgün et al., 2010) and can have difficulty responding to shocks (Kitsos et al., 2019), they may have access to alternative forms of labor and markets due to their social ties. Nevertheless, some degree of instrumentalism or marketness is critical to success in a market economy (Bloom and Hinrichs, 2011).

Finally, in the "Type IV" quadrant, individuals display high marketness and low instrumentalism. Accordingly, price is the primary motivating factor, but values are community-based. Individuals in this quadrant are conscious maximizers. Examples might include industrial organic food, rural marketing, or models of sustainable (or green) capitalism.

As this section has explained, embeddedness type results from a complex dynamic of interaction between values, motivation, and action. This interaction is summarized in Figure 2 above. Embeddedness is not static and can change in space and time, and according to context and product. Similarly, the axes between embeddedness quadrants should be thought of as opaque and fluid boundaries across which individuals may cross rather than strict demarcations of type. It is also critical to remember that no quadrant is good or bad and should not be interpreted as degrees; they are simply types of embeddedness.

The embeddedness scores

Developing embeddedness scores

To measure embeddedness, this tool utilizes a survey of small and medium-sized farms and their customers. The survey uses a unipolar 1–5 Likert-scale survey to estimate marketness and instrumentalism and place farmers and consumers in one of the four quadrants on the ETM.

Measuring embeddedness, instrumentalism, or marketness directly is difficult due to the complex and abstract nature of the terms. Accordingly, the tool utilizes a factor analysis

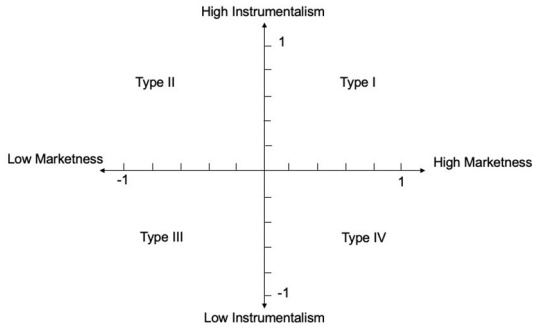

FIGURE 3
Embeddedness score grid.

that uses observed, Likert-scale questions to measure the latent or underlying factors. While a factor such as instrumentalism cannot be easily measured directly, as a latent factor, it causes behaviors that can be measured through survey responses. Factor analysis measures the relationships between observable items in order to provide a measure of an unobservable factor (details in Section Methodology and method below).

The survey provides producers and consumers with a score of −1 to 1 for both instrumentalism and marketness. Taking both scores together assigns individuals to one of the four embeddedness quadrants in Figure 3.

Factor categories

A literature review of embeddedness and sustainable agriculture informs the factors and categories that a survey of producers and consumers should address. This set of literature, both theoretical and empirical, identified several attributes that are critical to understanding and measuring embeddedness.

The literature revealed five broad categories for the Instrumentalism factor and four categories for the Marketness factor. These are listed below, along with their associated attributes.

Instrumentalism Factor categories and attributes

- Shared commitment: information transfer, risk, trust, uncertainty
- Goals: concern for the environment, economic goals, health, local production
- Inputs and Outputs: local inputs as percent of production, length of supply chain, core and repeat customers, output sold locally, length of distribution chain
- Social Connection: bond between producer and consumer, community connection, industry importance, networks of relations, redistribution
- Values: community importance, instrumental and relational values in action, land stewardship, non-production values, salary concerns

The Marketness Factor categories and attributes

- Costs: by-products as inputs to production, operating costs, transportation costs
- Decision drivers: profits, prices
- Fictitious commodities: cost of land, access to money and credit, labor usage and relations
- Market dynamics: demand, perceived competition

Survey development

To develop Instrumentalism and Marketness scores and assign consumers and producers to a quadrant on the Embeddedness Type Matrix, surveys are designed to elucidate the categories outlined in Section Factor categories and highlight producer and consumer values, motivations, and behavior. The surveys are comprised of affirmative statements (Lahne et al., 2017) of the form "I feel a sense of obligation to my consumers" across all appropriate categories and attributes above. All questions are unipolar 1–5 Likert scale questions with response options from "Strongly Disagree" (1) to "Strongly Agree" (5). Questions are specified for the industry and geography in question, and specific to consumers and producers.

The factor categories and attributes listed above are neither complete nor exhaustive. Surveys are designed specifically for a particular study and categories and attributes are added or removed according to the industry, geography, and research question. Survey responses provide valuable insights into the motivations, values, goals, and relationships within the agricultural system being studied.

Following best practices from Chen (2013) and Chen and Scott (2014), initial survey questions are reviewed by subject area experts to further develop the surveys. Revised surveys are administered to a development sample of producers and consumers to determine question-factor correlation using confirmatory factor analysis.

Methodology and method

Factor analysis is a "best practice" in the methodological literature for reducing the number of observed variables to a smaller set of latent or underlying factors (DeVellis, 2011; Lahne et al., 2017). While latent variables, such as instrumentalism and marketness, cannot be directly measured, they can be indirectly measured by examining the relationships they cause in observed variables, e.g., survey responses.

Factor analysis is more appropriate for the development of the Embeddedness Type Matrix than principal component analysis due to the causality of factors on observed variables.

While principal component analysis assumes that observed variables influence latent variables, factor analysis assumes that latent variables influence observed variables and are, thus, revealed by observed variables. This approach to embeddedness understands that individual values and the social structure within which those values operate to influence the expression of those values in the form of actions and survey responses. In other words, latent instrumentalism causes observable survey responses, for example.

Confirmatory factor analysis (CFA) is used when a theoretical structure, such as the one developed in Section Factor categories, informs the variables in a factor model (Ferguson and Hansson, 2015). The Embeddedness Type Matrix utilizes CFA to analyze the embeddedness survey responses to "confirm" that observed variables are correlated with the instrumentalism or marketness factor theorized above (de Groot and Steg, 2007). In other words, to determine if the questions that aim to discover instrumentalism indeed describe instrumentalism and not marketness.

Using a CFA with oblique rotation and a target of two factors assigns a factor load of 0–1 for each variable and explains the variable's correlation with each factor (Migliore et al., 2014a). Factor loadings are compared to the theoretical structure to confirm that the variables with the highest loadings are assigned to the appropriate theoretical factor, and variables are realigned to factors with which they have the highest loading, if necessary (Lahne et al., 2017).

Factor loading can be used to determine a factor score in multiple ways (DiStefano et al., 2009). The Embeddedness Type Matrix tool uses a weighted load-weight sum factor score in which observed variable values (1–5 Likert responses) are multiplied by their weighted factor loading to assign a score of 1–5 for each factor. These scores are normalized from−1 to 1 to assign a factor score for each individual for each factor, instrumentalism and marketness. Individuals are then placed on the ETM to determine embeddedness type for each individual.

Operationalizing the embeddedness tool

This section explores how to read the ETM, identify the sustainability region of the matrix, and understand how policy can affect producer and consumer placement within the context of sustainability.

Reading the matrix

We offer a hypothetical example to demonstrate how to read the ETM. Consider a dairy farmer whose 74 survey responses yield an instrumentalism score of 0.37 and a marketness score of −0.02, after being scored using the method outlined above. This farmer, denoted by a star, would be deemed Type II. Continuing this example with 50 dairy consumers and 50 dairy producers, produces the example dairy industry ETM in Figure 4.

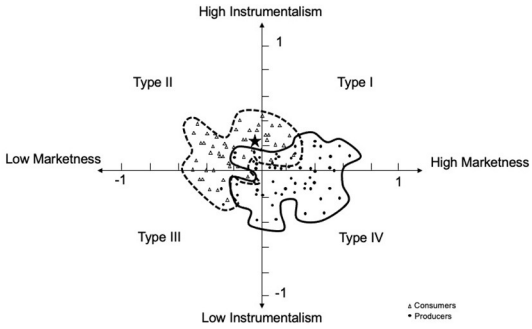

FIGURE 4
Example embeddedness tool results.

As this example figure shows, dairy consumers in this study, with individuals represented by triangles and encircled by a dotted line, fall more frequently in the Type I and Type II quadrants. Dairy producers in this study, represented by circles encircled by a solid line, fall more frequently in the Type III and Type IV quadrants. Consumers display higher levels of instrumentalism, in general, while making decisions across the marketness spectrum. Producers display lower levels of instrumentalism while making decisions more heavily weighted toward price considerations. This differentiation between consumers and producers may indicate that, as a whole, producers are not able to meet the values of an embedded consumer base. From a policy perspective this may mean, for example, increasing opportunities for small farmers including subsidized land and labor costs, and access to local markets.

Sustainability

Agricultural systems are sustainable if they provide food in such a way that the economic, social and environmental bases to provide food in the future is not compromised (Nguyen, 2018). Accordingly, a sustainable food system must be profitable, socially beneficial, and environmentally just (Hinrichs, 2000, 295). Due to the interaction of these three critical components, we outline the region of sustainable agriculture as the shaded area in Figure 5.

As Figure 5 shows, and as this paper has argued, embeddedness is not synonymous with sustainability and low levels of marketness and instrumentalism do not guarantee sustainability.

Indeed, sustainability rests upon relational values with society and the environment, and expresses those values by means other than price. At the same time, however, some

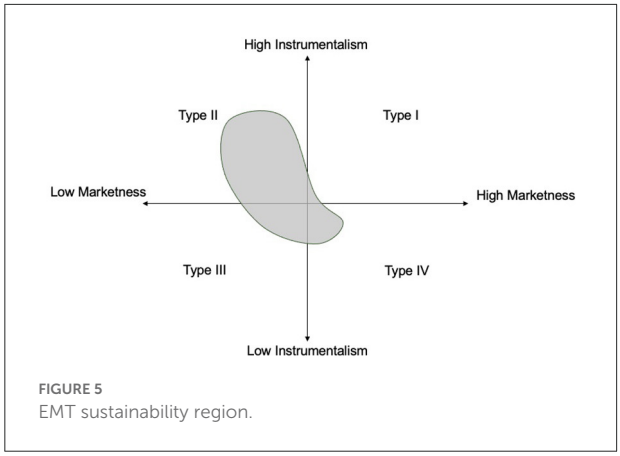

FIGURE 5
EMT sustainability region.

degree of instrumentalism is critical to the economic success of small and medium farms. Similarly, some focus on price is required to be profitable in the long term. While too much instrumentalism and too much marketness certainly undermine the social bonds and environmental relationships that are precursors to sustainable food systems, too little focus on price and economic success can undermine a viable farm. It is this dynamic between social and environmental values, on the one hand, and economic success, on the other, that exemplifies embeddedness in a market economy and informs the region of sustainable agriculture on the ETM.

Sustainable agricultural practices can be tested using regressions where the dependent variable is sustainability outcomes and the independent variable is embeddedness type. Similarly, hypotheses regarding the relationship between embeddedness and sustainability can also be tested using the embeddedness score. The ETM can also be used with predictive modeling to predict the impact of policy changes, to be explored now.

Policy implications

The Embeddedness Type Matrix, with its visible demonstration of the sustainability region, will assist policy makers in designing and implementing policy to "nudge" actors in the direction of sustainability by means other than the traditional price and production goals. This includes labor policy, land access, and subsidization of socially embedded industries.

Analyzing the data underlying embeddedness scores, including factor loads and individual question responses, reveals the dynamics where policy can have the most impact in embeddedness and sustainability. For example, if a large portion of agricultural producers were to exhibit high levels of marketness and the factor loads and survey responses concerning mortgages revealed that the cost of land was considerable factor in being placed outside of the sustainability region, policy could be directed at interest rates on farmland mortgages or subsidized or free farm land. This could have the effect of reducing the importance of mortgage decisions in farm operations and, in effect, "move" farmers to lower levels of marketness.

From the perspective of consumers, if it is revealed that the price of food limits individuals' ability to express their social and environmental values, policy could be designed that could have the effect of limiting the level of marketness in consumer behavior. This could include subsidized production or consumption policies that decrease prices for consumers. It may seem counter-intuitive to use price policy to address the failings of price, but in a market economy, price is the central organizing factor. Sustainability policy should be partially aimed at making price less important in decisions so that other values can be expressed.

Overall, the Embeddedness Type Matrix allows policy makers to view the social landscape of a particular agricultural industry, understand what drives embeddedness type, and consider policy that will move individuals and industries into the sustainability region.

Conclusion

This paper fills what we believe to be a methodological and theoretical gap in understanding and measuring the social aspects of sustainability. By drawing upon the social embeddedness literature, this paper develops a theoretical framework for understanding the complex social interactions that take place in small- and medium-sized farms. This is in contrast to the rational actor model upon which much economic analysis, and therefore policy prescriptions, are implicitly based. This approach allows policy makers to design polices that are well-aligned with the issues facing farms and those who consumer their food.

That this paper develops a methodology for measuring embeddedness does not imply that price, production, and market access measurements and policies are not important. Nor does it imply that outcomes measurements such as poverty and access to markets are not useful. Those measurements and indicators and the policies they inform are critical to sustainable agricultural systems. This paper is meant to complement that work in order to provide a broader understanding of agriculture, specifically the complex social dynamics that support agricultural production and consumption.

The policy implications of a broader understanding of the social dynamics of agricultural landscapes are exciting. By understanding how farmers make decisions and what motivates their actions, policy can be aimed at things like sustainable land conservation, just labor practices, and culturally-appropriate distribution systems. Measuring social embeddedness in the

manner outlined in this paper can provide an understanding that has been missing but is critically important for designing policy based upon what actually motivates producer and consumers. Importantly, it has the potential to shed light upon the social and economic components that both guide and limit the transition to sustainable agricultural activity.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

Author contributions

JA developed the methodology within the paper and wrote the manuscript. AT and DT provided supervision, theoretical framing, literature suggestions, review of early drafts, and also contributed writing. CMorg and CMors both contributed to writing and editing as well as providing invaluable perspective on sustainable agriculture and related literature. SM and T-LL contributed statistical assistance in the development of the methodology and contributed to writing and revision. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Transformative learning to promote transformative evaluation of food system praxis

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Evaluation ideally plays an important role in determining the value and impact of community food system initiatives and movements, providing recommendations for informed decision-making, learning, and programmatic adjustments. Given that community food system work is characterized by critical praxis rooted in deconstructing dominant epistemologies and addressing social and systemic injustices—including discourses and practices from agroecology, food justice, and food sovereignty movements—simple, technical-rationalist approaches to evaluation are inadequate and inappropriate. In parallel with recent developments in critical food system work, the field of evaluation has evolved toward more critical and transformative approaches—including Culturally Responsive and Equitable Evaluation, indigenous evaluation, feminist evaluation, all generally regrouped within the framework of the transformative evaluation paradigm. At the nexus of these trends, to meet the rising demand for critical evaluative thinkers ready to grapple with the complex, dynamic, and contested questions of community food system praxis evaluation, there is a need to equip emerging evaluators with the requisite knowledge of evaluation approaches. To be ready to be critically reflective evaluators, in food system praxis and beyond, the next generation of emerging evaluators must engage fruitfully and in practically wise ways with the complex and contested aspects of critical food system work. Reflecting on the burgeoning literature on evaluator education and evaluation capacity building (ECB), and given the centrality of critical praxis and transformation in both food system work and evaluation alike, we posit that transformative learning theory has a potential role to play in preparing evaluators to meet these challenges. As such, the purpose of this conceptual paper is to highlight the intersections between critical evaluation approaches and critical food system praxis, and propose transformative learning theory as one way to help emerging evaluators prepare to meaningfully grasp and engage with the complexities manifest at this nexus of critical food evaluation praxis.

KEYWORDS

transformative learning, emerging evaluators, food movements, transformative evaluation, food system

Introduction

Community food security (CFS) is "a situation in which all community residents obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximizes community self-reliance and social justice" (Hamm and Bellows, 2003). Organized communities stand a better chance of addressing food insecurities despite the challenges and complexities associated with community food systems (Hamm and Bellows, 2003; Hall et al., 2019). A key concept of CFS is "the right to food" for all within a community (Hamm and Bellows, 2003). Food justice, also broadly translated as the right to food, encompasses "communities exercising their right to grow, sell, and eat food that is fresh, nutritious, affordable, culturally appropriate, and grown locally with care for the well-being of land, workers, and animals" (Alkon and Agyeman, 2011). Food justice initiatives seek to enhance access to food for all regardless of location, societal class, race, age, or gender. Food justice leads to proportionate access to quality and nutritious food by eliminating systemic bias and negative social tensions. Institutional or systemic bias takes various forms, anchoring on race, socio-economic status, religion, ethnic group, clannism, and geographic disparities, among other factors. Such disparities disproportionately affect people of color and minorities (Hamm and Bellows, 2003), leading to starvation, indignity, and food access challenges, with little done to solve the ever-recurring problem.

Coupled with systemic food inaccessibility and indignity, global food systems are fragile. That fragility is not entirely accounted for by global instabilities, such as the fallout of COVID-19; the Food Agriculture Organization's (2020) High Level Panel of Experts' report found that food systems showed evidence of fragility even before the epidemic. "Climate change, loss of biological and agrobiological diversity, loss of soil fertility, water shortage and loss of water quality, and population growth" all contribute to the fragility of the food system at a global and local scale [(McIntyre et al., 2009), p. 2]. This fragility was further exacerbated by the COVID-19 pandemic and political conflicts pitting major global food baskets against each other (Clapp and Moseley, 2020). For instance, according to an IPES-Food (2020), the underlying inadequacies and inefficiencies within the global food system regime brought forth by COVID-19 include, among other shortcomings, a near world-wide lockdown that affected food supply chains, disrupted market access, and slowed food production. The cataclysmic impact of the pandemic temporarily disrupted volunteer work among community members. That notwithstanding, local community members, mutual aid, and food access organizations played an integral role in the resiliency of low-income communities who were affected by the pandemic (Haynes-Maslow et al., 2020; Lofton et al., 2022). A recent study by Mould et al. (2022) found that, to a large extent, during the period of the pandemic, mutual aid has been thrown into the limelight. This exposure has led to further appropriation by the states, who absolved their responsibilities of funding social welfare to the public. In order to reduce the harsh impacts of future pandemics and naturally occurring disasters on the food system, Mould et al. (2022) propose a community-focused approach, which includes collective responsibility, co-operation, and mutual survival. This is an approach in which "vulnerabilities are viewed less as static variables to be countered, but as spaces of radical emancipation from the injustices of capitalist systems that created the vulnerabilities in the first instance" (Mould et al., 2022, p. 875). To achieve this, food movements must advocate for a layered collaborative approach bringing together various stakeholders, including food system evaluators.

The community food system challenges described above are complex, leading to injustices, albeit at varying scales. Nevertheless, a "whole systems perspective" and "action that establishes alliances" as proposed by Levkoe (2011) seems like a viable solution to address food access challenges. A working model, as Alkon and Agyeman (2011, p. 6) postulate, is "to operate through grassroot community-based organizations" in collaboration with state actors, tertiary education institutions, local voluntary organizations for professional evaluators (VOPEs), and donor organizations (also see Figure 1 below). Meter (2006) advances a systems approach to community food systems evaluation, arguing against food commodification and commercialization which leaves communities without culturally appropriate or sufficient food. Food system evaluation should account for "multiple perspectives" (Meter, 2006, p. 150), stakeholder participation, and political narratives and epistemologies. As such, evaluation helps determine the value and impact of community food system initiatives and movements, providing recommendations for informed decision-making, learning, and programmatic adjustments.

Program evaluation is "an applied inquiry process … that culminates in conclusions about the state of affairs, value, merit, worth, significance, or quality of a program, product, person, policy, proposal, or plan" (Fournier, 2005 as cited in Mertens and Wilson, 2018, p. 6). A Center for Agroecology (2022), article on evaluating food systems outlines the need for evaluations that (1) highlight and document program impacts, (2) respond to food producers and community needs, and (3) improve programs. Evaluation, just like other fields and professions, keeps growing and enhancing its approaches to address emerging societal, environmental, and practical concerns. As such, Mertens and Wilson (2018) proposed an additional branch on the evaluation theory tree (i.e., a metaphorical and schematic representation of the theoretical roots of evaluation; Alkin, 2012), the social justice branch, under the transformative evaluation worldview. The transformative evaluation worldview "primarily focuses on viewpoints of marginalized groups and interrogating systemic power structures through mixed methods

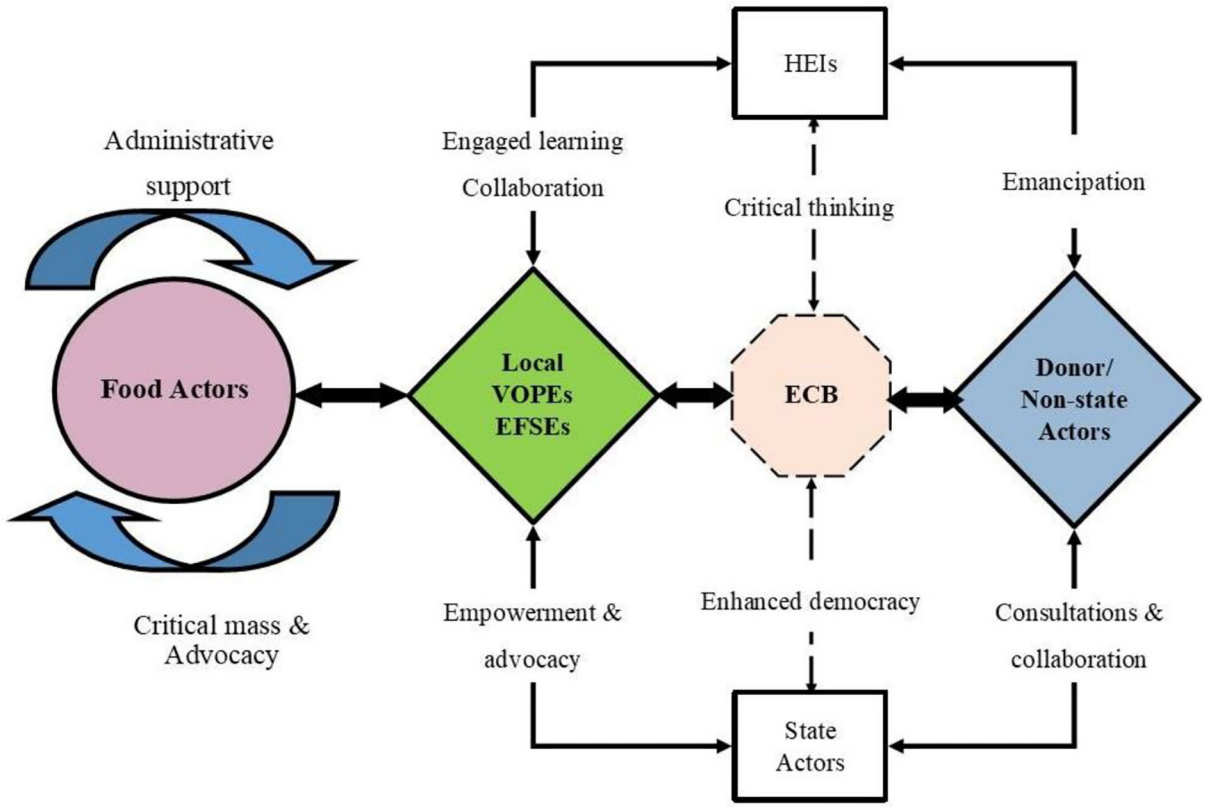

FIGURE 1
The social context for transformative evaluation capacity building.

to further social justice and human rights" (Mertens and Wilson, 2018, p. 42). As we will explore in greater depth below, the transformative learning theory's features, such as reflexivity and critical consciousness, all align well with the transformative evaluation worldview.

There is still growing acceptance of evaluation in organizations due to the increased focus on evaluation capacity building and use. Local organizations, such as those leading and implementing community food movements, face myriad challenges including but not limited to: (1) lack of proper evidence for effective decision-making and ineffective institutions; (2) power imbalances and policy conflicts between donors and local movements (Blaser Mapitsa and Chirau, 2019; Masvaure et al., 2020; Chirau et al., 2021); (3) an accountability-learning conundrum (Christie and Fierro, 2012); and (4) cultural and geographical influences (Vo and Christie, 2015; Al Hudib and Cousins, 2020), which disproportionately affect minorities, women, youth, and children. These challenges make it necessary to engage in a discourse that explores the transformative learning needed to prepare emerging evaluators to engage meaningfully and fruitfully in the nexus of critical, transformative community food system praxis, and critical, transformative evaluation, for the good of our rather vulnerable food systems.

The transformative learning theory helps build food systems evaluators' capacity to engage with contentious and complex issues and confront dominance by empowering local community food actors and local non-governmental organizations. Emerging evaluators have an opportunity to develop evaluation knowledge and practice among historically underserved communities to help raise local and organizational aspirations to champion better-suited food system interventions. This paper focuses on individual evaluators' interactions that collectively—through social interactions, reflexivity, consensus-building, and reflective discourse—make up elements of transformative learning. To meet the objectives for which they are established, food systems require responsive evaluation policies that crystalize and centralize evidence and feedback collection, ultimately leading to better decision making. Additionally, emerging food system evaluators (EFSEs) rely on existing political and policy agendas to inform their critical evaluation perspectives. The Food Agriculture Organization (2020, p. 5) High Level Panel of Experts calls for "critical policy shifts and support for enabling conditions that uphold

all dimensions of food security." We posit that these newly transformed emerging critical food system evaluators will be poised and well-positioned to use the conclusions of their evaluations to affect or even effect food system policy changes. In order to "facilitate multi-actor negotiations on food system sustainability by allowing diverse stakeholders to make sense of the complex adaptive nature of food systems" (Hebinck et al., 2021, p. 15), we advance a Multiple Streams Agenda-setting framework (Kingdon, 1995) that integrates the community food systems and evaluation agenda with existing political and community priorities to gain the requisite political traction and attention. Food system policy agenda-setting ideally involves multi-stakeholder dialogues and consensus building to determine policy goals (Hebinck et al., 2021). Emerging food system evaluators can rely on transformative learning theories to propose "reflexive and comprehensive evaluations" (Hebinck et al., 2021, p. 16) that inform policy agendas relevant to local food systems initiatives (Pothukuchi and Kaufman, 1999).

2. Food systems' evaluation guidelines - Options and implications

2.1. Building emerging evaluators' capacities for food systems evaluation

Evaluation capacity building (ECB) "is the intentional work to continuously create and sustain overall organizational processes that make quality evaluation and its uses routine" (Stockdill et al., 2002). Mezirow (2000, p. 5) defines learning as a "process of using past interpretations to construe a new or revised interpretation of the meaning of one's experience as a guide to future action". Based on this understanding, ECB's intentions to enhance organizations' abilities to conduct and use evaluation should involve learning dynamics. Based on Mezirow's definition, learning is the past and future experiences or interpretations that guide action or inspire adjustments. Likewise, ECB is a learning process that includes evaluators' and food actors' intentions to learn from the evidence and evaluation recommendations and use these learning experiences to establish a routine in food movements. In other words, ECB inspires evidence-informed organizational learning with evaluators taking on critical guidance and capacity-building roles.

Evaluation capacity building alone, however, is not sufficient to meet the ever-changing human and organizational needs. Evaluators need an enhanced knowledge frame to address a dynamic world. Food system evaluators are critical when determining the value and worth of food initiatives hence providing valuable recommendations. Emerging critical concerns in food systems foci such as agroecology, food movements, and alternative food systems, power dynamics in community food systems, dominant epistemologies, emancipatory constructs, social and systemic injustices, equity and equality concerns, feminism, among others become vital concerns for community work. To meet the rising need for evaluative critical thinking and pedagogy, there is a need to equip EFSEs with requisite learning methodologies, theories, and frameworks. This conceptual paper anchors on critical learning theories because of the rising need to nurture better evaluators, who will engage with contentious issues, confront oppression and dominance, and empower local communities to raise their voices and take charge of their wellbeing. Further, local EFSEs ought to take on leadership roles in developing evaluation knowledge and practice to help raise local and organizational capacities to carry out internal and contextual evaluations instead of importing international or non-local food system evaluators.

The point of intersection between transformative learning theories (TLTs) and ECB is the Social Justice Branch of evaluation under the Transformative Paradigm. Transformative learning refers to "the process by which we transform our taken-for-granted frames of reference (meaning perspectives, habits of mind, mind-sets) to make them more inclusive, discriminating, open, and emotionally capable of change, and reflective so that they may generate beliefs and opinions that will prove more true or justified to guide action" (Mezirow, 2000, p. 8–9). This definition places the individual and their experiences at the center of transformative learning. Collectively, communities work together to design programs and policies that best address their concerns through social learning and sustainable competencies (Rodríguez Aboytes and Barth, 2020). Community actors raise self-awareness and reflexivity (Harder et al., 2021), and critically place evaluation capacity building at the center of collective impact in an "attempt to democratize and share knowledge generation processes" (Niewolny and Archibald, 2015, p. 3). Among other theories, the TLTs form the basis for this transformative approach to practicing food system evaluations. The purpose of this article is to elicit prompt action from local food movements and actors and VOPEs to collaboratively advocate for a mind shift and possibly establish institutional structures that support transformative evaluation while situating food initiatives at the center of political discourses and agenda-setting.

2.1.1. Why emerging food movement evaluators?

According to EvalYouth (2016), emerging evaluators are individuals under 35 years old, who have <5 years' experience, are recent university graduates, and are development professionals with recent (<5 years) interest in evaluation. The interest in emerging evaluators is deliberate because of the years of neglect, particularly of competent women evaluators. This article aspires to correct this error by expanding the space for

more inclusive and diverse evaluators to equitably contribute to developing robust food systems. Emerging evaluators are now positioned as a new generation of advocates (Hoosen and Bennani, 2020) who will fill a shallow field of skilled evaluators. The focus is to raise and build the capacity of a new crop of critical evaluators who have a sense of agency and who would stand in the face of dominant epistemologies and advocate for local solutions to local problems. Cultural constructs, diversity of culture and languages, and indigenous knowledge might help form a critical context for food movement evaluation.

Other than the local VOPEs, local food actors and food movements offer institutional and possibly financial support to implement evaluation capacity building. For inclusive and participatory processes, government and non-governmental actors also play critical roles in policy adoption and enforcement. Higher education institutions (HEIs) are encouraged to take part since they can champion evaluator education and are important contributors to new knowledge. Furthermore, HEIs provide critical masses of young people and hence platforms for change. Figure 1 below illustrates the social context and the relationships among different evaluation capacity actors in a food systems context. While Gullickson et al. (2019, p. 20) calls for a shift from "what we are doing… to what we should be doing to educate evaluators", the central theme for this paper is to make transformational values explicit in evaluator education and practice. Gullickson and Hannum (2019), for instance, caution against evaluation training that focuses only on research methodologies at the expense of value systems.

2.2. The transformative learning theoretical framework

Rodríguez Aboytes and Barth (2020) identified four key features of transformative learning that are all instrumental for critical evaluation: (1) Transformative learning has gained widespread acceptance in cross-cutting fields, providing scholarly relevance to evaluation. However, the impending challenge is whether evaluators, including community actors, social change agents, policymakers, and development agencies, understand the need for critical explorations in transformative learning. (2) Transformative learning has a broad spectrum of possible learning outcomes. These learning outcomes are further enhanced by Mertens and Wilson's (2018) transformative evaluation paradigm that focuses on social justice, among other critical constructs. (3) Transformative learning shares the attributes of both social and experiential learning. Since learning is contextual, based on Mezirow's (2000) definition, experiential learning and social action are vital for transformation. Contexts shape frames of reference which ultimately influence an individual's epistemic cognition. (4) Systems thinking and emotional intelligence also influence transformative learning outcomes.

While touching on other transformative learning features, our focus is on individual evaluators' interactions that collectively—through social interactions in VOPEs—foster reflexivity and consensus-building and ultimately lead to social learning. Mezirow (2000) identified two key learning domains—instrumental and communicative learning—that influence learning processes, outcomes, and conditions. Rodríguez Aboytes and Barth (2020) similarly classify learning domains as how people learn, what they learn, and support systems for learning. Communicative learning involves a critical assessment of one's assumptions, which include intents and taken-for-granted frames of reference. These assumptions justify norms, mental constructs, beliefs, and hegemony.

It is important to note that the TLT is not the only, or most relevant, framework guiding evaluation capacity building and practice. The choice of this framework was largely informed by its focus on individual evaluators or food systems actors. The TLT coupled with Mertens and Wilson's (2018) Transformative evaluation paradigm creates an amalgamated framework for critical ECB called Transformative Evaluation Capacity Building (TECB) (Cook, 2020) and practice. Mertens and Wilson's Transformative evaluation paradigm improves the TLT model because it adds the social justice, collective action, agency, and inclusivity angles to TLT's frames of reference, disorienting dilemmas, reflexivity, and diverse perspectives. Transformative learning is context-based and includes critical reflection that challenges individuals' frames of reference (i.e., beliefs and assumptions).

2.3. Contextualizing the transformative learning theory for food system evaluators

Step 1: Understanding critical consciousness

Evaluators seeking to contextualize transformative learning should begin by critically self-reflecting and acknowledging their social blind spots. Evaluators, like other humans, find it difficult to let go of their existing frames of reference, which can impede objectivity and the quality of recommendations for change. The difficulty to let go of dominant frames, as Hooks (1994) asserts, results from individuals (i.e., evaluators, in our case) feeling insecure about exposing their vulnerabilities, guiding thoughts, and methodological paradigms. In the wake of social injustice, evaluators should be able to empower communities and help strengthen their quest to question existing frames and participate in solving the problems they face. Evaluators can help breed disorienting dilemmas that push individuals beyond the tipping point to start asking critical questions. Given the challenges vulnerable groups face, there is a common mindset

to accept any aid or assistance offered. This mindset must be challenged. Local communities also have the choice to determine what approaches work in their context and which parts of the food system works in their contexts.

Step 2: Deconstructing dominant frames of reference through emancipatory learning strategies

Emancipatory approaches to learning and knowledge generation accommodate alternative and diverse methodologies. Diversity, as used here, is in the view that dominant ontologies are not necessarily the best and only available foundation for appropriate methodologies. A common point of epistemic conflict is the use of indigenous evaluation epistemologies vs. the dominant Euro-American ones. Often, indigenous knowledge, for example in Africa, is considered inferior to Euro-American knowledge that dominates practice, theories, and education curricula (Shahjahan, 2006). As such, young and emerging food system evaluators must decolonize their epistemologies and adopt culturally appropriate and critical ontologies that in turn impact their evaluation knowledge, methodologies, and policy. Food system evaluation policy should encourage the use and recognition of indigenous epistemologies. Further, for inclusion in communities' political agendas as proposed by the multiple streams framework (discussed later), food systems' evaluation must address local needs. In the current world of knowledge commodification and capitalism, local community food systems and evaluators might face exploitation for capitalistic gains by a domineering secular neoliberal mentality. Further, knowledge dissemination is skewed and the media for sharing evaluation reports and subsequent utilization is limited. Shahjahan (2006, p. 231) asks; "How can we have a message when the medium is not accessible to many?" We propose that such gaps could be addressed by robust evaluation policy and agenda setting frameworks.

Step 3: Curbing hegemonic social norms in community food systems

Fighting these hegemonic social norms requires evaluators' boldness and deliberately stepping up for social justice through intentional emancipation of such social practices. Understandably, an advocative/activism approach to social learning might be unpopular, especially in traditionally hegemonic societies; for example, communities where women are considered subservient to men, and all farm/agricultural and household labor designated to them or where someone is first seen by the color of their skin or the ethnic group to which they belong. Such practices are so ingrained that anyone fighting these norms is considered degenerate and a betrayer. Unfortunately, such excessive power imbalance disproportionately affects underprivileged or underserved sections of society. One strategy proposed by Fenwick (2003) is to name and speak up against the mechanisms of cultural power and ultimate resistance. This is an important step toward critical consciousness and reflexivity that food system evaluators ought to embrace in policy and practice.

Step 4: What works in one context does not necessarily work in another: Deconstructing one-size-fits-all

Generalization/homogeneity is the assumption that what worked in one instance or situation works in another. Lave (1988) further categorizes generalization in terms of people's thoughts and actions based on findings of an experiment. The one-size fits all go against the natural social order because it disregards the social nuances in community food systems, such as social identity issues, poverty, discrimination, historical injustices, inequity, inequality, among other social ills. Homogeneity is a precipice for commodifying food systems for profiteering. Commodification provides avenues for control by external forces; those who make decisions on behalf of community members while ignoring their plights and underlying needs. Ubiquity limits options available for community members from which they can choose. Often, local food movements lose control of their programs as the power to make decisions gets transferred. As mentioned before, generalization as per Lave (1988), promotes consumerism tendencies which glorify acquisition, commodification, self-gratitude, classification of people, and ephemerality. The individualism/consumer culture then informs the direction food systems take, including restructuring their program delivery and activism to align to market-based/capitalistic tendencies. Market-based approaches draw their features from hegemonic and capitalist tendencies that place social programs in trajectories of revenue generation, profit making and efficiency.

Social program dynamics are relational rather than acquisitional (Niewolny and Wilson, 2009; Perez et al., 2010). Food systems encompass heterogeneous intra-cultural variations that complicate the exportation of things that worked elsewhere into different contexts. Some food system evaluators talk about dissemination of best practices and replication of programs in other contexts. Evaluation should facilitate community-engaged program conception, design, inception, implementation, monitoring, learning, and evaluating. Evaluators are encouraged to debunk a one-size-fits-all mentality. The evaluators are expected to lead a semantic shift from "best practices" to "tentative best judgment" (Mezirow, 2000, p. 11) which is an epistemic and ontological shift toward transformative learning.

Step 5: Understanding evaluators' diversity of perspectives

The transformative evaluation paradigm acknowledges diversity and homogeneity as key components to understanding social justice. This is a guiding principle in the policy making and agenda setting stage as it ensures various perspectives are taken into account through stakeholder participation (Liu et al., 2010). To best understand the relationship between different stakeholders' perspectives and how to facilitate a heterogeneous and transformative space while maintaining individual agency, critical consciousness is vital. Figure 2 below shows a diversity of perspectives and frameworks and the evaluator's role in enhancing capacity

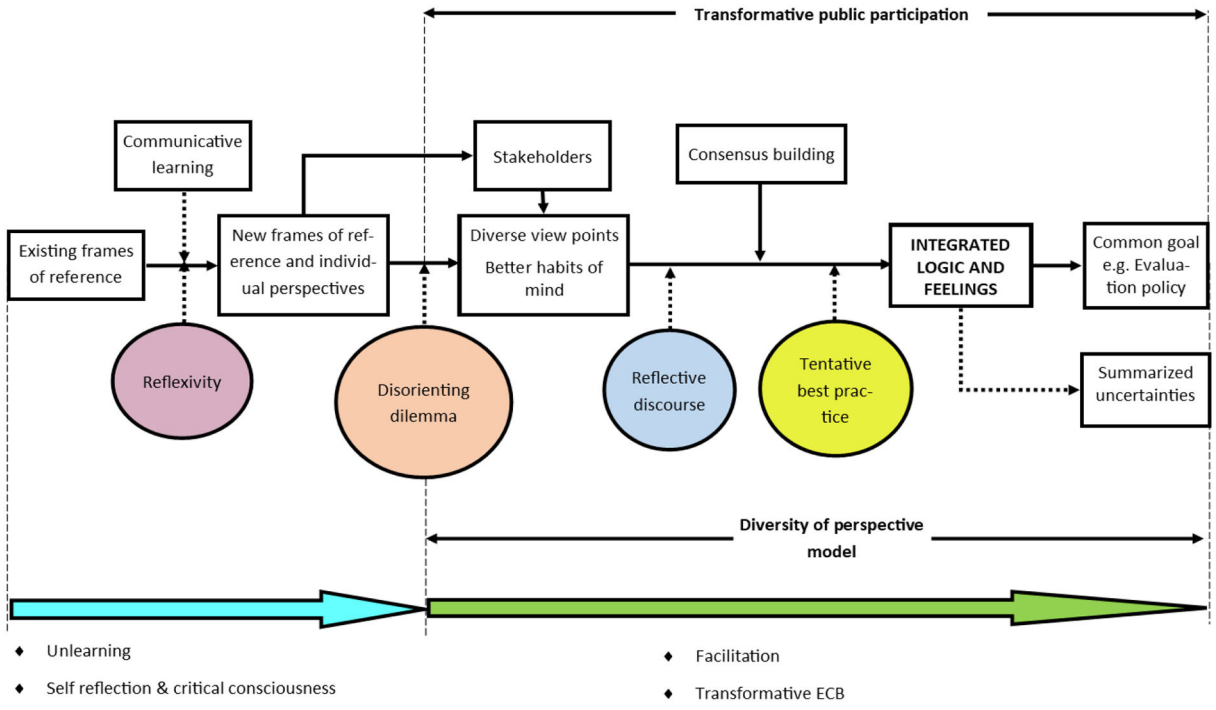

FIGURE 2
The diversity of perspectives model for evaluation policy process.

for public participation by promoting reflexivity and critical consciousness for evaluation. The framework also enhances the collection of diverse and individual evaluator and food actors' perspectives.

Step 6: Advocacy and social action

Collective action is critical in food systems because it enhances diversity, innovativeness, connections, sense of belonging, linkages, collective agency, and cultural sovereignty. Self-determination provides context for each of the collective action attributes discussed, based on the varying needs of minority groups. Diversity, for instance, provides an opportunity for food actors with varying backgrounds and cultures to come together to form a food movement. Food movements connect Evaluators, community members, and other social movements or cooperatives leading to cohesiveness, integration, and joint action. For instance, local VOPEs can come together to address social issues such as self-governance, collective economic gains, landlessness, political and economic autonomy, self-sufficiency through their own food production, raising consciousness and awareness among the people, designing strategies for liberation and empowerment, and disseminating evaluation findings.

Step 7: Evaluators taking a stand

To uphold the principles of power for all, common good, and equity, food system evaluators need critical approaches to policy and subsequently practice. Critical approaches to evaluation are developed through critical reflexivity, subsequent transformation, and advocacy. Social action and advocacy call for debunking neutrality in the face of social injustices. This is not to say an evaluator should not be objective or fair in their work. Objectivity and fairness are integral to any evaluation practice. Geerts (2019) proposes a move from "playing safe" or trying to appease everyone by acting neutral when one should take a stand. With good intentions, taking a stand is not polarizing as some critics would argue. By taking a stand and not playing safe, Evaluators create tentacular learning environments where lived experiences, as opposed to traditional indicator and Euro-western-based constructs, are shared. Evaluators should encourage diverse perspectives and give room for program beneficiaries to voice their contradicting views and actively contribute to the evaluation outcomes. ECB should make it safe to debunk neutrality and let individuals see things for what they are, however uncomfortable such discussions could be. Engaging "troublesome knowledge" involves preparing to stay with trouble by accepting to handle divisive and problematic subjects. Branlat et al. (2022) identify five measures that can help engage troublesome knowledge and ultimately enhance tentacular thinking. Enhanced food system evaluation policy should invite critical perspectives (diverse frames of reference), demanding critical reflection (reflexivity), promoting participation and commitment (diffractive pedagogy), enhancing ownership (democratic movements), and destabilizing authoritarian management and evaluation methodologies (decolonization).

2.3.1. Critique

Transformative learning effectively occurs at the level of cognition. The conundrum, however, is to get food system evaluators to this tipping point to enable reflexivity, social action, and subsequent transformative evaluation policy. In other words, it is critical to determine and ascertain the cognitive or epistemic disruptions that push individuals to engage in critical assessment. Transformative learning ought to expand backward to an individual's state of mind before critical assessment and reveal the epistemic and ontological tensions before the critical assessment stage. Such deliberate moves will elucidate the meta and epistemic cognitive abilities of individuals by determining the limits and criteria for transformative learning. The process of being critically aware of one's own biases and assumptions is a pivotal point for transformative learning because this is when individuals become conscious of the context and implications of their actions. Therefore, critical reflection leads to critical consciousness and critical assessment.

Nevertheless, important questions as to what critical assessment entails still arise. We fear that transformative learning might fall victim to scientific buzzwords that water down the intended meaning of critical non-formal learning discourse. Action research and good dissemination could lead to a better understanding of transformative learning and subsequent buy-in. Transformative learning is the most researched (Taylor, 2007) theory of adult education, signifying its importance and relevance among educators. Additionally, the point of intersection between an individual's critical reflection and those of others is not well-expounded by the theory. This concern is pertinent because transformative learning ultimately leads to social learning and the overall good of the community. However, questions arise around how individuals' critical assessment joins those of others to generate overall social learning outcomes. Further, critics also argue that the transformative learning outcomes are difficult to measure (Rodríguez Aboytes and Barth, 2020). As mentioned in the theoretical framework section of this paper, one key shortfall of the TLT is its failure to focus on social injustices and its approach to an individual instead of a holistic approach to learning. This shortfall is addressed by the transformative evaluation paradigm that improves this model.

2.4. Reflexive evaluation and food system policy agenda setting

Transformative learning theory leads to reflexive evaluation (Hebinck et al., 2021), which alters existing frames of reference and subsequently diverse stakeholder views and can lead to consensus building opportunities (see Figure 2 above). Reflexive evaluation can present diverse policy alternatives and trade-offs based on reflective discourses and food system needs. We propose that these newly transformed emerging critical food system evaluators may be prepared and well-positioned to use the evaluation conclusions to effect policy changes in the food system domain. In particular, we propose the multiple streams framework for policy agenda-setting as a potentially fruitful framework through which they could do so. The multiple streams agenda-setting framework (discussed below) places reflexive evaluation outcomes in a political setting leading to their relevance in informing public policy.

2.4.1. Agenda setting

Food is important; without it, there is no life. Food insecurity and related ills such as high prices, inadequacy due to failing crops and prolonged droughts, and highly capitalized food distribution networks make it a wicked problem. Head (2008) identified complexity, uncertainty, and "divergence and fragmentation in viewpoints" (p. 103) as key wicked problem identifiers. Food systems are complex (Slocum, 2007; Godfray et al., 2010), highly uncertain (Patel, 2009; IPES-Food, 2020), and divergent (Slocum, 2007; Alkon and Agyeman, 2011); hence the need for meticulous policy agenda setting and inclusion in mainstream local political agenda. Local policy processes encompass five key stages, critical among them is agenda setting (Liu et al., 2010). According to Liu et al., agenda setting is the first and most critical stage for a policy process. Subsequent policymaking stages include "alternative policy considerations, policy formulation, decision making, and policy implementation" (Liu et al., 2010). Liu (p. 71) define agenda setting as the "process in which certain public problems are identified, recognized, and defined, and specific solutions or alternatives are generated, considered, and attached to these problems." Agenda setting helps identify and define social problems. A relevant framework for illustrating the agenda-setting process is the multiple streams framework.

Kingdon's multiple stream framework identifies key aspects of policy agenda-setting which are (1) the problem stream which attracts attention to the policy issues, (2) the policy alternative stream, and (3) the political stream. At the center of these multiple streams are policy actors or facilitators, who Kingdon (1995) classifies as government officials, experts and scientists (including evaluators), interest groups (food movements), the general public, mass media, and local political actors. Emerging studies place local/community policy actors at the center of policy agenda setting, bearing significant implications even for national level. Baumgartner and Jones (2009) as cited in Eissler et al. (2014) debunks the "simplistic understanding of states as laboratories of democracy". Instead, Eissler and others emphasize the bottom-up policy agenda setting approach, one where local communities and municipalities influence the state-level policy agenda which then impacts the national policy agenda construction process.

2.4.2. Working with stakeholders and public participation

Stakeholders, according to Bryson et al. (2011, p.1), are "individuals, groups, or organizations that can affect or are affected by an evaluation process and/or its findings". Bryson proposes four categories of stakeholders in evaluation processes: those who have decision authority over the program, those who have direct implementation responsibilities of the program, intended project beneficiaries (direct and indirect beneficiaries), and those disadvantaged by the program. Stakeholders may be organized into interest groups or act as individuals, depending on context and stakeholder group. Interactions between stakeholders can take many forms, ranging from relatively hands-off to deep collaboration.

In more deeply collaborative arrangements, evaluators can fill the critical role of facilitator. There is some concern that evaluators' professional contributions can be marginalized if stakeholders get too involved in and subsequently dominate evaluation processes. On the other hand, stakeholders typically have critically important local and situational knowledge that evaluators lack. The question is, where do we draw the line between stakeholder engagement and the weight of evaluators' professional opinions? These are questions subject to further inquiry.

Legitimate participation requires ongoing negotiations so that evaluation policies for food systems are accepted and adopted. Stakeholders influence movements' management and development foci, and can influence decision-making processes. Stakeholders can affect roles, relationships, policy focus, and policy effectiveness.

For food systems, proper analyses can help evaluators or concerned institutions to identify the range of stakeholders, their level of influence, and the roles they play. Proper stakeholder identification and analysis is the first step in mapping food systems. The identification process outlines the level of importance of the stakeholder, with the most important stakeholders occupying the central role, closest to the project (Bryson et al., 2011). However, caution should be taken not to wrongly assign importance/relevance based on premature assumptions. This can lead to wrongful conclusions where an actor occupies the wrong layer of the food actors' map. This analysis helps to streamline policy/program planning, implementation, and evaluation. Further, the food actors' analysis helps identify existing relationships between stakeholders and how these relationships can be leveraged to alleviate food problems or address policy gaps in communities. Stakeholder analysis helps determine the feasibility (technical and political) of community food initiatives and improves the chances of policies meeting their objectives.

Existing models of stakeholder engagement may be drawn from as food system evaluators design participatory processes. For example, the consensus-building approach (CBA) offers a structured model for facilitated stakeholder engagement based on the objective of reaching agreement that all parties can live with through deliberative dialogue (Susskind et al., 1999). The CBA and various other strategies for collaborative evaluation and governance are designed to bring together the range of perspectives and interests using discursive techniques to facilitate meaningful dialogue and ultimately generate better outcomes. Key to the success of these strategies is bringing together the full suite of stakeholders, some degree of interdependence between them, and facilitating "authentic dialogue" among them (Innes and Booher, 2018). Innovation and creativity are common features of these stakeholder engagement strategies, as groups work together to figure out what will work for all. Nevertheless, such co-creation can still be extremely challenging, not least due to lack of institutionalization; processes are typically *ad hoc* and often ill-equipped. Politicians and other powerful actors can also interfere with processes to unduly advance their personal interests. Other challenges include disparities in access to resources and capacity between stakeholders, the reluctance of parties to engage and failure to see the benefits and interdependencies, the potential to miss key stakeholders, and variability in the quality of representation provided by those at the table.

2.4.3. Policy implementation

Community food systems and movements' governance structures influence policy formulations, adoption, use, implementation, and enforcement. Governance is defined here as traditions, institutions, and processes that determine how power is exercised, how citizens are given a voice, and how decisions are made on issues of public or organizational concern. Food movements are about giving a voice to the people. Governance entails decision making processes, and answers the question of who gets involved in a decision or policy process. What is the existing framework or process for evidence collection, learning, and decision making? Further, it is crucial to determine the level and type of actors in a food system. Food actors determine successful implementation or success of policies in a system. Other important considerations if policy implementation is to be successful include questions such as who are the players in the policy process and how close to or distant are they from the center of activism? What influence do these players wield? For the success of a policy, the proponents of the policy must determine, in the governance structure, who wields what power and commands what level of influence. These are most likely the same people who influence those that make decisions. In most dispensations, it is these people with considerable power that determine the mode of governance in food systems and run the risk of using these privileges for their personal benefits at the expense of community members.

While in some food systems evaluation reports are genuinely used to improve services, in others, evaluation is meant to

identify what went wrong and create more control measures for evaluators (Molas-Gallart, 2012). Evaluation gives confidence to food actors that food initiatives are on course and that the intended objectives are being met. In some low-income countries, however, external/foreign evaluation professionals get imported to evaluate community food systems without much regard for existing community structures or cultures. Every food system exists in a context and culture which requires input from the locals and local evaluation experts who understand the cultural dynamics of the country. This is not to say that partnering with international professionals is less desired. In fact, we are advocates for cross-border partnerships and integrations. Our intention here is to promote local solutions for local problems and acknowledge local professionals. The focus is to cede power and let local actors take leadership and equally participate in knowledge generation. With local solutions for local problems, food movements should fully utilize evaluation recommendations that ultimately feed into the mainstream public policy agenda for greater good. We conclude by summarizing a handful of recommendations for practice and further conceptual and empirical research to extend these initial proposals further.

Recommendations

(a) Evaluation for policy making. We take cues from Bisoffi et al. (2021) who argue for science-based policy making. In this article, we argue for an evaluation-informed public policy agenda. We propose that enhanced food system evaluation should feed into local, national, regional, and ultimately international food policy agendas. Transformative evaluation that incorporates evaluators' reflexivity and their roles in advancing social justice can help unearth underlying social nuances in food systems for robust and comprehensive policy processes. These approaches save communities from abstract top-down policy designs devoid of community aspirations and needs.

(b) Design local solutions for local challenges. COVID-19 laid bare food systems vulnerabilities, challenging the over reliance on market-based approaches to food production, distribution, and consumption (IPES-Food, 2020; Bisoffi et al., 2021; Vittuari et al., 2021). Further, commercial and industrialized agricultural systems can negatively impact the environment, disrupting local ecosystems and contributing to the climatic challenges we now face (Whitfield et al., 2018). Local communities must take charge of their food systems and encourage local or own food production. We are in no way belittling trade or market-based solutions to food needs and we are in agreement with Bisoffi et al. (2021) who argue for the need for alternatives and shorter local and regional supply chains. We depart from assertions such as Olabisi et al. (2021) that argue for market-based solutions without a single mention of "COVID-19" or even the word "disruptions" at a time when nearly everyone in the world faced uncertainties, including those who had enough money to buy yet shelves were empty. Vittuari et al. (2021) call for active citizen participation in food production and related community-based interventions for sustainable food systems. This clarion call transcends citizens and includes local professional and advocacy groups as well. For instance, the VOPEs can advocate for better program outcomes and improve their evaluation methodologies to include a stronger local voice in community programs. The ultimate goal is an inclusive public policy agenda designed to meet pertinent food access concerns.

(c) Build capacity for evaluation utilization and evaluative thinking. Evaluation policy helps to institutionalize evaluation utilization and evaluative thinking. These are strategies aimed at inculcating the desire to implement evaluation recommendations through policy and adjustments to improve program delivery and outcomes. Evaluative thinking on the other hand includes critical thinking, inquisitiveness, and deeper understanding of complex issues in the context of evaluation (Buckley et al., 2015). Evaluators must build food systems' capacities to utilize evaluation and develop the critical need for evaluation.

(d) Build local technical skills to evaluate and engage in policy advocacy. The recommendations by Fanzo et al. (2021) inviting enhanced rigor in evaluating food systems is welcome, although most evaluators could use further explanation of what this rigor might entail. This article attempts to address this by proposing enhanced evaluator's capacity to critically engage stakeholders and recommend actions for public policy intervention. HEIs, for instance, provide platforms for retooling local technical skills to evaluate and advocate for better food policies (Vittuari et al., 2021). The HEIs, through community-engaged higher education and action research, can impact the lives of emerging food system evaluators and ultimately improve local food systems' service delivery and program implementation.

Discussion and conclusions

The overall purpose of this article is to propose evaluation strategies to help establish viable, responsive, and just community food systems, which according to Hamm and Bellows (2003) entails different community actors coming together through multi-sectoral and layered approaches to solve food security concerns at the local level. Hamm further postulates that an organized community stands a better chance of mitigating challenging food justice and access concerns. In essence, there is a need to include all important stakeholders

in the food system. Multi-sectoral, and now multidisciplinary efforts, including evaluation and policy, is critical for a concerted and collaborative effort aimed at effective, responsive, accountable, and inclusive food systems.

For resilience, food system evaluators ought to advance collective activism against capitalistic tendencies and neoliberalism, which characterize global food systems. The global food system fragility confirmed the need to consider other alternatives to market-based solutions to food access and sovereignty. Market-based solutions neglect underprivileged and socially neglected groups while trusting that somehow the laws of supply and demand would put food on their tables. These institutional and systemic biases are solved through self-determination, community-based approaches, and collective action to address agricultural and food security challenges. Collective action is critical in food activism because it enhances diversity, innovativeness, connections, sense of belonging, linkages, collective agency, and cultural sovereignty. Diversity, for instance, provides an opportunity for evaluators with varying backgrounds and cultures to come together for a common cause. Further, divergent views enhance innovative solutions to wicked problems as addressed by social movements and sound policy structures. Food movements further lead to enhanced networks among educators, community members, and other social movements or cooperatives leading to cohesiveness, integration, and joint action. For instance, local social movements can come together to address social issues such as self-governance, collective economic gains, landlessness, political and economic autonomy, self-sufficiency through food production, raising consciousness and awareness among the people, designing strategies for liberation and empowerment, disseminating agricultural knowledge, and building institutions for agriculture.

Social movements are vital learning points, and they can be critical avenues for emancipation from dominant epistemologies. Our position is that the relationship between local and international food system initiatives should be mutually beneficial and respectful, with evaluation upholding social justice through focus on underserved communities and human dignity. For instance, food sovereignty (Niewolny et al., 2017) encompasses a democratic and participatory social agenda-setting process that results in social justice and the rights to make choices. There should be deliberate food system evaluation measures to bridge the social disparities while also addressing historical concerns (Alkon and Agyeman, 2011) and continually evaluate community food initiatives (Abi-Nader et al., 2009). The evaluation would lead to establishment of synergies in the food system and creating connections instead of groups working in silos. Giménez and Shattuck (2011) further emphasizes the need for social pressure as a means to effect policy change.

There is a need to unlearn dominant beliefs and practices in food systems. As mentioned, unlearning begins with critical self-reflection to resist dominance and give a voice to others community member and, educators through agency (Diduck et al., 2012). A review of one's purpose, beliefs, values, and meaning helps promote alternative, better, culturally appropriate views instead of those we assimilate or adopt. This paper transformatively outlines food system evaluation approaches and the local food system policy implications. Evaluators should be cognizant of individuals in the food system who might undermine hard-earned gains through labels and criticisms and ultimately derail food system collaboration, learning, and adjustment (CLA). The complexities and community food system dynamisms encompass cultures that still consider women and younger evaluators subservient to their male counterparts. These complexities call for critical food systems' evaluation approach, where different perspectives and viewpoints are considered when designing solutions. We acknowledge that it is not easy to stand against bigotry and dominance, save for when courage, strong value-systems, and empowerment (Geerts, 2019) are guiding principles to emerging evaluators.

Food system complexities include local political and policy agendas that now, in the wake of food system vulnerabilities, must feature public policy agenda for sustainability. We call for goodwill when designing and implementing food system evaluation and their implications for local political and public policy agenda. Emerging food system evaluators should read the room and rise above partisanship to lead an onslaught of change in the evaluation spaces while championing inclusion in public policy discourses. A clarion call for concurrence and unity among evaluators vide an enhanced public and evaluation policy framework for stronger and sustainable food systems.

Author contributions

DO conceptualized and wrote the manuscript. KN, NN, TA, and TS contributed to food systems, evaluation, and policy frameworks. DO designed the theoretical framework in consultation with KN, TA, and TS. All authors contributed to the article and approved the submitted version.

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Studying food systems as embedded, sensory phenomena

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This article offers a theoretical foundation for pursuing transdisciplinary food systems research, informed by deep sustainability and equity, across various scales of the system. It weaves together ontologically aligned, food-relevant social theory from ecofeminism, agroecology, ecological economics, systems theory and food systems scholarship, sensory studies, geography, and sociology. The epistemologies and associated methodologies of this literature all take seriously the physical laws of nature, while also recognizing that knowledge is situated in persons and places, and that people's experiences of the world are an important part of what we can know. They all recognize the urgent need to reorient Western mental modes and their destructive, attendant material relationships. Epistemological integration rests upon ontological convergence of embeddedness, embodiment, and the context for change, calling for a methodological approach of ethnographic, qualitative, and sensory research. No conception of the food system is complete without attending to the visceral, human experiences that shape it. Embeddedness and embodiment therefore offer an avenue for connecting information across different scales of the system, from the individual to the biosphere, allowing for the macro level to help make sense of the micro, and for the micro to reflect, resist, and alter the macro. Here, a new and better world is imagined and created through our bodies, in dialogue with and resistant to hegemonic power, and sensory research is key to understanding how things must and could change.

KEYWORDS

food systems, transdisciplinary, sustainability, embeddedness, social theory, methodology

Introduction

How do we imagine a better world? This is, arguably, a fundamental question of our time, perhaps of any time. It can be interpreted two ways. What do we imagine a better world would be like—what components would make it preferable to our current reality? And, equally, how do we go about imagining something that does not exist, stretching our imaginations past what appears immediately possible?

Those of us in science, particularly the applied sciences, spend a lot of time thinking about problems and grasping for solutions. Our culture has been shocked out of its illusion of progress and wellness and into an increasing awareness of what critical scholars, advocates, and disenfranchised communities have known for a long time: that the very structures of society and economy are eating away at any long-term sustainability of human civilization. The logic of accumulation, domination, and separation from nature that underlies Western society exploits humans, other species, and ecosystems alike (Mellor, 1997; Merchant, 2003). "One of the penalties of an ecological education," Aldo Leopold wrote nearly a century ago, "is that one lives in a world of wounds" (Leopold, 1993, p. 67). These days, we live in "a world of hemorrhage" (Brown, 2016).

Ecological awareness does not by itself solve anything. The trouble is, all major problems we face—in energy, environment, climate, food security, and economics—can only be fully understood when seen as interconnected and interdependent (Capra and Luisi, 2016, p. 362). We see reformist remedies fail time and again because they do not root out the underlying worldview that originates the issues.

One of the most effective places to start dismantling the perception of hierarchy and the manifestations of domination is with food. Food is the immediate, visceral locus between human and environment, the place where the boundaries of our bodies are so clearly permeable, in constant physical dialogue with the world and culture around us. It blurs the boundaries between self, society, and the entire world. This fundamental relationship is a critical place for repair—our existence depends on it. It is also a site of ongoing resistance against the alienations of capitalism, as people are already trying to change the world through the way we grow, share, and eat. Food cannot truly be understood or leveraged, however, with the same objectifying and distancing lens that causes crisis in the first place. We must remove the assumptions of domination from our work. We must do so with the intentional choice of theory, questions, and methods that see the world in its whole, connected state.

Food systems is a developing field, and how to more effectively and equitably pursue its study remains an open question. Those of us practicing transdisciplinarity have nearly endless methodologies available and no traditional pathway for rigorous processes occurring at the intersection of established fields (Creswell and Plano Clark, 2007). The field has not yet attended carefully to the sensory and embeddedness insights inherited from anthropology and social theory broadly. We have an incomplete conception of the system when we leave out the human body, and I argue here for integrating social theories of embeddedness and embodiment and ethnographic methods into systems framing and analysis. These material and social aspects must be tied together using a coherent theoretical framework, for truly transdisciplinary research that attends to lived experience: the root of human reality and our understanding of the wider world.

This article therefore offers a theoretical weaving of aligned, food-related scholarship as a framework for researching food systems as they are now, and as we might strive for them to be. The weaving includes a justification for action-oriented research and a blending of literature on feminist studies and ecofeminism, agroecology and sustainable agriculture, ecological economics, systems theory and food systems scholarship, sensory studies, geography, and sociology. This diverse literature ties together through notions of embeddedness, embodiment, and the context for action, which build to a cohesive transdisciplinary methodological approach. It is an argument for and invitation to study food systems with particular attention to the social and environmental values they manifest. Precisely because "systems" are far-reaching and enormously complicated—and thus abstract in our attempts to represent them—attention to relation requires sensory and social interrogations. A better, more sustainable world currently exists only in our imaginations: which is to say, in our bodies.

Food's connective power

Food is a natural place for reimagining human-natural systems. It is an obvious, tangible, constant connection between humans and the rest of nature. It is both emblematic of, and a material contributor to, distressed environmental and social relations. There is a huge corpus of literature on how food, particularly agricultural production choices and food waste, negatively affects the environment. For instance, a systematic review of climate change causes found that food is one of the largest contributors and, therefore, one of the ripest places for change (Hawken, 2017). Although estimates differ, many agree that food systems contribute between about 20 and 30% of all greenhouse gas emissions (e.g., Vermeulen et al., 2012). Agriculture causes many other environmental harms as well, including soil degradation, water pollution, and decreased biodiversity, among others (Cleveland, 2017). Additionally, the effects of climate are both disproportionate in cause and effect: rich countries emit much more while poorer countries feel much greater climate effects, on average (Kreft et al., 2015; Piketty and Chancel, 2015). Thus, food is a place of relational crisis, both in terms of human relationship to the environment and also with each other. If we try to pick out anything about food, we find it hitched to everything else in the world (cf. Muir, 1911). It represents many aspects of human experience; it is both material and abstract, biological and cultural, ephemeral and ongoing, scholarly and domestic, theoretical and quotidian. It also possesses enormous possibility for reform, as seen in recent efforts to re-embed food systems in ecosystems and cultural practice.[1]

Because it touches so many arenas of human and non-human life, we must examine the connections to see the whole picture; food's multi-faceted and interconnected nature requires us to see it through more than one discipline at once, and at vastly different scales. Its environmental entanglement, cultural primacy, and biological imperative mean that we must study it in terms of the systems in which it operates. As a body of study, food systems encompasses all the physical and social components, actions, and consequences of food. It involves interaction between human and biophysical environments, including many activities (from production through consumption) and many outcomes (from food security to environmental effects to social welfare; Ericksen, 2008). Outcomes range in scale from individual wellbeing to the human breaching of planetary natural resources boundaries

1 Recent efforts are especially notable in agroecology, food sovereignty, and regenerative agriculture research and action. Agroecology, a science, movement, and practice (Wezel et al., 2009), both studies and advocates the application of ecological concepts and principles to food production, for better environmental and health outcomes (Food Agriculture Organization of the United Nations, 2019). The field of food sovereignty, intricately connected to agroecology, asserts "right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems" (Via Campesina, 2007). More recently, the buzzword of "regenerative agriculture" has reached mainstream conversation in the United States (e.g., Feldman et al., 2020; Velasquez-Manoff, 2018; Drawdown Solutions, 2017). For a review of how agroecology and food sovereignty's struggles and opportunities to more fully embed practices in local culture and practice, see Morgan and Trubek (2020).

(Ingram, 2011); even on the small scale, food activities are linked to global challenges. Primary areas of concern often identified in food systems—all complex and multidisciplinary in their own right—are the economic, social, and environmental, also known as the "three pillars of sustainability" (Allen and Sachs, 1991; Van Cauwenbergh et al., 2007). Whenever possible, attending to all three as intertwining strands, rather than standalone pillars, creates a more comprehensive picture of causes and effects.

Food's connective power means that understanding it requires not only seeing systems' manifestations, but also the values and relationships driving those outcomes. As Tsing (2015) writes in her treatment of foodways and capital accumulation, the global history of wealth concentration has been a history of alienation, of both people and things. "Alienation obviates living-space entanglement" in which we all exist (p. 5). Yet food contradicts attempted alienation. Some of us may be able to distance ourselves from how food is produced, distributed, but at the supply chain's end, we arrive at the most intimate moment of connection: we absorb that alienated thing into our own bodies, and remake ourselves with its matter (Alaimo, 2017). Even scalable, capitalist modes of production cannot fully erase living-space entanglement.[2] Worthy food systems scholarship incorporates such patterns of connection and reconnection. Whether people are trying to reconnect through food or to food is an open question—but narratives of separation and connection weave throughout empirical analysis I have conducted on these questions (Morgan, 2021).

Connections across disciplines

The Anthropocene era of human-dominated earth systems requires particular ways of thinking: economically heterodox, transdisciplinary ontologies and methodologies, ways of seeing both the problems and potential alternatives (Crownshaw et al., 2018). The same conceptual orientation is needed for food research in this era. Traditionally, agriculture, for example, has been highly disciplinary and focused on natural sciences, measuring success primarily in economic terms and not accounting for environmental, social, or unequal economic impacts (Francis et al., 2008). At the most egregiously disembodied end of the spectrum, a Nobel laureate economist has argued, for example, that because agriculture only accounts for a small amount of GDP, destruction from climate change will be of minor impact on the economy—as if that would not end all human life (and the economy with it; Daly, 2000). Food disciplines "from anthropology to zoonosis" remain relatively siloed in different parts of the food chain (From Silos to Systems, 2020), siloed away from social considerations. Food systems study, on the other hand, is by nature transdisciplinary: a cross-boundaries attempt at holism, informed by systems theory. For systems thought leader Meadows (2008), the "right boundary for thinking about a problem rarely coincides with the boundary of an academic discipline" (p. 98). In food, from seed to waste, that system leads from ecology and its subdisciplines through agronomy, technology and physics of distribution, economics, labor, food culture, food regulation and policy, geographic context, health and nutrition, gastronomy, social practice, nutrient cycling, and biosciences from climate to waterways—to name just a few. Transdisciplinary research can offer a better understanding of these kinds of complex contexts in socioecological systems than traditional academic silos (Knierim and Callenius, 2018). It is conducted explicitly to solve complex, multi-dimensional problems that involve the interaction between social and natural systems (Wickson et al., 2006; Knierim and Callenius, 2018). It is distinct from multidisciplinary and interdisciplinary research, which are organized around themes or around groups of people (Wickson et al., 2006). Transdisciplinary research is instead an integration, not merely a collection, of several disciplines all brought to bear on the same subject (Méndez et al., 2017). A wide diversity of recent food-and landscape-related studies take a transdisciplinary approach and defend it as critical for understanding their subjects' complexity (e.g., Farley et al., 2011; Morse et al., 2014; Mares, 2017; Méndez et al., 2017; Trubek et al., 2017). Despite this increasing recognition, the human bodily experience has generally not been integrated into data collection or analysis, although there are important and instructive exceptions, especially from geography and critical food studies (e.g., Turner, 2011; Slocum and Saldanha, 2016; Sarmiento, 2017).

The transdisciplinary field of ecological economics has long debated the merits of free-for-all methodological pluralism vs. a reasoned and intentional selection of complementary epistemologies and methodologies: complementary in that they share an overarching ontology and are not in foundational conflict, lest the resulting findings be essentially meaningless (Spash, 2012). Complementarity is necessary for new transdisciplinary fields to conduct good science outside the established processes of a particular tradition. It is also, I believe, the only way transdisciplinary researchers will convince academic traditionalists that the knowledge we generate is legitimate and enduring, particularly those of us in social and especially qualitative sciences. Developing rigorous food systems methods involves connecting knowledge bases that are compatible enough to generate coherent results. The epistemologies and associated methodologies reviewed below all take seriously the physical laws of nature (Spash, 2012) while also recognizing that knowledge is situated in persons and places (Haraway, 1988) and that people's experiences of the world are an important part of what we can know, in line with a lineage of feminist thought that exists in a space between realism and relativism (Koggel, 2007). In the context of empirical work, the balance between these stances may arise in a number of ways, including the complexities between different measures of environmental impact when considering "sustainability" in agriculture; or recognizing that people's food and diet choices are socially meaningful, involving, but not reducible to, discrete measurements of nutrient intake or carbon emissions. It also means incorporating practitioner and citizen knowledge as legitimate and significant (Scott, 2016).

Such a multi-faceted perspective shows up in various inter- and transdisciplinary fields linked to the study of food systems, including ecological economics, agroecology, food agency theory, and systems theory. I draw upon all of these—along with anthropology, geography, sensory studies, sociology, and

2 For example, even highly automated, conventional dairy farms rely on human care work for cows to survive and produce milk (Overstreet, 2018). In this case, capitalism relies on, rather than erases, connections between people, other species, and the places they produce food.

philosophy—as complementary ways of understanding agriculture, the food economy, embodied experiences, the relationships between them, and the larger systems within which they exist (different food systems scholars may assemble different groupings, but they should be similarly compatible). One way of framing this approach is "ecological thinking," as offered by feminist theorist Code (2006) as a response to the reductionist, atomistic, Cartesian tendencies that dominate much of science (Merchant, 2003; Plumwood, 2003). The features of this approach are the braiding of epistemological, moral, and political research implications; use of multiple disciplines; knowledge as provisional, dynamic, and changing; possibilities and limitations arising from context; "responsible knowing" as a product of engagement with the world and with critical reflexivity; and the upholding of material and embodied realities (Koggel, 2007, p. 180). "Ecological thinking, then, can be said to have promise for capturing the complexity of a world that reflects the continued effects of histories of oppression, colonialism, and imperialism and the ways in which global factors are increasingly shaping and reshaping people's lives, communities, ecosystems, and the world as a whole" (p. 179). In other words, it reflects the complexity of causes necessary for repairing the effects. This way of thinking is imperative. It is also a tall order for a scientist who needs to draw a boundary around a research subject. I discuss methodological approaches to grounding such an encompassing view in practicable empiricism.

Sensory and change-oriented research

A world in crisis and transition will, of course, affect academia along with everything else. The world is in third-wave countermovement to privatization; a global reaction against the commodification of nature, land, and natural resources (Burawoy, 2009).[3] Living in such a countermovement reframes the understood role of the scientist. The trend toward research intended to make an impact is happening in various social science fields, both theoretically and methodologically (Pink, 2015). Intellectuals have a dual task, both analytical of the world as it is and normative about how it could be (Burawoy, 2009). It is not accurate to posit research as value-neutral, because the act of attention to a problem is itself a value judgement, as is any analysis of its possible solution. And if research is not value-neutral, scholars have the responsibility to choose their subjects to reflect both reality and what could yet come into being. Because of our own inherent subjectivity, interpreting the world is ultimately inseparable from changing it (Shotwell, 2016). I therefore rely on scholarship concerned, explicitly or implicitly, in diagnosing and repairing problems in the food system related to "white supremacist, colonial-imperialist, hetero-patriarchal capitalism" and problems in the Anthropocene (Khasnabish, 2019, p. 6), as I subjectively and with extensive evidence diagnose these as the most damaging drivers of environmental and social exploitation in our time.

Awareness of human-generated crises in ecological and social justice has arisen alongside what has been called the "sensory turn" in ethnographic scholarship, in which scholars pay greater attention to what can be learned from the human senses. This "turn," detailed below, is part of a wider shift in how academics understand the world and how we might intervene in its workings, through design, education, policy, education, or community engagement (Pink, 2015, p. xii). Paying attention to these future possibilities, as they play out in daily efforts, can be termed "ethnographies of the possible" (p. 47), inherently linked to change-based research.

Huge research gaps remain in this process. Although the idea that we need to radically transform human systems is becoming more widely acknowledged, it does not necessarily come with the knowledge about how to get from here to there (Gobby, 2019), or even where there is. What, exactly, are we working toward? While we ponder this, the world continues to transform. In a world of constant upheaval, the question might not be how to create change, but how to shape it (Gobby, 2019), through deep knowledge of what is being attempted and its odds of success.

Embedded, embodied, emplaced

In line with a transdisciplinary systems lens, in line with ecological thinking, this approach to food systems study is at its core informed by a theory of human embeddedness in the broader world. Theory is an underlying component of any scientific endeavor, whether explicit or not, and how we make sense of the world's "infinite manifold" (Burawoy, 2009, p. 13). The approach is also framed by the normative ideas that sustainability and justice are important in their own right and critical to the thriving and survival of humans and the rest of nature. Again, this framework is informed by theories from various complementary disciplines, which are necessary for understanding food in all its complexity—as a system, a material object, a cultural phenomenon, and a personal and universal experience.

The term embeddedness originated in social theory to describe how the market economy functions within, not independent from, the larger social world (Polanyi, 1971). It has since been used more generally as a way to understand the context of various social phenomena (Schmidt, n.d.). In current food systems literature, embeddedness may refer to the relationship between economic and social behavior (Migliore et al., 2014) or more broadly to "the context in which actions take place, the values that drive those actions, and the manner in which the two affect and are affected by one another" (Ament et al., 2022, p. 6). The market is embedded in social contexts, and likewise our social contexts include market sensibilities (Hinrichs, 2000).

I also follow categorizations from ecofeminism and cultural anthropology, which argue that human activity takes place within broad environmental and social contexts and must be understood as such. In ecofeminism, embeddedness goes beyond "shallow

3 The process by which nature and "natural resources," itself a contested categorization because of its anthropocentric framing (Brown, 2004), become exchangeable, both in terms of trading private property, and in terms of being indistinguishable from each other. The counterpoint to this is that nature and place are highly specific, not under the pure domain of humans, and valuable in their own right far beyond market mechanisms. For an overview of how (Western) humans developed this idea of nature, see *A History of the World in Seven Cheap Things: A Guide to Capitalism, Nature, and the Future of the Planet* (Patel and Moore, 2017). A "classic example" of the commodification of household activity is food (Wright, 2010).

ecology"[4] to say that humans not only rely on the physical environment, but are interconnected and interdependent with the entire natural world (Mellor, 1997, p. 1). The fact of *immanence*—that humans live embodied lives, embedded in physical worlds—has serious implications for understanding food as both a relational and physical object. As ecofeminist scholar Mellor (1997) writes:

> Awareness of immanence makes the concrete relations of any product virtually infinite. Who grew/extracted the raw materials? Who made the components? Who made the transport that brought it here? Who drove it? What energy was involved? How do all those people live? What do they consume to support their work? What emissions or elements will the object and the processes that created it break down into? Where will they go and with what effects?... the life history of a product destroys the neoliberal notion of the independent consumer and the autonomy of economics processes. (p. 195)

Ecofeminism argues that the logic of domination and accumulation that capitalism applies to natural resources is mirrored in its treatment of women, people of color, and other exploited groups. Therefore, true sustainability can only be achieved by reconfiguring our cultural and economic relationships both to the environment and to human citizens. After nearly a decade of pause in the field, young scholars (e.g., Abatemarco, 2018; Ruder and Sanniti, 2019; Ament, 2020) are taking up ecofeminist theory and allied scholarship (e.g., Shotwell, 2016; Alaimo, 2017) as it is uniquely suited to connect and explain the multiple forms of domination and exploitation we see across humanity and more-than-human lifeworlds; it is likewise uniquely suited to get at the root causes and therefore possible solutions. While it has been justifiably critiqued at times for being overly white-centric in its outlook and authorship, ecofeminism is, and should be, intersectional (Kings, 2017); it recognizes domination to be spread across identities including gender, sexual orientation, class, and color (Mellor, 1997). Ament (2020), writing in the tradition of ecofeminism and ecological economics, argues that an ontology of social and environmental embeddedness comprehends that "an objective biophysical reality exists independent of humans, ecological and social processes are interconnected and co-evolutionary, and facts about social and environmental reality are inseparable from values" (p. 171). We are products of the social and environmental contexts in which we operate, affecting and affected by them.

Embeddedness underlies other fields directly applicable to food. Ecological economics, for example, argues for understanding the economy as nested within the biosphere, taking in materials and expelling waste (Daly, 1992), subject to the realities of resource flows and of physical laws (Georgescu-Roegen, 1975). The current ecological crises of agriculture occurred because agricultural and economic systems do not allow for the physical realities of ecosystem functioning (Farley et al., 2011). In agroecology literature, agriculture is understood as embedded in ecosystems (agro-ecology) and in broader social systems, integrating ecology, society, and economics (Simón Reardon and Pérez, 2010). Embeddedness is especially important to understanding alternative food systems projects, which are often driven by explicit acknowledgment of the contexts in which they operate, and by social and/or ecological values rather primarily by profit (Sonnino and Marsden, 2006; Galt, 2013; Jones and Tobin, 2018; Ament et al., 2022).

The goal here is to identify which fields' methodology will illuminate the parts of the system we deem most important to consider. This is the reason ecological economist Spash (2012) argues strenuously against using neoliberal economic methods, because the underlying ontology and epistemology imports foundational assumptions about the world that are directly at odds with research on nested biophysical and social systems. Similarly, agroecologists would not argue for purely economic measurements of agroecosystems because the approach ignores the very systems, ecology, and resiliency about which the field is most concerned. Transdisciplinary food systems scholars must lay out its guiding lens and design research accordingly.

As Mellor's explanation of immanence makes clear, notions of embeddedness lead to notions of embodiment, connecting human-natural relationships across scales. As a term, embodiment has a complex lineage throughout social sciences, including anthropology, cultural studies, philosophy, and sociology. In anthropology especially, it refers to the "porous, visceral, felt, enlivened bodily experiences, in and with inhabited worlds" (Harris, 2016, para. 1).[5] Like feminist critiques of Enlightenment science, embodiment inherently rejects mind-body dualism, which puts (supposedly male) mind-based rationality above felt, "feminine," more animal bodily concerns. Instead, embodiment integrates different methods of cognition in the world (Lock, 1993). Embodied epistemology has been called "knowledge-in-action that is the basis of social practice and world making" (Wolputte, 2004, p. 258), similar to the multifaceted understanding of agroecology as a science, social movement, and (embodied) practice (Wezel et al., 2009). This is a strategy for linking broad domains of inquiry about food systems and ensuring that they are ontologically compatible.

One of the most direct, tangible ways of reconnecting to the realities of food is through our human senses. An embedded, embodied understanding of ourselves—as in and of the biosphere, as beings with breachable boundaries—changes one's perception not only of what to study, but how. Three decades ago, Haraway (1988) called for a "feminist objectivity" in science. This was, she claimed, the recognition that all knowledge is situated in a particular place and is partial, because humans are not all-seeing. One could call this "science from somebody." Other scholars have since called for generating knowledge, rigorously, from our selves. Feminist legal scholar Scott (2016), for instance, collaborates with citizen scientists on polluted indigenous land reserves in Canada. There, where the government and industry do not collect adequate

4 The implication that ecological function is only important insofar as it relates to human interests.

5 There are many ways in which embodiment shows up in anthropological literature, let alone in other disciplines. Broad sub-fields of embodiment in anthropology include aesthetics, autoethnography, bioethics, biopower and politics, social/material/spiritual aspects, gender, kinship, race, economics, cultural/national identity, and sensory studies, including taste (Mascia-Lees, 2011). Social/cultural aspects of embodiment, taste, and sensory studies are especially relevant to empirical work on sustainable food systems. A review of relevant sensory studies literature follows.

data about ongoing chemical contamination, residents use their own bodies to generate knowledge about their environment, monitoring pollution through their physical senses. Scott explores this body-place dialogue through "paying attention to and with" the body (p. 277, emphasis original).[6]

In studying the margins of global capitalist food chains, Tsing (2015) contemplates that it "is time to reimbue our economy with the arts of noticing" (p. 132), in an anthropological sense—to make again personal and immediate what has become distant and homogenous, and consider that process of knowing to be legitimate. We need to take this approach not only with the economy, but also with the entire food system. Scholars, notably also from anthropology, have begun this work (e.g., Gould, 2005; Trubek, 2008; Højlund, 2015; Mann, 2015; Mares, 2019). It is time to bring such observations from the anthropology of food into food systems analyses more generally.

To this end, as mentioned above, social sciences and humanities in recent decades have undergone a "sensual revolution," necessary for a full understanding of cultural and personal experience (Howes, 2005a), both fundamental aspects of the study of food. Sensory ethnography in particular has been used across disciplines, both scholarly and applied (Pink, 2015). Such new efforts undermine historical Western hierarchies of the senses, starting with Aristotle and Plato and continuing through Enlightenment Europe, which posit sight and hearing as "higher" senses, associated with rational thought because of their distance from perceived phenomena; and smell, taste, and touch as "lower," associated with women, workers, and non-Westerners, in part because of the immediacy and more "animal" nature of these senses (Howes, 2005a,b; Mazzio, 2005).[7] These are, of course, the senses most directly related to the sensations of eating food. This philosophical tradition actively advocates a separation of humans from the world and puts more trust in the senses understood to be distancing and abstracting of that which is perceived. Medieval, Renaissance, and Enlightenment thought continued this trend, establishing "a subjectivity separated from nature, protected by mediation, and propelled by a desire born out of the very estranged relation thus created" (Stewart, 2005, p. 62). The historical suppression of sensory powers in Europe corresponded with patriarchal science's oppression of women, "witches," and domestic and healing knowledges (Classen, 2005b)—like ecofeminism, linking patriarchy with the suppression of diverse ways of being and knowing. Even a socially-oriented field like agroecology, for instance, has not fully integrated the embodied and sensory practices of cooking and eating into the analysis of agroecosystems (Morgan and Trubek, 2020).

Scientists now, however, may engage with all senses as ways of knowing through the body, with the recognition that the senses mediate "between self and society, mind and body, idea and object" (Bull et al., 2006, p. 5). A sensory approach to science blends the different theoretical traditions on which this article draws. Using the senses to generate knowledge rejects the classical mind-body dualism critiqued by ecofeminism, by recognizing that the mind is itself embodied (Bull et al., 2006). Cultivating the senses is a way to recover power over the body from the economic alienation of capitalism (Stewart, 2005). Understanding place, in particular, is a multisensory endeavor, involving not only sight but all the senses (Feld, 2005; Bunkše, 2007). According to some sensory scholars, an extension of embodiment is emplacement, which "suggests the sensuous interrelationship of body-mind-environment" (Howes, 2005a, p. 7)—another way of seeing nested systems, or the body-scale within the landscape-scale. Even the question of sustainability may rely on human sense, for it is through our senses, directly or through the extensions afforded by technology, that we track environmental damage (Scott, 2016). Human meaning exists "in the contingencies of the body itself, and with its environment" (Connor, 2005, p. 230); embodiment can be understood as the biological process of relating to the environment (Pink, 2015).

The sensory turn in science shifts not only what we can imagine, but how we might intervene in the world. As sensory anthropologist Howes (2005a) argues, social revolutions are sensory revolutions. Put another way, "the way a society senses is the way it understands" (Classen, 2005a, p. 161). Changing the world, and especially the food system, cannot be accomplished without the integration of human sensation—how we connect to that wider world.

Reconnecting across scales with the senses

Following conceptions of human embodiment and embeddedness, I argue that food systems scholarship should explicitly attempt to reconnect across scales: the body and the system, in relational crisis, linked through food. Often, when people write about "the food system," they refer to the global or national network that encompasses all food activities from seed production through growing, harvesting, processing, distributing, selling, preparing, eating, and disposing of food—and all the macro forces that influence those activities. Within larger systems, however, are always smaller, nested, embedded systems (Meadows, 2008). A country's entire agricultural system is one, as is the immediate food system of a surrounding community, and the dining program of a local institution. Each system has its own goals, dynamics, and specific contexts. And each exists within, and in reference to, the larger system around it. This does not mean that a nested system always acts in perfect concert with a larger one (Meadows, 2008). Sustainable agricultural projects, for instance, can express multiple kinds of values, including relational ones, while operating within a larger economic system mostly driven by instrumental, market-based values (Jones and Tobin, 2018). But neither do nested systems operate entirely independent of the whole. To understand any particular food system, or aspect of a food system, requires not only multiple disciplines; it requires comprehending multiple scales, and the power inherent to each, even while attending to one in particular. Understanding what

6 While in some theoretical treatments, "the body" is distinct from "embodiment," many people writing about embodiment use the two terms almost interchangeably, or at least in reference to each other (e.g., Lock, 1993). Bodies, anthropologists have argued, are "a matter of meaning, experience and identity" (Mol, 2011, p. 467).

7 The "five senses" are a Western cultural and philosophical categorization, not a universal one, as various anthropological studies have revealed (e.g., Classen, 2005a; Geurts, 2005).

is at play, and what is at stake, connects everything from global biophysical limits to food production and economic activity (e.g., Meadows et al., 2004; Rockström et al., 2009; Raworth, 2017)[8] to the rich, sensory relations of places including landscapes (e.g., Bunkše, 2007; Ingold, 2009; McGregor, 2009)[9]; to the immediate experience in a human body (e.g., Carolan, 2008; Emerson et al., 2011; Tsing, 2015).[10]

The sensory realm is the primary place people engage with food; the sensory therefore is key to understanding what food means and how it manifests in people's lives. This is true not only of eating, as farming, processing, distributing, and selecting foods are also sensory endeavors. Attendance to sensual realities is especially important when we are considering alternative food systems, and where people's actions are at odds with mainstream economic logics, where meaning is interpreted and manifested through the body's engagements with the landscape and its sometimes-injured abundance. In previous research on why people participate in a high-cost, high-labor local farm, one participant pointed to health and environmental reasons, and still claimed they weren't enough to understand the full rationale, which was rooted in bodily enjoyment: "In reforming essentially local food systems, there's got to be other things involved [beyond freshness or low-input practices]… The pleasure of cooking. The satisfaction of good food" (Morgan, 2021, p. 88). In many cases, sensory experience itself is the reason for action: the search for food that tastes better, that feels better, in multiple senses of the word. In these circumstances, an abstract model, based on resources flows or neoliberal economic theory, could neither capture nor predict people's choices and their outcomes (Ament et al., 2022).

Sensory and embodied methods are necessary to illuminate what is happening in these sensory and embodied contexts. "When you look at a farm from the outside, it looks like [hard] work is the cost. From the inside, you find that the work is the reward, or, rather, the work is all there is, and it's a beautiful thing," writes one farmer, memoirist, and local food systems research participant (Kimball, 2019, p. 282, emphasis added). For researchers, such insight comes from being on the inside, embedded. Such illuminations can even come from a less embedded but still sensory approach. The aesthetics—the design principles that appear in a sensual experience—of a particular phenomenon reveal fundamental cultural inclinations (Bourdieu, 1984). This can be a direct way in to discerning (sensing) the goals and differences between alternative food projects (Morgan, 2021).

Additionally, because our senses are the way we perceive and interact with all reality, not just food—and because food always represents more than its physical manifestation—attending to the sensory in food systems studies provides data beyond the sensory information itself. As Korsmeyer (2014) writes, "…intense sense experience is not accurate described simply as bodily indulgence, it is a means by which spiritual, perhaps even mystical truths about life's transience and splendor are realized" (p. 209–10). The sensory can illuminate aspects of everything from morality (Miller, 2005) to late capitalism (Howes, 2005b).

In attempting not just to represent but to remake the world with our scientific attention, recognition of embeddedness and embodiment further allows us to reintegrate the pieces of reality broken apart by Cartesian dualism. These scientific divisions between mind/body, man/woman, and human/nature (Mellor, 1997) are the same hierarchies that underlie social and ecological damages wrought in and by the food system. Dualism is the removal of the body and therefore of sensation, and in such a view food is reduced to a mere energetic input. The visceral aspects of life, of the "fully minded-body" (quoted in Hayes-Conroy and Hayes-Conroy, 2008, p. 462; understood as both minding the body and in understanding that body and mind are one) thus move us away from atomism and toward holism: a fully inhabited, rather than disembodied, view of complex systems.

In the U.S., descriptions of embodied practice and connection with nature have been used for over a century to argue for a different way of living, growing, and eating (Gould, 2005). Sensory methods, discussed more below, can help show where, how, and even why people connect to the world, the ways they connect despite the alienations of capitalism, and through this lens we can better see the realities, the resistances, and the ways forward those resistances illuminate. Through close attention, they can also show where gaps between ambition and action in pursuing multiple goals in food projects (Morgan, 2021).

The goal of maintaining connections across scales informs a critical methodological approach in food systems. Conducting research requires a boundary around the research subject, even when the subject is understood in context (Yin, 2013). In choosing

8 Rockström et al. (2009) lay out the "safe operating space" for humanity in terms of global use of natural resources. Industrial agriculture is one of the largest contributors to breaching the boundaries of safe human operation. In *The Limits to Growth,* Meadows et al. (2004) offer a 30-year update to their original, sensational argument that endless economic growth on a finite planet is impossible because of biophysical limits. Raworth (2017) draws on these and many other scholars in *Doughnut Economics*, which argues for a new economic approach that provides quality of living for all humans—including enough food—without breaching planetary resource boundaries.

9 Anthropologist Tim Ingold argues "against space," and instead for "place," a more full and inhabited definition, and holds that culture and science are not separate but together in a meshwork of practice; generated in situations, not emptiness. Anderson (2010) discusses human emotional connection to landscape, manifested through food choice, culture, and religion. Bunkše (2007) provides a wild sensory ride through the sensual ways a person can inhabit and commune with landscapes, which are all experienced differently through human feeling. Indigenous scholar McGregor (2009) breaks down White, Western assumptions of separateness from environment and instead honors the relations that humans have with other species and places.

10 Tsing's (2015) *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins* traces the anthropological, human-level effects of capitalism in one mushroom's global food chain and shows the possibilities and the precarities of (human and non-human) life in global economic margins. Scott (2016) demonstrates how local indigenous ways of knowing, using sensory faculties, can become the legal monitoring processes for industrial chemical pollution, a locus of human interaction with larger webs of economy and toxicity. Carolan (2008) discusses the embodied aspects of knowing and posits human consciousness as situated in body and place. Emerson et al. (2011) in their guide to ethnographic fieldnote methods, remind us to hold up participants' meanings as critical, legitimate aspects of scientific knowledge.

a methodology appropriate not only for the research questions but for the theoretical orientation of a study, I have variously used mixed qualitative and quantitative methods, mixed qualitative methods, and holistic case study. Several scholars inform us on how to make such choices. Born and Purcell (2006) make a forceful argument that we cannot assume local food will generate particular outcomes such as sustainability or justice. They assert that because food systems are highly contextual, they must always be studied in context. Their argument relates to the "patchiness" of the Anthropocene era, as put forth by Tsing (2015), who uses ethnographic methods to explore the universalizing forces of capitalism and climate change and the diverse ways those forces affect different places. Sociologist Burawoy (2009) tackles multiscalar fidelity through the "extended case method," which involves attending closely to a bounded research case while recognizing and teasing out its connections to related macroprocesses. Specific to systems, scales, and food, Bland and Bell (2007) propose the epistemological tool of "flickering." This agroecological approach sees farms as "holons," or whole entities that cannot be understood outside of the "ecology of contexts" in which they survive (p. 286). Flickering is the "trick to learn to continually switch back and forth between the perspective of the part and the perspective of the whole" (p. 287). Differences in scale can thus be somewhat rectified, and complexity and context can exist side-by-side with bounded cases of deep inquiry. Within empirical work, "flickering" involves a close attention to the cases at hand, and to participants' meanings and experiences (Emerson et al., 2011), while always attempting to show how they relate to larger cultural patterns and ecological realities.

Methods in service of this kind of knowledge include those from social sciences and qualitative traditions. Ethnography is "particularly well-suited to exploring the affective, embodied, and imaginative dimensions of social movements" (Khasnabish, 2019, p. 7). Interviews, for instance, are especially valuable for feminist researchers, as they happen in person (i.e., in embodied relationship; Pink, 2015). Participant observations, particularly when documented through fieldnote memos, can spotlight the sensory details that emerge from being embedded in one's research context (Emerson et al., 2011). Autoethnography, the rigorous examination of one's own lived experience of a phenomenon, provides corporeal and emotional information (Spry, 2001; Ellis et al., 2010), meaningful in its own right or as a way of triangulating participant explanations. Methods such as PhotoVoice combine participatory (i.e., socially embedded and responsive) research values with the visual illumination of meaning (Migliorini and Rania, 2017; Sitter, 2017). Tasting, whether as researcher or participant, can help us understand place, cultural practice, and increased food preparation skills (Trubek, 2008; Højlund, 2015; Hedegaard, 2018). A good starting place for these and other methods is the edited volume *Food Culture: Anthropology, Linguistics, and Food Studies* (Chrzan and Brett, 2017). Through all such methods, researcher positionality—the collection of identities that influence lived experience and social power—provides an important lens for examining how a researcher may (mis)understand or influence such richly subjective data; positionality, after all, is the recognition that we are embedded in social worlds and in relation to others (England, 1994; Rose, 1997; Merriam et al., 2001).

Of course, not all scientists will use such methods. In more disembodied research approaches, these principles may be maintained through careful interrogation of assumptions and of context. Such research should reject premises, models, and equations that assume placelessness, universality of experience or values, and "rational actor" economic theory, all of which erase particularity, which is to say, reality. It should account instead for specificities of history, culture, geography, and power. It should take seriously the importance of embodied and sensory experiences and desires, including taste and cultural practice, in how and why food systems manifest, and in who and what they might harm.

For a cohesive transdisciplinary approach, you must first identify your own theoretical lens, whether from explicit development in your own work or absorbed implicitly through your intellectual circles. Rely on information and methods from disciplines that align with this lens. You must represent multiple scales and facets of the system—although they cannot all be attended to equally, readers must see the links between your focus and the wider network of actors, influences, and outcomes. The work should comprehend food systems as both social and physical phenomena, with permeable boundaries. Ideally, the work reflects both social and physical outcomes as well. It is legitimate and even critical to engage with the need for solutions rather than simply describing situations. We transdisciplinary researchers can and should work with scholars with different disciplinary frames; but we can never discount the theoretical lenses employed. Our pursuit of knowledge itself is a nested system, and the goal is to see those layers as clearly as possible—for "better accounts of the world, that is, 'science'" (Haraway, 1988, p. 589–590).

While often discussed in meta-level abstractions, social transitions are not only systemic, they are personal, emotional, and felt (Feola and Jaworska, 2018). To achieve true sustainability, we must go further than the theorists of the past and integrate the sensory realm into our social and ecological transitions (Howes, 2010). The fields drawn upon here, especially ecological economics, agroecology, and ecofeminist studies, all acknowledge their normative natures (all fields possess inherent normativity; it may just not be overt). They are openly driven by relational values, from social and environmental justice in economics, to sustainability and sovereignty in agriculture, to equality and care in human relations. They detail and theorize what is currently true about the world, including how it falls short of what is needed. Meadows (1996) argued passionately for spending time on vision: what is the world we want? Can we boldly own our own deepest hopes? If we cannot answer these questions, we cannot chart a path forward. One vision she shared, for a hunger-free world, involved more than people simply having enough food; it went deep into reimagining the underpinning culture, relationships, and the commitments of global society. Meadows said her visions arose best when she disengaged her "rational" mind and instead imagined the sensations of a sustainable world.[11] After all, the body, with all its

11 Pink (2015) makes this exact point in her book on sensory ethnography: "Futures, however they are defined, are nonetheless not simply cerebral imaginings, but embodied and sensory ways of perceiving what is not known… We imagine not only with our minds, but also with our bodies" (p. 192). Similarly, Shotwell (2016), a Canadian philosopher and author of the

sensations, can be the ultimate site of resistance (Hayes-Conroy and Hayes-Conroy, 2008). We must keep both values and sensations close to even structuralist efforts in remaking the food system.

The world changes two ways, through cumulative and unintended consequences of status quo actions, or through cumulative conscious projects of social change (Wright, 2010). I believe we should pursue the latter, in part through the rigorous, intentionally transdisciplinary development of knowledge. What does the embodied experience of food allow us to understand about self, community, economy, place, and eventual sustainability? Imagine what we might find out.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

book *Against Purity: Living Ethically in Compromised Times*, writes about "...reaching toward concrete possibilities—a warm horizon imbued with possibility—prefiguratively practicing open normativities that might produce practices of freedom we cannot predict" (p. 193).

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Collaborative survival in the city: Envisioning alternative urban futures through Black agrarian praxis

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Urban inhabitants exist within hybrid spaces of continual transformation and metabolism where human labor is woven into the work of the trees, the grass, the water cycle. The built environment – concrete, houses, skyscrapers – butts up against urban riparian zones and wetlands. The postindustrial landscape exposes both the possibilities and the limits of building resilience in the context of constant metabolism and change. This article asks about the potential for collaborative survival in these spaces of deindustrialization, where the abundance of so-called vacant parcels represent a pathway toward more self-determined food systems and the potential for reimagined urban futures. I play with the concept of collaborative survival to consider a plurality of epistemologies, knowledge systems, and traditions, as well as histories and geographies of exclusion that contribute to this reimagining. I examine the work of Black gardeners and farmers in Cleveland, OH as an example of collaborative survival: their work within a changing environment to grow food for themselves and their community, producing the city around them as a socio-ecological hybrid. Urban food production, in this case, serves as a praxis and a knowledge frame for liberation and emancipation. This paper explores urban agrarianism among Black residents in light of two historical moments that have deeply impacted Cleveland, and that I argue have shaped and informed Black agrarian praxis and growers' urban imaginaries. Collaborative survival recognizes that processes of urban development are ongoing and immanent and contests developmentalist narratives that marginalize epistemologies embracing alternative urban futures. Examining Black growers' experiences with attention to a framing around survival and resilience highlights the continuity of structural and systemic racism and violence against Black and brown bodies, as well as the innovations that individuals and groups deploy to contest that violence.

KEYWORDS

community resilience, urban agriculture, black agrarianism, urban political ecology, afro-surrealism, agrarian praxis, police violence, housing crisis

"All that you touch, you change. All that you change, changes you." Octavia Butler, 1993.

1. Introduction: Collaborative survival in the city

What is the potential for collaborative survival in spaces of deindustrialization, overlaid with historical geographies of racial violence? In landscapes that appear neither urban nor rural, where there are perhaps nearly as many so-called vacant[1] parcels as there are those that are "occupied." I borrow the concept of collaborative survival from Tsing (2015), who artfully explores its possibilities in the face of precarity in the aftershocks of capitalism. I am interested in what this might mean in places, like Cleveland, where built structures are often so old and worn, they have begun to transform back to previous forms, almost like dead and decomposing trees in the forest. Is this also the life cycle of milled timber? Places where the concrete succumbs to the insistence of weeds, shrubs, and tree roots to form a crooked trail like in a field or on a hillside.

Urban inhabitants exist within hybrid spaces of continual transformation and metabolism: the labor that humans contribute is complemented and matched by the work of the trees, the grass, the water cycle. The built environment – houses, skyscrapers, gray water systems – butts up against urban riparian zones, forests, and wetlands. However, any 'boundaries' are fuzzy at best, or maybe nonexistent. Bioswales, just as much a part of the built environment as any traffic sign or highway onramp, are built landscapes created to manage stormwater runoff, and find their counterpart in the persistent growth of tree roots and branches that contest the presence of sewer pipes and electrical wires. In these corners of neighborhoods in Cleveland, Ohio, once densely populated and driven by production – mostly steel – collaborative survival is another way to think about resilience. Survival and resilience are built here the same way as anywhere else. The togetherness of habitation across life forms, landscapes, and livelihoods, a togetherness cocreating an existence that somehow feels old and worn and more like a remembering of something that emerged generations ago.

In urban spaces with ample vacant and abandoned parcels and buildings, where demographic movement and historical geographical processes concentrate both racial segregation and poverty (Tornaghi, 2017), that remembering emerges in varied and innovative ways. Cleveland, the geographical focus of this paper, was an important destination during the Great Migration for Black Americans escaping racial terror and violence in the American South with the hopes of finding stability, employment, and safety in the North. The second and third generation of Black migrants have deep – and yet contested – relationships to an agrarian culture and heritage. Many "third generation" Clevelanders recall grandparents who were gardeners, that "came up from the South, did all of the agricultural things" and whose parents (second generation migrants) "wanted nothing to do with it." That generation wanted "to get married so (they) could shop at the grocery store" (personal communication, 2017). The younger generation that lives with more, or different, precarity than their parents did, or perhaps that can see beyond perceptions of urban food production as "backwards, southern, rural," (see also Zeiderman, 2006) more readily seeks to unearth agrarian knowledge and traditions. These are the acts of remembering: pulling upon or rediscovering the practices, knowledge, and lived experiences of ancestors and elders to enact them anew.

The story of collaborative survival in these settings is about the processes that comprise and produce the city and the practices that continuously transform and reimagine it. It is about growing food and people, about the assemblages within the city that produce space, agricultural and otherwise; about the changes, transformations, and constant metabolisms that occur between people, their environment, and the non-human natural world (Swyngedouw, 1996; Hinchliffe and Whatmore, 2006; Certoma, 2011; Classens, 2015). It is the coming together of historically and geographically embedded memories that we are sometimes not even aware we possess. It is the moss that appeared one day on the rotting front steps that you assume must have always been there. It is the young child who learns from her grandmother about where she came from, about why her hands and fingers are twisted and knotted like the trees in the front yard of her childhood home. It is the remembering and integration of ancestral knowledge and traditions with current practices, lived experiences, and local knowledge. Ultimately, this is about continual change, the power relations that undergird it, and the resulting influences on Black geographies in the city and a persistent Black urban agrarianism.

Drawing upon literature on racial capitalism, urban political ecology, and afro-surrealism, as well as several years of qualitative research in Cleveland, this article explores Black and brown residents' relationship to an ancestral and diasporic heritage in shaping both growing practices and a vision for and relationship to the city spaces they inhabit. Given decades of deindustrialization, white flight, and disinvestment, the political ecologies of Cleveland allow for a collective reimagining of the city. The politics of this are complex, and many visions for urban space do not allow for self-determination in food (Lindemann, 2022). Collaborative survival recognizes that we are "no longer in a position to stop change from occurring" whether that is the impacts of climate change or processes of urban development (Van Zandt et al., 2020, p. 27). Examining Black experiences with the urban food system with attention to a framing around survival and resilience highlights the continuity of structural and systemic racism and violence against Black and brown bodies. This framing also centers the innovations that individuals and groups have deployed to contest that racism and violence and the persistent systems and structures that produce them.

I am concerned with the political ecologies and socio-spatial implications of the production of food and land as they relate to processes of racialization and how both of these impact the potential for collaborative survival – in the many forms it takes - in Cleveland. I explore how Black subjects contest the socio-political and spatial representation of Black spaces and thus Black bodies, as both marginal to and at the margins of the state (Asad, 2004): illegible or erased. I examine processes of and motivations for the production of urban space and a "Black sense of place"

1 Noting here that the concept of "vacant land" is very much predicated on a developmentalist mindset; a parcel without a built structure is only absent a structure, not a blank slate that requires development or that is vacant of life.

(McKittrick, 2006, p.948) through engagement with the land, the soil, memory and ancestry, as well as reimaginings of how people live in and relate to the city. The among groups who are often both simultaneously under the hypersurveillance of governing apparatuses and excluded from discursively white spaces (Asad, 2004; Wilson, 2006; Finney, 2014; Anderson, 2022).

This article draws upon semi-structured interviews, participant observation, and other ethnographic methods (Weiss, 1995; Small, 2009) from almost 4 years of research and engagement in Cleveland, Ohio between 2014 and 2018. I also draw upon research examining recent historical events in Cleveland – a housing crisis for which Cleveland was the epicenter and police violence that claimed the life of a twelve-year-old boy – that inform not only how Black and brown bodies move through and experience space, but the iterative development of and manifestation through agrarian praxis of identity frames and epistemologies rooted in these experiences. I focus on how the production of space – as an active and agentic practice – manifests concerning access to land, personal and community safety, and urban and community development. My analysis of historical geographies of Cleveland allows me to draw connections between the socio-spatial and political actions of Black growers across the city, and a seemingly collective ancestral and diasporic heritage that informs not only growing practices, but a latent surrealist philosophy of (agrarian) praxis that I argue informs a vision for alternative urban futures (Forbes, 2022).

2. Literature and background

2.1. Resilience in the post-industrial city: Reclaiming a neoliberal project

The postindustrial landscape lays bare the "unruly edges" of the built environment (Tsing, 2015, p. 19), exposing the limits and the possibilities of human agency vis-à-vis urban forms and geographies over time. People are matriculated into assemblages of labor, metabolism, and change that defies even the most well-planned or constructed metropolis. Narratives about urban change generally leave aside the plurality of human epistemologies, knowledge systems, and traditions, and the histories and geographies of exclusion that relegate significant proportions of the world's population to the margins. In other words, development is and has always been uneven, as are processes of "dedevelopment" or deindustrialization. Both are intensely embedded in power relations, bolstered by or resulting in long-lasting racial projects: exclusion, removal, rendering less visible (Omi and Winant, 1994; Wilson and Sternberg, 2012). Marginality refers to physical or spatial separateness, but also to metaphorical, political, economic, and epistemic exclusion. Those who exist on or within the margins face injustice and neglect; they also often occupy a place of epistemic difference (Wylie, 2003), outside of normative Enlightenment or western epistemic frames.

Critiques of the concept of and expectation for resilience tend to highlight the tendency of resilience discourse to reproduce the neoliberal subject and to excuse the state of responsibility for the wellbeing of citizens (Joseph, 2013; Cretney, 2014; Chandler and Reid, 2016). Ranganathan and Bratman (2021, p. 115) write that resilience, as a proposed solution to vulnerability, "validat(es) embedded processes of racial capitalism that have historically dehumanized and endangered residents and their environments in the first place". As Joseph points out, resilience itself cannot be reduced to a neoliberal policy or system, but it can align with larger aspirations of neoliberal ideology (Joseph, 2013, p. 38). Scholarly discussion of resilience in this vein largely focuses on resilience discourse as targeting the individual, reinforcing the theory of resilience as part of the neoliberal project.

Examining resilience through this lens of critique highlights the ways in which discourses encouraging resilience tend to push individuals to adapt to and "bounce back" from the shocks of systemic disturbances and global historical patterns of capital flight, deindustrialization, urban renewal and gentrification, and the racial projects in which they are embedded (Meerow and Newell, 2019). The scalar mismatch between individual resilience and systemic disturbances demands either a different approach to resilience [if not a rejection of the concept entirely (MacKinnon and Derickson, 2013)] or a different understanding of the individual's role as a resilient subject.

Emphasizing the inevitability of climate change, Sharon Van Zandt writes, "Bluntly (resilience) means that we know impacts will occur, and, to survive, we must learn to bounce back from them" (2020, p. 39). We must not only bounce back, she continues, but also adapt. "It suggests a need to change ourselves; change the way we live, the way we use the land, or what we put on it" (Van Zandt et al., 2020, p. 39). This understanding of and approach to resilience, when applied at the scale of the individual, replicates and reifies the neoliberal discourse of personal and individual responsibility of dealing with and adapting to issues not of one's own making. However, if we jump scales to consider the neighborhood, community, or even city, Van Zandt's framing of resilience is more easily refracted through a political ecology lens, where it can become an expansive project of resilience that is collaborative and liberatory. Van Zandt's writing suggests we might "change ourselves" and our relationships to and with the land. Reimagining human agency and action (Davis and Zanotti, 2014; Tsing, 2015) allows for a collective reframing of the function and physicality of the spaces that all beings live in, experience, and move through.

Just as rural and urban space have elements of each found in the other, the meaning and physical form of these spaces is continually evolving. Ananya Roy examines rural spaces and "ruralness" as one aspect of the "constitutive outside of the urban" (Roy, 2016, p. 813). Rurality is often also constitutive of the urban. Within the city are rural histories, urban-rural migrations, incomplete and fractured processes of urbanization and deruralization, and processes of deindustrialization that are often coupled with the hollowing out of neighborhoods across the city. Roy calls attention to the importance of how the agrarian question and the urban question are intertwined, which becomes even more evident in the enmeshed historical geographies of rural people who come to live in and build urban spaces, of agrarianism (de)industrialization, and a post-industrial return to, or reinvigoration of agrarianism in the city. The rural here is not defined by its distance from the urban, but rather by close relationship to it. In Cleveland, rural histories, agrarian imaginaries, and processes of rewilding – both intentional and secondary to these historical geographies – create hybrid spaces

that allow for the possibility of more expansive understandings of a Black agrarian praxis.

2.2. Black agrarianism and praxis

An article about Black food sovereignty activist Dara Cooper opens with the following description of Black people's relationship to the land:

> For Black people, Black southerners in particular, land is sacred and our relationship to it is complicated. The land swaddles the bones of our elders. Our histories are rooted deep beneath surfaces (made) rich with Black blood. And that Black blood marks the spot where Afro-futuristic possibilities are waiting to be unburied and rediscovered (Savali, 2019).

Combined with the agrarian and urban questions noted above is a complicated land question that is central to US Black agrarianism. A lack of Black land ownership throughout history – despite the ways in which enslaved Black hands drew forth life and endless profits from that land – is one big chapter of the land question. Black land ownership that reached a peak at between 16 and 19 million acres of land in about 1910, followed by persistent decline in Black land ownership is another chapter. Black cooperative farming, and the role of Black growers during the Civil Rights and Black Power era in feeding, housing, and supporting those fighting for racial justice is an important part of the story (see White, 2018), and the ways in which urban histories related to housing (addressed more in depth below) are implicated as well in questions of ownership over and access to land for Black growers are also essential elements of the Black land story. I touch upon these here to note the complexity and breadth of Black agrarianism in the U.S. over time.

Rural Black agrarian history and the struggle for access to land is deeply embedded in Black agrarian praxis today, often representing what several Black geographers describe as building or producing "spaces of Black liberation" (Bledsoe and Wright, 2019, p. 420) or a "Black sense of place" (McKittrick, 2011, p. 948). Historian Russell Rickford describes the pastoralist influence on Black imaginations around citizenship and identity in the 1970s, even as a vast majority of Black Americans were living in cities (Rickford, 2017). Black urban agrarianism today is comprised of a plurality of spatial strivings around space production, land as liberation, and reaching into history to draw upon the strength, wisdom, and survival of ancestors' agrarian praxis. Rickford (2017, p. 960) writes, "African Americans have craved land as a source of refuge, freedom, and power since the days of slavery. [. . .] The quest for land also reflected larger desires to create sovereign black communities beyond the reach of white society".

Black urban agrarian praxis to build a more self-determined Black and brown-led food urban systems often exists outside of white-dominant and normative systems and structures (Hoover, 2013), including epistemologies of land value and white colonialist (often aesthetic) determinations of what constitutes the city (Tuck et al., 2014; Angelo, 2017). This is particularly salient to epistemological questions of land value (Lindemann, 2022) and to how Black agrarian work is viewed: where Black bodies do and do not belong (McKittrick, 2011) and whose cultural (food and growing) practices are acceptable in the process of negotiating alternative urban futures, alternative urban land use (Rickford, 2017), and postindustrial urbanism more broadly (Zeiderman, 2006; Reese, 2019).

Anti-Black racism and racial violence in northern cities fuel what Lipsitz (2011) calls the Black spatial imaginary, consisting in part of negotiations of "power, space, and confinement to create places of care and celebration" (Reese, 2019, p. 71). Narratives of care (Miewald and McCann, 2014; Tornaghi, 2017) permeate much of the literature Black agrarianism (see also White, 2012). Acts of caring for spaces and in the production of space as well as care for self and community contest prevailing narratives of Black neighborhoods as unsafe or neglected, and work toward a "vision of thriving, self-reliant African American communities and the desire to rebuild soil, neighborhoods, and economies" (Fiskio et al., 2016, p. 19). Miewald and McCann (2014, p. 540) write that food (and food production) "can be positioned centrally in the study of geographies of poverty and survival" to elucidate residents' "everyday agency". As I expand upon below, caring constitutes part of the collective and agentic resilience of collaborative survival; it is central to the consistent and intentional work of Cleveland's Black farmers and gardeners to draw forth from the land alternative imagined urban futures in the face of ongoing and persistent precarity.

2.3. The influence of historical geographies

Cleveland, Ohio is a very intentional setting for examining the possibility of collaborative survival in part because of the historical geographies that have shaped the lives and lived experiences of Black Clevelanders over decades and generations. While I won't dive fully into all that entails - others have done so in more complete ways – (Phillips, 1999; see Kerr, 2011; Black and Williams, 2012), there are two "moments" in Cleveland's history that continue to shape Black geographies and socio-spatial experiences within and across the city (Abrams, 1982; McKittrick, 2006), and in turn shape how Black Clevelanders imagine urban futures and the possibility of more alternative relationships to and with the land and agrarian praxis. The housing crisis in Cleveland and the police killing of Tamir Rice are two moments that are unique to Cleveland in certain ways; however, they also represent the continuous (re)defining of racial projects across landscapes, urban and rural. Both moments illustrate racialized narratives around where Black bodies do and do not belong and form part of a collective consciousness as motivating factors in the ways that Black residents move through, appropriate, and produce space within and across the city.

The two moments referenced above are deeply embedded in the urban Black agrarian praxis in Cleveland and can be used as analytical devices to gain a deeper understanding of the racial, political, economic, and spatial dynamics over time in the city, and, more specifically, of the lives and experiences of Black Clevelanders as they struggle to build, rebuild, and make sense of their everyday environments (Loftus, 2008). I use these events to narrate how the production of space and Black agrarianism in Cleveland are deeply informed by Black geographies and

epistemologies (McKittrick, 2006; McKittrick and Woods, 2007; Brahinsky et al., 2014; White, 2018; Reese, 2019). Black histories inform and are informed by Black geographies: "placements and displacements, segregations and integrations, margins and centers, and migrations and settlements" (McKittrick, 2006, p. xiv). Both race (as "bodily difference") and space (as asocial, homogenous, and ahistorical) tend to be essentialized within conventional social theory (McKittrick and Woods, 2007), but I attempt here to "de-essentialize" the histories and geographies of Black Clevelanders through a closer look at the particularities of Black spatial experiences and their role in shaping the political economic and socio-spatial experiences of Black urban growers in Cleveland (Abrams, 1982; McKittrick and Woods, 2007, p. 7).

Although not directly related to each other, both moments speak to how Black bodies move through, respond to, and are perceived across the urban terrain. These moments have been particularly influential in producing perceptions and representations of Black bodies and geographies. According to geographer Carolyn Finney, these types of representations of Blackness and Black bodies are deeply impactful within the Black community as well, presenting "a danger of internalizing negative images to the extent that they cannot imagine different possibilities for themselves" (Finney, 2014, p. 68). The two moments in question illustrate not only the continued importance of race in Cleveland's historical-geographical landscape but demonstrate how crucial the historical scaffolding of racial formations and other racial projects have been in constructing racial politics in the city today (see Omi and Winant, 1994). Both of these moments have had significant impact on the Black population of Cleveland; they are etched into a shared Black consciousness and have more deeply entrenched many of the racial formations and racialized patterns of inequity in the city.

2.4. Moments in Cleveland: A housing crisis and a young king

The first historical geographic "moment" in fact occurred over a period of several years in the 2000s, with direct repercussions for thousands of individuals and families across the city and the surrounding Cuyahoga County. From 1995 to 2007, the number of housing foreclosures in Cuyahoga County quadrupled (Coulton et al., 2010). While this was a nationwide and even global crisis, four of the top twenty-one U.S. zip codes impacted by the housing foreclosure crisis in 2007 were in low-income, majority Black neighborhoods in Cleveland (Christie, 2007). A foreclosure domino effect – whereby the existence of foreclosed-upon and vacant homes increases the likelihood of other foreclosures in proximity – intensified the impact in these neighborhoods (personal communication 2015; Rokakis, 2013). Slavic Village, a predominantly Black neighborhood, included the hardest hit zip code in the United States in 2007. By 2013, about 3,000 of the 12,000 residences remained vacant (Smith, 2013).

In just 1 year, housing values across Cleveland plummeted, with the median sale price dropping from $62,000 in 2007 to $15,500 in 2008. Black neighborhoods bore the brunt of the loss. Homes in neighborhoods such as Kinsman, St. Clair-Superior, and Hough lost between 80 and 87% of their value between 2004 and 2015 (Western Reserve Land Conservancy, 2015, p. 33). This protracted moment was acutely painful in itself, but it also falls in line as one more example of the many instances of "creative destruction" in majority Black neighborhoods across Cleveland: decades of slum development (and subsequent clearance), urban renewal (Michney, 2011), arson (Kerr, 2011, 2012), housing demolition, and so on. Central to most racial projects inscribed in space, creative destruction is an intrinsic, albeit unpredictable, part of the capitalist spatial fix: a reworking of capital across space that "thoroughly transform(s)" landscapes for the purpose of reinvigorating capital accumulation (Brenner and Theodore, 2002, p. 355).

The other moment took place over fewer than 45 seconds in a small public park. On November 22, 2014, a 12-year-old boy named Tamir Rice was shot and killed by police trainee Timothy Loemann outside of the Cudell Recreation Center on the west side of the city. Tamir was playing outside with other young children, waving a toy gun in the air. The 911 call described Tamir as "probably a juvenile" and the gun as "probably a fake," but those two key pieces were not relayed to the responding officers (Heisig, 2017). Upon arriving at the recreation center, the two officers broke protocol by driving over a curb just a few feet from where the children were playing. Within 2 s of exiting the car, Loemann shot 12-year-old Tamir from close range. Neither Frank Garmback (the other officer on the scene) nor Loemann offered Tamir medical attention, as protocol would have demanded. The boy died the next day from his wounds. Neither officer was convicted of any crime associated with the killing, although Loemann was later fired from the Cleveland Department of Police for having lied on his employment application (Fortin and Bromwich, 2017).

Both police violence and the Great Recession of the 2000s were "racialized moments" (Schein, 2012, p. 942) in Cleveland. These transformations in urban space over time are essential to "processes of racial formation [and] racialized landscapes" (Ibid.) and are intimately connected to the racialized historical geography of the city as a whole. These moments connect with Black political organizing in Cleveland over time, the history of Black farming in the American South, and an international Black agrarianism that has found local roots in Cleveland. Both moments have had deep impacts on the lives of Cleveland's Black population, including experiences with urban gardening, farming, and land-stewardship, as well as understandings of these practices.

To demonstrate the historical geographical importance of these two moments, to understand their role as "markers of transition" (Abrams, 1982, p. 195), I situate them within the broader historical geography of Cleveland and its Black residents. I do not claim that either the foreclosure crisis, as a spatial crisis of capital, or the homicide of Tamir, as an instantiation of racial violence, is directly responsible for producing any particular historical event or conjuncture. Rather, particular social, political, or economic configurations, crises, and contradictions lay the groundwork for the "dissemination of certain modes of thought, and certain ways of posing and resolving questions" (Gramsci, 2014, p. 184). This approach to history helped define Gramsci's "concept of immanence" (Gramsci, 2014, p. 400), which is central to his philosophy of praxis, or the ways in which theory and action inform each other. Immanence, or the mutual constitution

of history, geography, economy, and politics – and of political ecologies – is expressed in each fragment of praxis and is present in each moment of the (re)production of new social natures (Loftus, 2008; Ekers et al., 2013). Gramsci's concept of immanence, or "being with history" is present in resident and community praxis that asserts a different way of living and being within (and against) the hegemony of racial capitalism. Collaborative survival, a striving toward multispecies resilience, represents the possibility of collective praxis, one that is shaped by the political ecologies and historical geography not only of Cleveland, but of the Black diaspora and Black agrarianism across time and space.

2.4.1. Housing foreclosure as creative destruction

The more protracted "moment" of housing foreclosures and mortgage loan crises in Cleveland has had deep socio-spatial impacts on the Black community in Cleveland, with implications for Black agrarianism and the urban agriculture movement more broadly. Despite the lingering effects of the Great Recession and widespread foreclosures in Cleveland, a discourse of revitalization and renaissance is common in political and community development circles, albeit in uneven and racialized ways (Lebovits, 2017). The uneven development in Cleveland is increasingly evident, with significant investment in the downtown business district as well as a few predominantly white west side neighborhoods such as Ohio City, Tremont, and Detroit Shoreway. In majority Black neighborhoods such as Kinsman (95% Black), median house values peaked in 2005 at about $72,000, and fell to just over $15,000 by 2015. As of 2021, median house values in Kinsman remained far below pre-recession levels at around $25,000.

The foreclosure crisis does not explain every struggle facing the Black community, nor does it lay a complete groundwork for an alternative urban future embedded in collaborative and multispecies resilience. The foreclosure crisis does represent, however, an important moment within the prolonged history of creative destruction of communities of color in Cleveland drastically changing the landscapes and the political ecologies of these spaces. The housing and foreclosure crisis of 2007 serves as a microcosm of many instances of creative destruction in Cleveland over the last several decades.

Cleveland was a major destination for migrants from Georgia, Alabama, Mississippi, and South Carolina during the induced migration of Black Americans from southern states (Davies and M'Bow, 2007, p. 14; McKittrick and Woods, 2007). These migrants were spatially confined through politics and policies of segregation, displacement, and dispossession (Davis, 1972; Rothstein, 2017). The two moments that provide the analytical frame for this article are squarely situated within the Black geographical imaginary of Cleveland, which is in part constituted by this historical movement of Black bodies across space.

Black Clevelanders have long been concentrated in neighborhoods on the east side of the city. By 1940, 80 percent of the Black population of Cleveland was concentrated in the east side Central neighborhood (Davis, 1972, p. 271), in part because the influx of Black southern migrants into Cleveland created a sense of urgency for city officials to both manage and accommodate the changing population and racial dynamics of Cleveland. Race-based divisions between the east and west sides of the city that emerged with the first waves of Black migrants sequestered in the Central neighborhood (Davis, 1972) persist to this day. Since the creation of Cleveland's redlining "security" map in 1936, the racial, socioeconomic, and spatial divisions within Cleveland that they helped, in part, to create, have been crystallized.

Racial segregation remains "sticky" (Saldanha, 2006) meaning that present-day Black geographies are deeply historical. In 1976, for example, a fire burned down more than 60 homes in a neighborhood in Kinsman known as Garden Valley or the Forgotten Triangle. Inadequate water pressure in the hydrants prevented firefighters from putting out the fires (Kerr, 2012). Due in part to bank redlining practices that labeled this residential neighborhood as high risk, none of the houses had homeowners' insurance. "Supermarket redlining," (Eisenhauer, 2001) which mirrors housing redlining practices, has left this area with no full-service grocery stores; instead, Garden Valley is dominated by businesses that prey upon and benefit from concentrated poverty, including check cashing, lotto stores, and comparatively expensive corner stores with limited selections of fresh produce or nutrient-dense food (Alkon et al., 2013; Reese, 2018). Led by the federal government and national banking system, redlining maps illustrate how geographical and racialized patterns endure across time despite social and political intervention. They also illustrate the difficulty of undoing this sort of de jure segregation (Saldanha, 2006, p. 10).

The most recent housing and mortgage loan crisis in Cleveland is only one example of the evolution of "the geographic landscape of capital accumulation" (Harvey, 2011, p. 185) as both a racial project and a process of re-embedding racial economies within urban space (Omi and Winant, 1994; Wilson, 2006, 2009; Soss et al., 2011). It is another manifestation of the tendency for financial and spatial speculation to prioritize capitalist accumulation over social relations (Polanyi, 1944; Harvey, 2011). Capital's need for mobility and constant reinvestment (Marx, 1976) leads to changing socio-spatial (and racial) configurations of capitalist accumulation with impacts within and across urban regions (Harvey, 1985; Weber, 2002; Brenner, 2004; Martinez-Fernandez et al., 2012; Schein, 2012). The intensification of racialized poverty though geographically concentrated foreclosures in Black neighborhoods has resulted in these communities being seen as hopelessly lost to violence, disorder, and destruction. Black subjects, in turn, are cast as desperately in need of management, control, and "re-molding for the civic…good" (Wilson, 2009, p. 103), while simultaneously being treated – like the spaces in which they reside – as pathologically lost to chaos, abandonment, and destruction.

From the perspective of many of Cleveland's city planners and community development professionals, the foreclosure crisis in Cleveland, much like the fires in the 1970s and 80s, provides the opportunity to welcome outside investment (Sheldon et al., 2009; personal communications 2015, 2016). This illustrates Harvey (1985) understanding of how capital both destroys and regenerates landscapes at particular junctures in space and time: "Capitalist development must negotiate a knife-edge between preserving the values of past commitments made at a particular place and time, or devaluing them to open up fresh room for accumulation" (Harvey, 1985, p. 150).

Urban renewal, large-scale development projects, and the mortgage and housing crisis can all be interpreted as similar "racialized moments" in the history of Cleveland (Schein, 2012). Many east side neighborhoods in Cleveland were left with property vacancy rates of between 20 and 40% and property values at a fraction of their pre-crisis levels (Western Reserve Land Conservancy, 2015), while the majority of previously foreclosed-upon houses in wealthier urban and suburban communities have recovered their value.

The concentrated impacts of vacant and abandoned properties, vacant land, and lower population density within predominantly Black neighborhoods persist to this day. Parcels of vacant land in the city have historically been the starting point and a crucial resource for both formal and informal practices of urban agriculture. And yet, would-be urban gardeners and farmers do not have consistent access to vacant land because of a planning paradigm and governance strategy that – despite favorable legislation and the support of some city officials – are still enmeshed in a particular understanding of growth and development (Lindemann, 2022). The patterns and histories of creative destruction, demographic change, and socio-natural transformation that the housing and foreclosure crisis represent (including cycles of growth and decline, deindustrialization and neoliberalization of urban space, and a growth-based politics of land management, assembly, and development) have shaped a specifically Black agrarianism within Cleveland. I mention them here as part of the larger historical geographical context: namely the racializing patterns across space and the politics of land management, assembly, and reuse over the last several decades of decreasing population density in Cleveland.

The protracted trauma of these patterns and histories are central to understanding the Black geographies of Cleveland's urban gardening and farming movement.[2] The spatial "fix" of capital, campaigns of renewal and destruction, and variable land use policies and norms, continuously reappear and reinvent themselves as anonymous neoliberalizing processes of urbanization. This stands in contrast to the ongoing strivings of a Black agrarian praxis, with growers, rooted in place, working to build resilient neighborhoods and communities.

2.4.2. The social, spatial, and bodily aspects of racial violence

It is important to note that Tamir Rice was shot and killed in a public space, participating in what is generally considered to be normal kid behavior. He was playing outside with other children in a city park, waving a toy gun that a friend had lent him when a neighborhood resident called 911. The called told the dispatcher that the boy was probably a juvenile (although he also described Tamir as "older looking," and later said he thought he was closer to 20 years old because of his size.). He reported that he was playing with a gun, which he qualified as "possibly fake," but also said that he was "acting gangster" (Cuyahoga County Sheriff's Department 2015:9).

The above description of Tamir focuses the lens on questions about which kinds of bodies – raced, classed, and gendered, among others – are welcomed in or allowed access to public spaces and those that are found to be suspicious or out of place (Peake and Schein, 2000; Slocum, 2007; Mitchell and Heynen, 2009). This moment also brings into relief the extent to which racialized spaces influence how behaviors are interpreted and handled by residents, police officers, and other agents of the state (Soja, 1980, 2009). The west side of Cleveland is historically dominated by white bodies and the hegemonic white geographies that govern those spaces dictate how bodies are perceived, and what is allowed and not allowed, such as "acting gangster." White geographies, or what McKittrick (2011, p. 947) refers to as slave and post-slave geographies, supersede and destroy any "black sense of place" even on the grounds of a community center where Black children regularly gather to play (Lipsitz, 2006; Slocum, 2007). Tamir was occupying this space in a way that, for some people, did not align with an established ethic of whiteness, and his killing joins a long list of racial violence that deeply influences a "[B]lack sense of place": how Black subjects move through, appropriate, react to, and produce space.

Geographer Mitchell (1996, p. 155) highlights the contradictions and tensions embedded within public space "as a legal entity, a political theory, and a material space". The "contested concept" of public space – what it constitutes and how – is tied up in a "dialectic of inclusion and exclusion, order and disorder, rationality and irrationality, violence and peaceful dissent" (Ibid.) that changes over time. Notwithstanding changes in cultural norms and socio-spatial practices, the racialized, gendered, and classed tendencies of public spaces – especially in urban areas – foment power dynamics that often do not allow individuals to "confront one another … as subjects on an equal footing" (Ruddick, 1996, p. 134). The Black male body, "constituted through fear," is continuously represented as deviant in public spaces, and Tamir – constituted as a deviant, "gangster", Black male, rather than as a (white) child – was no exception.

Tamir's death is important as a historical geographical analytic because of what it represents about socio-spatial relations and racial politics within Cleveland. The presence of a Black body in a public city space in a mostly white and Hispanic neighborhood on the predominantly white west side of Cleveland is a good example of how difference is encountered within communities constituted by difference (Young, 1990; Ruddick, 1996). The encounter of difference within this space – particularly the lack of empathy through asking questions or engaging in conversation – ended in a violent encounter that has reified a racialized urban spatial politics of isolation. Tamir's death confirmed for many that Black bodies are not welcome in white spaces. Drawing upon Ruth Wilson Gilmore, McKittrick describes "geographies of domination" as "'the displacement of difference,' wherein 'particular kinds of bodies, one by one, are materially (if not always visibly) configured by racism into a hierarchy of human and inhuman persons

2 I use the word "movement" loosely, and do not characterize urban food provisioning or urban agriculture practices in Cleveland as a cohesive or organized movement. Rather, the idea of a movement signifies shared ideology and objectives across much of the community of Black growers.

that in sum form the category of human being"' (McKittrick, 2006, p. xi). At the very least, there are specific expectations or standards for how to behave and look that differ from their white counterparts. In a book written as a letter to his Black son, author and journalist Ta-Nehisi Coates' (2015) words explain this sentiment:

> … I feared not just the violence of this world, but the rules designed to protect you from it, the rules that would have you contort your body to address the block, and contort again to be taken seriously by colleagues, and contort again so as not to give the police a reason. All my life I'd heard people tell their black boys and black girls to "be twice as good."

While a significant proportion of Cleveland's population identifies as Black, these spaces are governed and policed by largely white social norms, and majority white political, disciplinary, and security apparatuses. As Rachel Slocum points out, white space is not about counting the number of Black or white bodies in a particular space, but rather how different bodies act and are interpreted or governed "in a particular context, and the socio-spatial processes with which those tendencies are linked" (2007, p. 521).

After his death, Tamir – as other Black subjects before him (Montgomery, 2016) – was portrayed by many as responsible for his own death. This is hinted at in the way the resident who called 911 described the young boy as "acting gangster" and as much older than his 12 years. In response to a lawsuit filed by the Rice family against Officer Loehmann and the City of Cleveland, the defense stated that "injuries, losses, and damages complained of, were directly and proximately caused by the failure of [Tamir] to exercise due care to avoid injury" and were further "directly and proximately cause[d] by [Tamir's] own acts, not this Defendant (Loehmann)" (Rice v. Loehmann, 2015). In other words, 12-year-old Tamir Rice did not take care to avoid being shot.

While this case is especially jarring because of the age of the victim, the narrative supported by city officials and the CDP works discursively to take away his youth – and with it, the presumption of innocence – by blaming his appearance and how he was playing for his own death (see Brahinsky et al., 2014). The former president of the Cleveland police union, Steve Loomis, said that "Tamir Rice [was] in the wrong" (Schultz, 2015), describing Tamir in a way that would reaffirm that narrative: "He's menacing. He's 5-feet-7, 191 pounds. He wasn't that little kid you're seeing in pictures. He's a 12-year-old in an adult body." Portrayals of Tamir as a threateningly large (Black) man, rather than as an innocent child playing with other children in an outdoor space, not only racialize Tamir as a social deviant, but play into deeply ingrained fears about the threat that Black (male) bodies pose in these spaces. The portrayal of Black bodies as deviant, out-of-place, or responsible for the harm done to them is consistent with the widespread use of isolating and exclusionary language builds a normative construction of "public space" as raced and classed: white, wealthy, orderly, and obedient (Ruddick, 1996).

3. Black agrarian praxis and imaginaries in Cleveland: Examination and analysis

3.1. The emergence of collaborative survival

The ways that Black farmers and gardeners describe the drive to produce a different kind of urban space in Cleveland reflects embedded memories and ongoing experiences of (moments of) violence overlaid with an unwavering belief in the possibility of something different. For Cleveland's Black growers, access to land, innovation around vacant land use, and a deep connection to ancestral and diasporic agrarian practices define and shape their agrarianism and have become central to the production of Black space and a Black sense of place (McKittrick, 2011). To be sure, there is variance amongst growers in Cleveland: their relationship to political processes or willingness to engage in them, how they understand what it means to "be political" or how they frame their agrarianism in relation to politics, social movements, and other growers, and how they situate themselves as a part of the historical geographies and struggles around Black land. Notwithstanding this variability, all growers I spoke with are concerned with the production of Black space and with the potential for positive impacts that agrarian praxis might have on Cleveland's Black community. Growing food in the city is much more than growing food; it is growing the city and its possible alternative futures.

The concentrated impacts of housing foreclosure including vacant and abandoned properties, vacant land, and lower population density within predominantly Black neighborhoods persist to this day. Parcels of vacant land in the city have historically been the starting point and a necessary resource for both formal and informal practices of urban agriculture. And yet, would-be urban gardeners and farmers do not have consistent access to vacant land because of a planning paradigm and governance strategy that – despite favorable legislation and the support of some city officials – are still enmeshed in capitalist understandings of growth and development (Lindemann, 2020). The patterns and histories of creative destruction, demographic change, and socio-natural transformation represented by the housing and foreclosure crisis (including a developmentalist politics of land management and assembly) have shaped a specifically Black agrarianism within Cleveland. The protracted trauma of these patterns and histories are central to understanding the Black geographies of Cleveland's urban gardening and farming movement.

Accounts of police violence and excessive use of force, the fear of such, or frustration with what is perceived as the over-policing of Black neighborhoods came up organically in several interviews with farmers and gardeners, as well as in casual conversation and participant observation. None of my interview questions focused on police violence, rather connections were made spontaneously by growers themselves. This is not entirely surprising in a city that has had two Federal Department of Justice investigations focused on inappropriate and unprofessional comportment of police officers. In other words, violent police behavior looms large and infiltrates

many aspects of Black subjects' lives. In 2004 and 2014, DOJ investigations found that a significant proportion of cases of use of force by the Cleveland Division of Police (CDP) "fell short" of a "respect for human life and human dignity, the need to protect public safety, and the duty to protect individuals from unreasonable seizures under the Fourth Amendment" [United States Department of Justice Civil Rights Division. (DOJ)., 2014]. Cleveland, as also one of the most segregated cities of its size, continues to experience the lasting legacies of redlining, urban renewal, suburbanization and white flight. The other geographic racial projects combine with current experiences of police violence that disproportionately harms Black bodies, to influence the everyday lived experiences of Black residents across the city.

Building urban agricultural spaces in Cleveland's Black neighborhoods is often understood to be part of community efforts to stay safe in the face of an ever-present threat of police violence. Gladys, an elder in Cleveland's urban food movement, describing the situation in her community in Cleveland lamented, "We're just trying to stay alive." She frequently referenced the widespread perception of heightened police presence in predominantly Black neighborhoods and police violence against Black bodies within and outside of those neighborhoods while also describing her vision for urban gardens and green amenities as "oases" of safety and health for Black residents. "Staying alive" is related to both the prevention of police violence and the provisioning of foods in spaces of food apartheid. The assumption is that the production of agrarian spaces would decrease police presence while also increasing the availability of life-giving foods, collectively makes these spaces safer for the residents who inhabit them.

In describing the philosophy embodied by growers at a large urban farm on the east side, Keymah, one of the founders described his understanding of how growers (re)imagine their world to in the production of peaceful and safe environments where all things can grow and thrive.

> What better place to incubate life than in the garden? Whether it's ideas or plants…there's an innate sense that most humans have about nurturing. Mothers get it from a maternal perspective when they nurse or care for a child. And it's the same feeling you get when you nurture a plant or nurture an animal, because you have to give so much of yourself before it could ever give you back anything. We believe that phenomena not only helps to create a peaceful environment but it is also been shown to reduce violence in communities.

The importance of building these networks and "oases" lends a quite literal meaning to the concept of collaborative survival for residents living in a context of heightened community or police violence. And in a more expansive sense, the give and take this farmer describes of nurturing between landscapes, ideas, and people elucidates an integrated network of care, resilience, and survival.

3.2. History, collective memory, and black agrarianism

Ongoing efforts in Cleveland to establish spaces of safety, health, and wellbeing draw upon continuous practices of mutual care and nurturing that are also deeply influenced by family history of agricultural work (especially in the American south) and by the organizing of Black historical figures. During a conversation about political organizing, one grower insisted on the importance to the food movement of retaining and spreading knowledge of Black political organizing of the past, especially among Black youth:

> Like we did in the sixties, you know…in the basements of churches, we trained folks: "Look: this is how you go out and register voters, this is how you go out and you talk to people." […] To give our young people a contextual knowledge base. There's even stuff coming out that I never knew about. About those leaders – Fannie Lou Hamer – all those folks who contributed. Ella Baker, you know.

Organizations such as cooperative farms that emerged during the era of Civil Rights and Black Power – including Fannie Lou Hamer's Freedom Farms – continue to inspire residents in asserting their own ways of "knowing and writing the social world" through a "material spatialization of 'difference'" (McKittrick, 2006, p. xvi). Processes of spatialization of the "racial-sexual [B]lack subject" (Ibid.) emerge both from racial projects across space and through the contestation of such geographic racial projects. Figures like Fannie Lou Hamer and Ella Baker are powerful as "heroes and sheroes" considered by many of Cleveland's Black growers to be part of the collective diasporic ancestry whose influence crosses geographies and generations.

Like on Hamer's Freedom Farms in Mississippi, migrants to northern cities rejected the oppression they (or their ancestors) experienced in many parts of the American South. Gladys, quoted earlier, connected the lack of land ownership in Cleveland to the oppressive labor conditions Black farmers experienced in the South in prior generations. She recounts speaking at a Ward meeting in the city and responding to her councilman who told her the City would not allow her to purchase parcels of vacant land:

> It showed me his disconnection to the whole thing. That he would stand up publicly (and say) "Oh no, we not goin' let you own the land, you can lease it." *I don't wanna sharecrop for the rest of my life.* You need to be supporting us in owning this land.

Land ownership – and access to land more broadly – is one of many rights claims that growers across the city continuously make, whether explicitly or, as Gladys does, in more subtle, tacit ways. Eleanor, who worked for several years on a vacant land reuse program called Reimagining Cleveland, recounted the same analogy being made to describe exploitative land/labor practices: "It's sharecropping all over again. 'We don't own the land; we're just investing in it.'"

Constellations of influence on the agrarian praxis of Black growers range from historical figures such as Hamer and Baker and oppressive practices such as sharecropping, to places and energy across the world, that are, as Keymah, an urban farmer put it, "beyond our physical presence around each other" (personal communication 2017).

> Our work connects with everybody that's positive about sustainability on the Earth. Because that's the energy that goes forth that pushes back against commercial deforestation, all of these individual efforts. They combine somewhere in the space beyond me being in your physical presence. [. . .] There's a term called "universal consciousness" that if enough people think the same way at the same time we can create a shift in the universe. [. . .] There's a common energy there that exists that makes a difference in the universe.

This farmer described his understanding of connection and universal consciousness as a sameness between people all "shar(ing) the same air every day," "shar(ing) the same sunlight." Michael, another farmer at the same urban farm, situated humans even more intimately within their landscape, saying, "We are soil ourselves," and likening "deficiencies in the soil" to those that "reside in mankind" (personal communication 2018). The concept of universal consciousness across geographies also reflects not only connection of Black agrarian histories, as noted above, but the embedded memories that many growers carry with them and that guide their approach to survival and resilience.

Kim, who is concerned with environmental justice in Cleveland, evokes the idea of collective memory or consciousness that is somehow rooted in the genetics of those whose ancestors farmed:

> I think we carry genes, and we carry memory. I believe in that. [. . .] My great-grandmother could green-thumb all day. And I remember that. I think we have some memory of that . . . it's like "We just have to remember where we came from." This is just going back and remembering or relearning something that we already know.

Amina is an grower with roots in Arkansas, where her grandfather grew up. Amina and her neighbors "all grew up with a garden." This practice took hold in response to both a lack of accessible food options and to the "down south, up south" ties that emerged from the migration of thousands of people from southern spaces to Cleveland (Adero, 1992). Seeing, understanding, and experiencing the spatially uneven and racially determined character of development in the city – especially the geographies of food access – has informed the work of many Black urban growers in calling upon knowledge and histories of urban food production. Amina recalls her connection to southern agricultural practices throughout her entire life:

> We all grew up with my mom canning and all that kind of stuff, so it's not foreign, it's just to be reintroduced back into the family. I know how to do all of that, I learned it by helping my mom. And then when we would go to Arkansas, we had to help. So yeah! It's just there, but when you live in the city, when things change, you get that convenience, and you forget. And that's what – I forgot.

The idea of memory – both remembering and forgetting – is reflected in what another grower, Sofie, says about the oppression many growers faced in southern states and the land they used to work and steward.

> You have a generation of farmers in the south that lost their land. You know about that Black farmers thing. So, when their descendants moved to the north, their memory is about detachment from the land.

Black geographies across history thus comprise both positive and negative motivations for the current spatial practices and strivings of Black urban growers. The collective Black consciousness and memory help to create a vision for what Black subjects do want as much as what they do not want. For the vast majority of growers I interacted with, the influence of a childhood in the south or stories from their parents or grandparents had a powerful impact on how they re-envision what is possible in Cleveland.

Louise, an elder who now gardens on almost two acres on Cleveland's east side recounted how things were in rural Mississippi: "Everyone had a garden in the front yard and a garden in the backyard. You shared with your neighbors and grew what you ate" (personal communication 2015). The instantiation of a southern agrarian heritage in the city is more complex than simply bringing rural landscapes into an urban space. Black agrarianism in Cleveland enacts a different production of space entirely, reworking the multiplicity of socio-natural relationships that can be less visible in urbanized landscapes (Lefebvre, 1991; McKittrick, 2006). It draws upon alternative understandings of what the city is or what it could be, including the valuation of land, meanings of community development, and the embedded relationships. Growers are explicit about their vision for imparting value into land as well as how that value can extend and take root in their community. Building upon Michael's understanding of humans as soil, the very act of working and stewarding the land is akin to building or caring for human bodies in another form. Keymah, quoted above, described the relationship and exchange between humans and the soil as a "spiritual connection that exists" that is expressed in a multitude of ways. "It's (sic) no textbook for it, no manual for it, you can't buy it off the shelf. It's not packaged or bagged, it's just so organic, it flows out of what's into you, you put it in the soil and the soil gives it back to you, so it's more like an exchange than it is something that you can replicate place to place."

The relationships – with the soil, with memory and ancestral agrarian heritage, with the city, and with other people – that are built through Black agrarian praxis contest the violence of racial projects and ongoing moments of trauma that target Black and brown bodies. This is how collaborative survival emerges.

4. Conclusion: (Afro)surrealism and collaborative survival

I conclude this paper by suggesting a connection between the concept of collaborative survival as I have deployed it, and an ontology and philosophy of practice that I see woven through the work and strivings of Black gardeners and farmers in Cleveland. Historian and scholar of the Black radical tradition, Kelley (2002, p. 5), characterizes surrealism as a "revolutionary movement concerned with the emancipation of thought". "The surrealists are talking about total transformation of society, not just granting

aggrieved populations greater political and economic power," he continues. "They are speaking of new social relationships, new ways of living and interacting" (Kelley, 2002, p. 5). Surrealist praxis emerges "in the poetics of struggle and lived experience, in the utterances of ordinary folk, in the cultural products of social movements, [and] in the reflections of activists" (Tyner, 2007, p. 220). The multiple vectors of lived experience point to "the many cognitive maps of the future, of a world not yet born" (Tyner, 2007, p. 220). Indeed, surrealist thought and practice is intimately bound up in struggles for emancipation, liberation, and abolition. Like the agrarianism of Black growers in Cleveland and their diasporic influences, surrealist praxis has always been grounded in multiple ways of knowing, being in, and experiencing the world.

The farmers and gardeners I worked with and interviewed in Cleveland did not use the language of surrealism or Afrosurrealism in our interactions. However, their strivings – in the soil, in their communities, in relationship with plants, the soil and the land, through art, music, poetry, and movement – run parallel to and reflect surrealist ontologies. Like Van Zandt et al. (2020) contention that resilience can be built through a changing relationship to the land, Black agrarian praxis understands land as a vehicle to liberation. Land as part of an abolitionist future is not unique to growers in Cleveland, but is a thread woven through the Black radical tradition, and one that reflects a surrealist praxis. Keymah spoke about the space where he farms as "a blank canvas you can paint anything you want" (personal communication, 2016). This perspective suggests a relationship to and with land and space that is interwoven with imagination, creativity, and the infinite possibility of alternative futures.

Collaborative survival requires much more than just association, proximity, or even similar life circumstances, objectives, and values. True collaboration requires trust and the willingness to be vulnerable in the face of adversity and challenge. The trust that collaboration requires is often absent from the community of Black growers in Cleveland, in part because of the ways in which the politics of resource allocation spawns competition instead of collaboration. One of my frequent collaborators in community development spaces often reminded me of that by insisting that I not disclose anything we discussed with other people or share any of her strategies for community organizing or programming.

The alternative futures suggested by a surrealist philosophy, when refracted through a Black agrarian praxis, are embedded in dynamic and complex relationships that transcend one place or even the present moment, drawing simultaneously upon the past, present, and future. They also demand trust and collaboration among and between people. One farmer told me, "Food gives us life and we give life to the plants and food." Building resilient and collaborative alternative futures requires breaking down the barriers to trust between and among those striving for liberation. Embracing surrealism, as a philosophy in action characterized by poetry, imagination, and emancipation or abolitionism speaks to this: collaborative survival points to the need to "discredit and destroy the forces of repression" of mind, body, and spirit (Chicago Surrealist Group quoted in Kelley, 2002, p. 158). It is an oneness between the grower and the plants whose nurturing is reciprocated as mutual acts of care.

The spiritual and metaphysical elements of surrealism, Kelley argues, were present in the Black radical tradition and Afrodiasporic culture before surrealism became its own movement. The concept of emancipation and liberation within Afrosurrealist traditions are as much bodily (emancipation from slavery in all forms) as emotional, mental, or spiritual ["a struggle against the slavery of rationalism" (Kelley, 2002, p. 160)]. Liberation in this sense, and embracing the poetry of "a world not yet born" (Tyner, 2007, p. 220) enables a Black agrarian vision wherein the plant world, the soil world, and other elements of urban landscapes are woven together with the work of people to produce alternative urban futures that support Black health, wellbeing, and safety, at the same time that they produce beautiful, more livable, and sustainable urban spaces.

There is a vision of the contested city that emerges out of my observations and interviews as well as the other interactions I have had in Cleveland. This is a vision that paints, with broad strokes, an image of a site of constant struggle, a place where residents strive to build radically democratic and liberated futures (Holston and Appadurai, 1999; Kelley, 2002; Purcell, 2008). The city as contested space is not a uniform vision, nor is it shared by all Black subjects who appropriate and produce space across Cleveland's urban terrain. This vision should not be taken as one that essentializes or flattens the differences or struggles that exist within and amongst growers, nuances that are informed by their unique experiences, worldviews, or standpoints. Rather, framing the city as contested treats it as a space where ontologies are continuously challenged and reconfigured. It is an ideal site of inquiry for exploring everything from state building and governance to the various ontologies and epistemologies of social-natures, relationships of trust and co-creation, and the constant metabolisms that produce and reproduce the city as a dynamic part of those interactions (Mitchell and Heynen, 2009). It is produced space, the result of and situated among the intimate socio-spatial relations of everyday life.

Sometimes a life of survival leaves little room for liberation; however, a vision and imaginary of what constitutes a liberated life are embedded in the collective resilience that contests the thrust of individualist capitalism. It is through this plurality of alternative ways of knowing and being that the concepts of collaborative survival and liberation become relevant and productive to socio-spatial change.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the Cornell University Institutional Review Board for Human Participant Research. Written informed consent for participation was not required for this

study in accordance with the national legislation and the institutional requirements.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Parity as radical pragmatism: Centering farm justice and agrarian expertise in agricultural policy

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Rather than treating symptoms of a destructive agri-food system, agricultural policy, research, and advocacy need both to address the root causes of dysfunction and to learn from longstanding interventions to counter it. Specifically, this paper focuses on agricultural parity policies – farmer-led, government-enacted programs to secure a price floor and manage supply to prevent the economic and ecological devastation of unfettered corporate agro-capitalism. Though these programs remain off the radar in dominant policy, scholarship, and civil society activism, but in the past few years, vast swaths of humanity have mobilized in India to call for agri-food systems transformation through farmgate pricing and market protections. This paper asks what constitutes true farm justice and how it could be updated and expanded as an avenue for radically reimagining agriculture and thus food systems at large. Parity refers to both a pricing ratio to ensure livelihood, but also a broader farm justice movement built on principles of fair farmgate prices and cooperatively coordinated supply management. The programs and principles are now mostly considered "radical," deemed inefficient, irrelevant, obsolete, and grievous government overeach—but from the vantage, we argue, of a system that profits from commodity crop overproduction and agroindustry consolidation. However, by examining parity through a producer-centric lens cognizant of farmers' ability, desire, and need to care for the land, ideas of price protection and supply coordination become foundational, so that farmers can make a dignified livelihood stewarding land and water while producing nourishing food. This paradox—that an agricultural governance principle can seem both radical and common sense, far-fetched and pragmatic—deserves attention and analysis. As overall numbers of farmers decline in Global North contexts, their voices dwindle from these conversations, leaving space for worldviews favoring de-agrarianization altogether. In Global South contexts maintaining robust farming populations, such policies for deliberate de-agrarianization bely an aggression toward rural and peasant ways of life and land tenure. Alongside the history of parity programs, principles, and movements in U.S., the paper will examine a vast version of a parity program in India – the Minimum Support Price (MSP) system, which Indian farmers defended and now struggle to expand into a legal right. From East India to the plains of the United States and beyond, parity principles and programs have the potential to offer a pragmatic direction for countering global agro-industrial corporate capture, along with its de-agrarianization, and environmental destruction. The paper explores what and

why of parity programs and movements, even as it addresses the complexity of how international parity agreements would unfold. It ends with the need for global supply coordination grounded in food sovereignty and solidarity, and thus the methodological urgency of centering farm justice and agrarian expertise.

KEYWORDS

agricultural policy, parity, price floor, supply management, farm justice, racial justice, community-based research methodology, agrarian movements

Introduction

Though globalized food and agricultural systems have been intentionally packaged as a natural and self-regulating "global food system," cracks reveal themselves as crushing ecological and health externalities, chronic agrarian and labor crises, and unprecedented agro-consolidation, as described by the United Nations and countless others (IAASTD, 2009; UNCTAD, 2013; IPES-Food, 2022; McGreevy et al., 2022). While dominant agri-food public, private, and philanthropy sectors' responses remain neoliberal and agro-corporate-led, diverse agrarian movements around the world tenaciously cultivate and clamor for alternatives to survive. Organizing around fair farmgate prices and cooperatively coordinated supply management—a combination deemed "parity" by U.S. farm justice movements—these pillars protect agrarian livelihoods, land retention, and evasion of agro-corporate dominance. U.S.-based farm justice movements effectively transformed farm policy into a mechanism of staving off agro-industry capture of value, demanding programs to prevent the pitting of farmers against each other in a race to bottom of farmgate prices, regionally, domestically, and internationally.

Recently, the food price problem, wherein consumers and import-dependent countries cannot afford nourishing food, has garnered necessary attention and alarm. Yet, subsequent interventions often compound the parallel, but largely invisible, farmgate price problem. From the vantage of neoliberal logic, interventions toward "parity" seem a radical disruption of a naturalized, freed, self-regulated market. From many sectors, perspectives, and fields, agricultural parity policies and principles seem preposterous (Graddy-Lovelace and Diamond, 2017). The paper concurrently explores the flip side of this antipodal subject: how farmers across many places and times demand their agricultural products be valued fairly at markets. Senior co-authors Naylor, Edwardson Naylor, and Wilson provide a grassroots farmer analysis of the disconnect between what a farmer must pay for her purchases vs.s the prices she receives for her produce.

Technically speaking, calculated by the USDA (United States Department of Agriculture), the parity ratio is the relationship between "prices received vs. prices paid" for domestic farmers. Though the current dominant agricultural economic expectation is that farmers can garner income from increased exports, this paper explores how managing markets, like all big industries, is especially needed for farms. Otherwise, the secular downward pressure on farmgate prices leads to bankruptcy, land loss, rural outmigration, land concentration, and market consolidation for those trying to make a living from farming itself. At an international scale, the regulatory mechanisms of the World Trade Organization (WTO) continue to relegate price discovery to international supply and demand as determined by the speculative trading of futures contracts and eliminating tariff measures to protect domestic systems of agriculture. This penalizes domestic governance support for "parity" (price floors, supply management, quotas, grain reserves). For countries other than the dominant grain exporters, WTO governance has fostered dependencies on surplus commodity crop imports–just as farmers around the world warned in their decades of protests. The current global food crisis, reeling from disrupted supply chains, demonstrates the risky consequences of acute import dependence. From dominant agro-economic perspectives of market self-regulation, parity policies and orientations seem radical.

Methodologically, this article chronicles and contextualizes farm justice movements through community-led action-research projects with esteemed, grassroots agrarian organizations, elders, and community leaders. Durable agricultural policy requires research methodologies that are led by agrarian practitioners and coalitions struggling for social, ecological, and economic wellbeing for those working in agriculture or living in rural communities. From the vantage of those cultivating food and stewarding land, governmental interventions into the agri-food system have long been pervasive. In fact, most of these interventions over the past 70 years have favored and enabled agro-corporate consolidation that now undergirds the current extractive nature of agri-food systems. As rural economies become de-capitalized, the fabric of society begins to tear in these areas and beyond. Considering this grand tendency, of agro-capitalism unchecked driving industry consolidation, parity principles and programs—updated for racial and gender equity and climate resilience—become imperative, and from the perspective of diverse farmer livelihoods: common sense.

Shared imaginaries have been a consistent element throughout the long history of the farm justice movement. Historically, the voices of powerful figures have framed historical narratives that exclude and marginalize key activists, practitioners, and knowledge-holders who are not in positions of power. This paper seeks to shed light on the histories that have strengthened dominant hegemonies and raise awareness about the deeply entrenched inequalities and inefficiencies of dominant food systems. By educating scholars and activists about the way parity once served farmers and strengthened domestic food systems, and by connecting these histories to India's case, this research serves as an antecedent to policy action.

The interconnected agrarian histories described in this paper impact and continue to form each other, regardless of geographic distance. Policymakers have become disconnected from those who are working the land and "feeding the world". Proposed solutions distract consumers, policymakers, and the public from the root causes of overproduction, unfair wages, and large-scale disconnect from the land. For example, shaming consumers to take individual action by shopping local, supporting small growers, visiting farmers markets, and only buying organic produce disguises the underlying issues. These individual-targeted approaches offer a solution which only wealthy individuals can access, perpetuating a culture of food waste and further cognitive dissonance. On the other hand, parity principles are inherently rooted in principles of social justice and benefit both producers and consumers. Unlike consumer-focused solutions, supply management levels the playing field and addresses inequality of access to nutritious foods. Parity is class-conscious and in solidarity with consumers, but actualizing these principles will require a structural rethinking of food systems.

Parity principles are parallel to and inextricable from the urgent need for a living minimum wage for workers at large. In a transformed agri-food system, the worker is guaranteed a fair wage, while the farmer earns and is guaranteed a fair price, thereby "lifting everyone up" (Chappell, 2020). Importantly, the cost of a fair farmgate price floor would be shouldered primarily by dominant agro-food purchasers—nearly all of whom are corporations with ample resources to remunerate farmers, and their employees, fairly. The dominant agri-food model pits farmers against consumers, but the parity movement has long asserted solidarity with workers' struggles—a key tenet of the 1980s farm justice movement and a core tenet of current iterations of parity advocacy, such as Patti Naylor's recent local op-ed (Naylor, 2022).

Parity itself remains surprisingly simple as a concept and policy orientation: minimum support price (adjusted for inflation), supply management, grain reserves. However, the logistics of its implementation must be updated for the twentifirst century, keeping in mind agrobiodiversity, climate resilience, and racial, gender and labor equity, which requires teams of skilled people coordinating quotas, grain reserves, non-recourse loans, trade parameters, and farmer outreach. Research and extension are needed for analyzing, implementing, honing, and actualizing parity at multiple scales, for multiple crops, landscapes, and agricultural contexts across the U.S. and beyond.

From an economic perspective, without a parity safeguard, agro-corporate buyers inevitably drive farmgate prices down, farmers go bankrupt, and those desperate to remain on land degrade it with overproduction. Industrial agriculture wreaks ecological havoc, so an environmental movement not unpacking root causes of agricultural overproduction misunderstands the situation: industrial agriculture is the logical result of letting markets organize agriculture. The urgency of parity is in the exporting countries. Relatedly, it is also a question of if and how countries have the right to block cheap imports to safeguard their own producers, farmers, fishers, and rural communities. Currently, an historic convergence grows around critical food studies—from environmental to labor, racial justice to climate, health, civil society, and policymaking. This paper aims to facilitate dialogue with these movements to show the primary contradiction of agriculture, which undergirds the myriad salient secondary contradictions. It describes the generations of historical grassroots agrarian movements and subsequent governmental programs that arose to address the primary contradiction of industrial agriculture's wreckage of livelihood and land.

The paper begins by defining parity, its origins, and its implementation in the cases of the United States and India, with attention to their interconnected roots. The following section explains why supply management is needed for agricultural goods, particularly given environmental and social justice impacts of the status quo, including issues of wasted food, soil degradation, hunger, and overproduction. A description of the methodological development of the community-led research agenda continues to inform broader advocacy involvement and calls for future research. The paper then outlines the role of multilateral institutions like the World Trade Organization in the erasure of parity in pursuit of market liberalization, and the direct consequences for farmers globally. A historical overview of the rise and fall of parity programs follows, describing the marginalized farmer-led advocacy and coalition building that emerged in response. These movements inform an analysis of the reliance on subsidies, helping to distinguish between holistic supply management and direct payments, which have compounded consolidation and commodity overproduction and further marginalized small, medium, and BIPOC farmers. Ultimately, the paper concludes by linking the movements through the shared threads of justice, dignity, and radical imaginaries.

The urgency of food system transformation

Agricultural parity–as a suite of programs or even as a set of principles–comprised a central tenet of the U.S Farm Bill but is currently absent from most federal or state government farm policies or goals. When vestiges of it do persist–in the case of sugar or cotton tariffs for instance (Powell and Schmitz, 2005; Beckert, 2015); – it is usually convoluted and even corrupted from the original context of countering unfettered agro-capitalism. Farmgate price floors seem peripheral in the face of worldwide monumental crises, but a deep look at global catastrophes reveals their convergence in the environmental, social, economic, and political externalities of high-input, corporate-dominated, industrialized monocultural commodity crop (over)production. An even deeper look shows how agrarian crisis drives, results from, and exacerbates these externalities.

Most notably, in 2021, the UN Intergovernmental Panel on Climate Change declared a 'code red for humanity' demanding immediate action and attention toward our planetary boundaries. 2022 was characterized by the continuation of a global pandemic, coupled with record amounts of unpredictable severe weather events, extreme heat, and momentous soil degradation (IPCC, 2022). The globalized food system is deeply intertwined within these climate and public health intersections, making it a critical nexus for radical transformation. Global industrial monocropping and markets contribute massively to climate change, and at the same time, are extremely vulnerable to its impacts. While dominant

agri-food policies often assume and champion limited government intervention, it is pertinent to note how much calculated action and protective measures tend to uphold the agro-corporate-serving status quo, both in the United States and globally.

India serves as a real-time case study of the tussle between the forces of agro-capitalism and farmers. The Minimum Support Price (MSP) system is the sole safeguard for farmers, which offers economic dignity through fair prices. While farmers want fair price/MSP systems to be written into law, corporations are lobbying through three farms laws, to push for tax-free corporate markets, farmgate sales to corporations, the end of grain stocking limits, and the expansion of contract farming. They hoped to dismantle grain reserves and MSP, while simultaneously pushing for further market liberalizations. The MSP system, borne out of USAID (United States Agency for International Development) as a mechanism to safeguard farmers from predatory capitalism and the promotion of Green Revolution technologies, has been a cornerstone of Indian agricultural policy (Damodaran, 2020). Centuries of British exploitation destroyed India's economic and agrarian resilience. Indian farmers were forced to grow commodities like indigo, cotton, opium, and tea for British markets, which left less land for food crops. The colonial policies are directly responsible for over 30 famines during the British Raj. By the time India achieved Independence, much of its rural agrarian resources had been enervated, and the Indian government needed food aid: wheat and paddy, to ensure food security. Meanwhile, the US government had been monitoring Indian weather and crop patterns and used the PL-480 food assistance program as food diplomacy.

The program provided critical famine aid to India, providing a temporary solution to the lack of food security in the country. The aid was on a limited basis, however, as the US government used its food aid as leverage to coerce the Indian government to implement agricultural reforms that would lay the foundation for the Green Revolution. It began by funding agricultural research, setting protocols for agrarian legislation, and then introduced agrichemicals and Green Revolution seeds. Punjab was the first state to undergo this US-backed project of industrial agriculture. Agrichemicals were freely spread over the region, sometimes by fly-by-night operators (Shiva, 1989). Traditionally, farmers in Punjab grew native long stock wheat in certain areas, while rice/paddy was rare. When irrigation technology was introduced through the Green Revolution, however, Punjabi farmers were persuaded to grow paddy on a mass scale.

Minimum support prices were offered for wheat and paddy through government regulated market yards (APMC mandis) because Punjab did not have buyers for paddy and the new varieties of foreign wheat. Paddy/rice was not part of the Punjabi diet and was agronomically not suited to Punjab. It is only with the advent of electricity, tube wells and canals, that paddy cultivation was possible in Punjab. Once the MSP was set, the government stepped in as a buyer. It bought most of the produce for its food reserves and public distribution system. As years passed, food production in India increased and the food prices especially for MSP crops like wheat and rice started to fall. The case of paddy and wheat are important because they began to be grown by farmers in other parts of the country as well.

Over time, millions of Indian farming families have benefitted from this scheme. In 2022, Indian states of Punjab and Haryana where the MSP program and government grain procurement are still active, have the highest per-capita agrarian incomes (Tribune News Service, 2022). But just as corporations dismantled the parity program in the U.S., new attempts are being made to erase its living memory too. The three farm laws were one such attempt.

Within the U.S. context, Farm Bills consistently eroded market management, following pressures from WTO, and shifted price supports to subsidies, most often to the wealthiest and largest farm owners, thereby exacerbating racial and class disparities among landowners. Through chronically low global commodity crop prices, coupled with rising costs of production, farmers are pressured to "get big or get out." Many have been forced out of agriculture altogether, while others must produce more and more just to stay afloat. This system pollutes ecosystems, destroys rural communities, and contributes to food waste, but benefits corporate agri-business. Massive corporations can cheaply buy feed grains to funnel into feedlots and Concentrated Animal Feeding Operations (CAFOs), thereby further contributing to overproduction of meat within the U.S. and crushing more sustainable methods of livestock production through subsequent cheap pricing. Treating food as a commodity overlooks the coercive nature of market forces guided by corporate interests.

In their argument for an updated version of supply management and parity pricing, Schaffer and Ray (2018) describe the economic characteristics of food that distinguish it from other commodities operating in a deregulated free market system. The balance of supply and demand are skewed in the case of agricultural goods because of people's fundamental need to consume them. In other words, consumer demand for food is inelastic, meaning the cost has little impact on the decision to buy. If prices decline, demand will remain relatively steady. In a free-market system guided by neoliberal priorities, downward pressure on prices leaves farmers unable to cover production costs and deprived of a decent standard of living. In the case of manufactured commodities, corporations can respond to mismatched supply and demand by reducing production, idling capital, and laying off workers, or increase demand for their products by intensifying their marketing efforts or buying up their competitors. However, a low-price elasticity of total agricultural crop supply leads farmers to respond to falling prices by producing more, to cover their fixed costs. As a result, producers flood the market and further depress prices. Supply coordination would not only allow farmers, both domestically and globally, to capture fair prices, it would reduce surplus production and supply-demand mismatch.

Overproduction coupled with little to no supply management policies also plays a significant but largely un-analyzed role in the notorious problem of wasted food. The USDA calculates that nearly 40% of the national food supply turns into waste (USDA-Food Waste, 2022). On an international scale, studies conducted by the Food and Agriculture Organization of the United Nations (FAO, IFAD, UNICEF, WFP and WHO, 2022) conclude that up to one-third of food is lost or wasted at some point in its journey from field to plate (FAO, 2022). Greater social and political consciousness surrounding the ecological impacts of discarded organic matter emitting methane from landfills, or imperfect

produce never reaching supermarket shelves for aesthetic reasons, has led to consumer-side interventions that place the burden on the individual. To combat this misplaced responsibility, Gascón (2018) points to the power imbalances inherent in the "hegemonic agri-food model". In doing so, the author shifts food waste responsibility toward a system controlled by corporate interests that marginalize producers. This is a key analytic step, but going one step further, a parity history elaborates how farm policies to curb commodity crop glut and supply-demand mismatch have been eroded, penalized, and forgotten. Interventions to reduce wasted food that overlook the systemic injustice may inadvertently perpetuate cycles of overproduction. Agricultural parity suggests policy interventions aimed at eliminating root causes of wasted food, rather than simply treating the symptoms of a wasteful and extractive food system.

Additionally, although the U.S. and India are at different levels of economic development, farmers in both countries face similar consequences of broken agro-food systems. In India, farmers struggle with rising debt, falling incomes, suicide, drug addiction, and domestic violence as a by-product of faulty economic policies (Singh, 2022). In the U.S., rural sociologists and a few journalists and analysts have chronicled the devastating social impacts of the farm crisis on rural communities (Loboa and Meyer, 2001; Walters, 2003; Chrisman, 2019; Scheyett and Bayakly, 2019), and chronicle "hollowed out heartlands" (Edelman, 2021). But more investigation is needed on how decades of farmers' financial fallout led to a cascade of land loss, unemployment, hospital closures, mental health crises, and addiction. (Naylor P. E., 2017) Iowa op-ed laments the crushing experience of farmers who cannot "make it in the game," to quote a USDA official. Parity—as a set of principles and programs–offers an intervention to both cases of wrenching rural decline.

Methodology

This piece is informed through a decade-long practicum with graduate researchers, agri-food experts, and agrarian justice leaders at American University's School of International Service. This practicum, now in its ninth year, has generated dozens of mixed-methods, multimedia, multi-disciplinary deliverables. From documentary shorts to statistical analysis, from congressional briefings to ArcGIS maps, the practicum has also informed analyses *about* community-based research methodologies (Orozco et al., 2018; Fagundes, 2020; Montenegro et al., 2021; Watson and Wilson, 2021; Auerbach et al., 2022). In 2022, AU SIS "Agricultural Policy and Agrarian Justice" practicum researchers visited leaders and members of The Federation of Southern Cooperatives/Land Assistance Fund (FSC/LAF) in Alabama and Mississippi, farm justice leaders of the National Family Farm Coalition (NFFC) in rural Iowa, and Rural Coalition's member organization World Farmers, a refugee and immigrant farming group in Massachusetts. Using these methodologies as a baseline, three students, including co-author Andrea Jewett, traveled with Graddy-Lovelace (2021b) to Alabama and Mississippi to work with and learn from the FSC/LAF (O'Brien, 2017). Discussions of parity pricing and supply coordination served as throughlines of the discussions of member outreach and ground-level implementation of Farm Bill policies. Cooperative organization plays a key role in ensuring that Black farmers capture fair prices when deprived of federal assistance.

Simultaneously, Graddy-Lovelace and three student researchers, including co-author Jacqueline Krikorian, traveled to Lancaster, Massachusetts to visit Flat Mentors Farm and learn from World Farmer's founder Maria Moriera, Executive Director Henrietta Isaboke, and Policy Director Jessy Gill, with the objective of honing market-based research for program farmers to better support small farm businesses. Finally, four students, including co-authors Avinash Vivekanandan and Katherine Stahl, traveled across Iowa, and conducted interviews with farm justice leaders, including George and Patti Naylor, Brad Wilson, and Larry Ginter. These humbling and inspiring conversations with lifelong activists shed light on the socioeconomic decline of rural and small-town America, the deep pain of losing the family farm, and how parity offers a chance at a more holistic and healing farming future. In addition, India agricultural policy expert Devinder Sharma spoke on the fight for a minimum support price (MSP) in India (Sharma, 2021), bringing an international perspective for the global fight for farm justice. Together with the valuable guidance, support, and editing expertise of community partner and co-author Indra Shekhar Singh, the Iowa research team produced a 42-min documentary intended to make the story and economic underpinnings of parity more broadly accessible to all, rather than just those in academia. Included are first-hand accounts of the environmental impacts exacerbated by the "get big or get out" mindset farmers had to adopt as price floors fell and eventually disappeared altogether (Naylor G., 2017). Parity, as discussed in the film, emerges not as a utopian vision, but as a pragmatic and precedented policy alternative with the potential to reduce rural poverty by revitalizing farming communities, reverse biodiversity loss stemming from fencerow-to-fencerow farming of GM crops, reduce agriculture-related environmental pollution, and bring people back to the land.

This article is most closely influenced by the lessons and histories passed down from farm justice leaders and legends and exists within the broader context of the decade-long research. Their commitment to the movement, tenacity to work the land, and selfless leadership informs understandings of intersectional agricultural policy. Importantly, resistance to the global food system has not historically been documented with plentiful or honest visibility. As a result, oral histories, historical archival analyses, and intuitive learning through relationship with land can support the formation of intersectional agricultural policy. Most of the knowledge that practitioners have is stored within their own selves and shelves, in their lived experiences, movement-held home and office archives, and communal oral histories rather than written, published literature (Riley and Harvey, 2007). Faced with a system that has commonly discouraged the participation and value, BIPOC, immigrant, and marginalized farmers worldwide have grown distrustful of agri-food systems to provide them with fair and dignified treatment. Researchers, farmers, practitioners, and experts have come together to co-design and co-author this open access article, despite differences in perspectives and experience. This paper represents months of dialogue and co-creation which has converged as an antecedent

to largescale policy research and design, rooted in pillars of agro-economic justice.

Farm justice in a globalizing world

With fair wages for farmers being a seemingly 'common sense' solution, what obstacles lie between its implementations? For one, parity principles of supply management and price floors are effectively criminalized by the WTO. These measures are considered highly trade-distorting, and as such, are subject to reduction. The world price is "sacred" for the WTO, as domestic price floors set too high above the world price must be reduced in accordance with Agreement on Agriculture (AoA) regulations. Importantly, the world price is effectively set by massive agricultural corporations, and this control generally keeps the world price for products at a level below the cost of production (Ritchie and Dawkins, 1999, 2000). AoA regulation prevents nations from implementing domestic price floors at parity levels, hampering the ability of domestic policy to adequately support small and family farmers. Supply management programs are also considered market distortion by the WTO, and the last vestiges of US supply management were eliminated in the 1996 Farm Bill to be in line with WTO regulations (Murphy et al., 2005). The result has been US farm policy that hurts both US and non-US farmers alike. As Murphy et al. (2005) explain, this result occurs because supply management programs "helped to correct a structural flaw in agricultural markets:" too many sellers and not enough buyers – commodity buyers hold too much power, and sellers (farmers) too little. In 1996, agribusiness lobbyists (and neoliberal economic philosophy) were finally successful in eliminating government intervention, which had helped foster an allegedly free market. Following this, "US agricultural prices went into free fall," creating a situation where commodity buyers could purchase products under the cost of production. Since the mid-twenteeth century, the U.S. has been accused of commodity crop 'dumping': exporting surplus commodity crops below cost of production and/or below farmgate prices of importing countries; undermining small-scale farmer viability globally. Since the 1996 Farm Bill, levels of dumping have risen across the board, harming producers around the world (Murphy et al., 2005; Murphy and Hansen-Kuhn, 2020). Only growers with large economies of scale garner reliable income from export markets, and the profit margin remains razor-thin and vulnerable to trade stand-offs.

Problematically, the WTO similarly discourages grain reserves through its insistence that domestic support does not distort trade. Grain reserves pull excess supply off the market to prevent prices from falling too low, and release supply into the market when prices rise too high. Reserves are an important tool to combat food shortages and protect human health; a mechanism to ensure more stable commodity prices, thereby benefiting consumers and producers; and a means to limit private sector control of agriculture (Murphy, 2009). A lack of reserves can exacerbate country-level vulnerability to supply chain disruptions, volatile commodity prices, and climate shocks that affect crop yield (Wright, 2009). The logic behind reserves is ancient, and the idea of stockpiling supply in good crop years, to safeguard against famine in bad years, is seen across ancient civilizations (Murphy, 2009). However, WTO regulations make public reserves difficult to establish and operate. Although the WTO does not outright ban reserves, it makes them tricky to even conceptualize. Reserves are key for effective price supports (Murphy, 2010; Murphy and Lilliston, 2017), exemplified by India's case. Cutting production without reserves places societies in vulnerable positions, heightening food insecurity. The WTO is not the only barrier to public grain reserve success – grain reserves require the public to place a great deal of trust in their government's ability to manage them adequately and equitably, and that trust is often, for good reason (authoritarian regimes, state-sanctioned racism, corporate corruption), lacking. More research is needed on reserve viability given this lack of trust.

Although the AoA fails to benefit farmers in the U.S. and abroad while pouring benefits upon wealthy multinational corporations, the WTO heavily favors highly industrialized nations of the Global North (Díaz-Bonilla et al., 2003; Clapp, 2006; Wise, 2009; Burnett and Murphy, 2014). Structural Adjustment Programs, introduced by International Financial Institutions, encouraged the production of commodity crops for export, neglecting local food baskets, and "made poor countries dependent on a volatile global market for their food" (Shattuck and Holt-Gimenez, 2010). Economically poor countries evolved from net food exporters to net food importers because of SAPs and influxes of low-priced Northern foodstuffs (Joseph, 2011).

Although all member nations were required to reduce "trade-distorting" support (by 20% for developed countries or 13% for developing), reduction commitments were tied to support levels between 1986 and 1988 – a period when US and EU farm support was very high compared to the rest of the world. Thus, developed nations account for 95% of current global "total aggregate measure of support" (AMS) entitlement, creating an artificial comparative advantage for developed country agricultural producers, and displacing farmers in developing countries (Sharma et al., 2021).

It is pertinent to note that farmers and peasants in the global movement La Via Campesina (LVC) have been calling for the WTO to get out of agriculture altogether, to dismantle the Agreement on Agriculture, and to remove agriculture from all Free Trade Agreements. Food production must meet the needs of local and territorial consumption first, protecting farmer livelihoods and the natural environment. LVC calls for governments "to build public food stocks procured from peasants and small-scale food producers at a support price that is just, legally guaranteed and viable for the producers," reflecting the principles of parity (LVC, 2022). Importantly, the WTO is not part of the United Nations system. It has emerged as an unduly powerful global institution, yet unaccountable to governments, elected officials, or democratically selected representative bodies. Rather, governments must adhere to WTO regulations or face steep punitive retribution. Updating agricultural parity policies requires multi-scalar, integrative, and responsive international supply, pricing, and trade coordination, aiming for agrarian wellbeing and diversity among all trading partners, as well as agroecological, labor, and health safeguards (Fakhri, 2020). In short, international parity policies, be they bilateral, multilateral, or regional, would need to be grounded in agrarian solidarity (Graddy-Lovelace and Naylor, 2021).

Although the stated intention of the AoA is to allow countries flexibility in designing and implementing domestic agricultural policies, the reality is a system that favors big agribusiness and highly industrialized countries. Family and smallholder farmers across the globe, including in the U.S., fail to benefit from domestic policies that offer a band-aid, rather than a solution, to the problem of low commodity prices (as explained by such agricultural policy analysts as Ritchie and Ristau (1987) in their "Crisis by Design" report in 1987). Despite well documented rising farmer debt, for decades U.S. farm policy has "patched together emergency fixes" (Hansen-Kuhn, 2020) while upholding the status quo. Fair prices for agricultural products, reliably maintained at a level above the cost of production, have the potential to radically change our global food system. For parity pricing to occur, however, the regulations of the AoA need updating to reflect how markets fail farmers and consumers through encouraging over-production and environmental externalities, prices that routinely fall below the cost of production, and relatively cheaper Northern products outcompeting local goods in foreign markets. Farm parity policies, in all their diversity, have the potential to offer alternatives to the dominant neoliberal paradigm. In the case of agriculture, the pressure for countries to submit to an allegedly self-regulating "free" market forces producers to sacrifice ecosystems and rural communities for the sake of global competitiveness. On a micro-scale, this hegemonic paradigm requires that farmers reject their personal belief systems just to maintain their livelihood.

Our global system and the many powerful multilateral institutions and entrenched belief systems that uphold it create an obvious barrier to parity principles being incorporated in domestic agricultural policy. Less obvious, however, is the unintentional role that even environmental movements for agri-food systems reform can play in upholding the status quo. These movements often frame farmers as the rich and powerful beneficiaries of massive subsidies, bank-rolled by the poor American taxpayer. In doing so, these movements turn the public against farmers and obfuscate the truth: farmers are not "subsidized". Rather, massive multinational agro-corporations are subsidized and profit greatly from the entire system that has made subsidies necessary in the first place. Many food and environmental movements pin the blame for overproduction on U.S. agricultural subsidies, which also creates the illusion that farmers actively choose to overproduce and engage in farming practices with significant ecological externalities. This framing falls short analytically. Many scholars are following the lead of civil society, which follows the lead of frontline communities in lambasting agro-corporate consolidation and impunity. For instance, Davis Stone Glenn (2022) recent book describes the agri-food corporations' systemic appropriation of value (2022). Going further, however, a farmer-centric perspective reveals how "subsidies" remain symptoms of the political economic problem. Getting rid of subsidies is frequently framed as a fix-all but fails to address the root cause of so many agriculture-related issues: chronically low prices upheld by a global regime of corporate behemoths. Fixing the multitude of issues within our global agri-food system will require radical solidarity within and between various movements, and it is critical for these movements to advocate for policy solutions that will support and diversify farmers – and a whole new generation of growers, agricultural cooperatives, and coalitions.

US farm justice through parity

Prior to the invention of the parity market management programs in the 1930s, there were six decades of market failure and cheap farm prices, with occasional brief exceptions (Schaffer and Ray, 2006). The failure to protect farmer livelihoods spurred widespread mobilization from coalitions of family farmers, especially in the Midwestern United States, who coordinated advocacy efforts, political mobilization, and built alternative systems (Schutz, 1986; Krebs, 1992). Importantly, the Farmers' Alliance rose in the 1880's, and shortly after welcomed women members, supporting the creation of the Colored Farmers' National Alliance by African American farmers in the South (Ness, 2004), signaling the beginning of inter-racial collaboration and a broader social movement. In addition, one of the major proposals of the Farmers' Alliance and the People's Party was the Subtreasury Plan, which would set up government warehouses to store a farmer's crop on which 80% of its value could be borrowed from the government to be paid back within a year (Ness, 2004). This would avoid having to sell at the disastrously low prices at harvest. The Subtreasury Plan provided a model for subsequent Non-Recourse Loan price support mechanisms of the New Deal. The groups also formed cooperatives for self-help, a strategy that continues to strengthen rural communities today. After the turn of the century, farmers formed the National Farmers Union, the Non-Partisan League, and the Farmers Holiday Association, which confronted Congress and the President on the need for fair prices (Graddy-Lovelace, 2019).

U.S. parity programs were designed to address a chronic failure of markets: "the lack of price responsiveness" of both the supply and the demand for aggregate agriculture (Schaffer and Ray, 2006). The programs managed farm markets through two main mechanisms: minimum farm price floors, backed up by supply reductions as needed, and maximum price ceilings, which triggered the release of strategic reserve supplies, balancing supply and demand (Ray, 2004). Chronically low prices were not just a problem during the Great Depression, when the programs were invented, but had occurred, with occasional exceptions, for six decades prior (Schaffer and Ray, 2006). The lack of price responsiveness for agricultural products has continued with few exceptions ever since (Schaffer and Ray, 2005), and the USDA and the Congressional Budget Office project continuations of low farm prices for another 10 years (USDA-Office of Chief Economist, 2022).

The parity programs achieved fair farmgate prices and reduced overproduction when well managed. The peak of the program occurred from 1942 to 1952, when price floors for "basic" and "nonbasic commodities" were set at 90 or 85% of parity (Bowers and Rasmussen, 1984). U.S. agriculture achieved 100% or more of the parity standard, also known as the parity ratio, calculated by dividing prices received by prices paid (USDA-NASS, 1955). During these years 100% of parity prices were generally achieved for most of the crops covered, including fruits and vegetables (USDA-NASS, 2022).

The following metrics further showcase how parity programs supported farmers and increased their chances of success. Farm sector debt, which peaked at $185 billion in 1932, was cut in half (down to $89 billion) by 1952. National net farm income rose from $35 billion in 1932 to $129 billion in 1952 (USDA-ERS, 2022e). Return on equity, measured as net farm income divided by equity, increased from 6% in 1932 to 12% in 1952 (USDA-ERS "Value Added", US Census, 1949 and Gardner, 2006a,b). This brought it more in line with that of other industries, such as farm implement manufacturers, food processors, food chains, restaurants, and tobacco and beverage companies, each of which also tended to be in the double digits (Letter, 1958). Average cash receipts for food grains, feed crops, and oil crops increased by 133% (1920-32 average vs. 1942-52 average, adjusted for inflation in 2020 dollars). Fruit, vegetable, melon, and nut cash receipts increased by 99%. Livestock, poultry, and related products cash receipts increased by 136% (USDA-ERS, 2022b). Between 1940 and 1950, the percentage of full and part owner farms also increased by 6% nationwide (USDA-NASS, 1969). For nonwhite farms in the South the increase was 12%, and this was the only increase in ownership between 1920 and the 1990s (USDA-NASS, 1969).

Tragically, the rise to the parity years was followed by a 40-year period of lowering minimum farm price floors ("loan rates"), after which the programs were eliminated (Ward, 1976 and Ray, 2004). For example, price floors for corn were lowered incrementally, from 90% of parity in 1942 to just 31% in 1995, after which they were totally dismantled (Sumner, 2006) (Figure 1).

The erosion of parity resulted in decades of socioeconomic decline for US farmers and rural communities. The progress shown above by major economic indicators was quickly reversed. Farm market prices closely followed the drops in price floors (USDA-NASS, 2022). The combined market income from 8 major crops fell below full economic costs every year but one from 1981 through 2005 (USDA-ERS, 2022a "Commodity Costs", USDA-NASS, 2022 "Historical Track Record"). Critically, although yields increased dramatically over these years, annual net farm income quickly dropped and generally remained low (Figure 2). With lower net farm income and greater debt (Figure 3), return on equity from current income quickly fell, from 22% during the parity years to just 3.7% as of 2019 (USDA-ERS, 2022c "Balance Sheet" and "Value added"). As farm prices fell, profitability rose for the agribusiness buyers of farm products, U.S. and foreign, who were buying below full costs. Return on equity for food processing companies and food chains rose to double and triple the rate for farmers (Krebs, 1992). For example, by the 1980s Ralston Purina and Kellogg's averaged 33.6% and 38.9% returns on equity, and each had five-year averages of 43% or more (Krebs, 1992). Meanwhile total return on equity for U.S. farmers fell below zero for 5 years in a row, and for the corn belt, double digits below zero for 6 years (USDA-ERS, 2022d "Farm sector financial ratios").

While farmers received cheap prices for feed grains, livestock and poultry CAFOs buying those grains profited, both from the ability to cheaply raise huge numbers of livestock, and from the subsequent comparatively cheap sale of that meat. Farmers raising livestock sustainably on pasture were unable to compete with CAFOs and so lost their value-added livestock. This loss led to a massive decline of farms with a diversity of sustainable livestock crops: grass pastures, hay, and oats. For example, in the five corn belt states (Illinois, Indiana, Iowa, Missouri and Ohio) while 61% of farms were lost between the 1950 and 2017 Censuses of Agriculture, 84% of farms with cattle were lost, 98% of hog farms, 99% of farms with dairy sales, and 97% of farms with poultry sales (USDA-NASS Census of Agriculture, 1954). With the loss of livestock diversity, crop sustainability patterns followed suit: 76% of farms with hay were lost, 95% of farms with pasture on cropland, and 99% of farms with oats (USDA-NASS Census of Agriculture, 1954), signaling broad trends of biodiversity loss and ecological destruction.

The long history of mass activism from family farmers, while oft overlooked and untold, speaks to the persistence of discontent. Importantly, this historical analysis requires layers of international contextualization, starting with how tribal and Indigenous nations were excluded from the programs, and moving on to how such federal farm policy excluded growers in the territories and neo-colonies of Puerto Rico, Guam, Mariana Islands and elsewhere. This international contextualization would also situate U.S. Farm Bills and farm justice movements within Cold War geopolitics and amidst the liberatory but convoluted dynamics of decolonialization. For instance, PL-480 provided an outlet for the vast surpluses in the post-World War II excesses of production. Over time PL-480 became a powerful agro-economic tool (Ruttan, 1993; Diven, 2001; Clapp, 2012; McMichael, 2021), reaching to India and beyond, that helped to achieve U.S. foreign policy goals. U.S. wheat, corn, rice have been as critical as the military in spreading U.S. hegemony across the world (Morgan, 1979). Further research is needed to uncover deeper relationships between supply management, surplus disposal, and PL-480 food aid programs. Throughout the 1900s, farmers formed new national and state organizations and alliances (Wilson, 2016). In 1955 the National Farmers Organization (NFO) was formed, eventually forming state organizations in 48 states. During the 1960s, NFO rallies reached 10,000, then 20,000, to an overflow crowd of 34,400 farmers (Krebs, 1992; Rowell, 1993). NFO protests were often geared toward collective bargaining, fighting against withholding actions such as milk dumping. At one point, NFO mobilized a million farmers to come to meetings in 19 states within a six-month period (NFO Reporter, 1963). As the decline from parity continued, the American Agriculture Movement (AAM) rose up vigorously during the 1970s, "with some 600 offices scattered throughout the United States, and with rallies of tens of thousands of farmers, and "tractorcades," including one in which farmers planted themselves on the National Mall in Washington D.C. for months, with tractors (De Graaf et al., 1982; Krebs, 1992). The Farmers Union (NFU) also played a major role. During the 1980s, the abovementioned groups and others formed alliances at state, national and international levels, with additional support from labor and church groups (North American Farmer, various issues). They all came together in support of proposals for restoration of parity farm programs, for example, at the United Farmer and Rancher Congress of 1986 (Naylor, 1986). The National Family Farm Coalition (NFFC) and NFU each developed proposals for restoration of price floor programs (NFFC, 2007, 2021; Schaffer et al., 2012; Wilson, 2012).

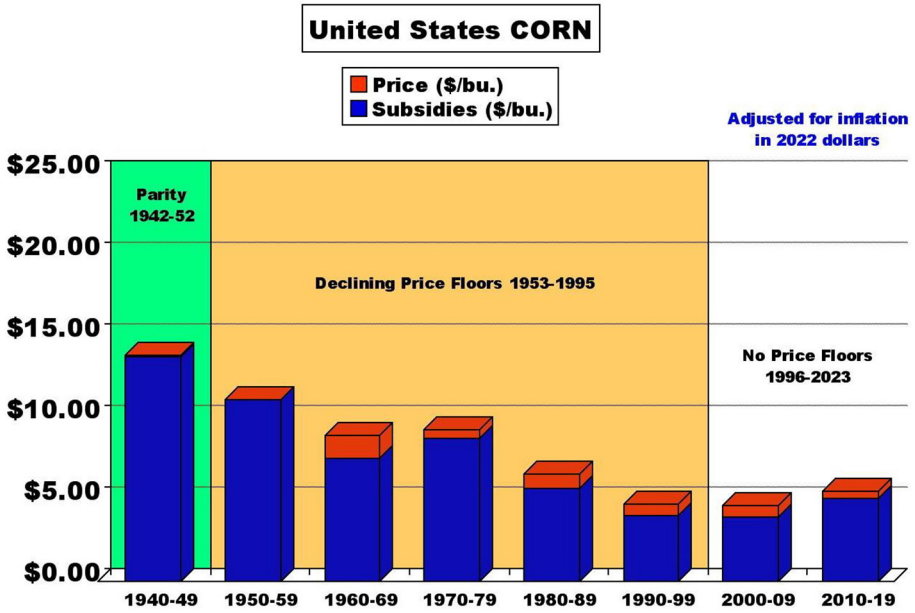

FIGURE 1
As parity eroded, price floors for corn were gradually reduced until finally being eliminated in 1996. This graph shows declining prices for corn, as they relate to declining government support.

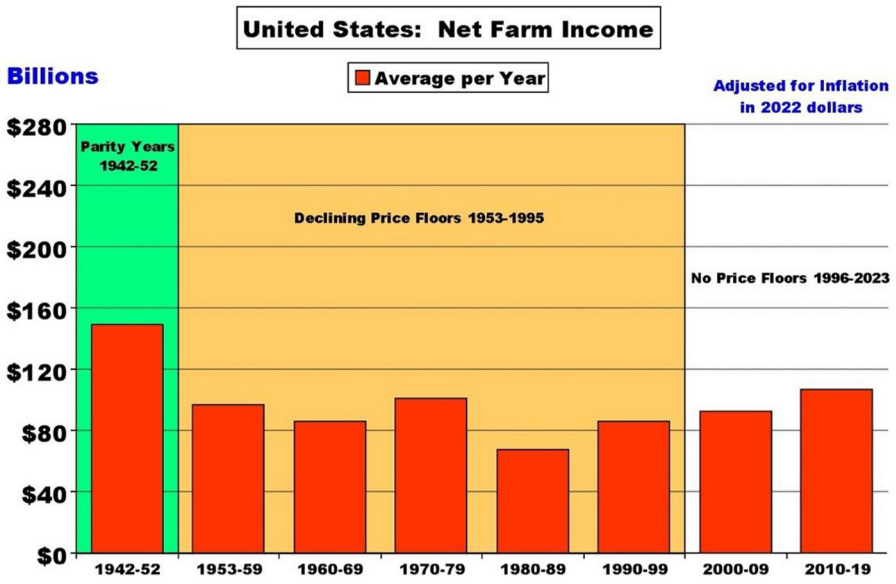

FIGURE 2
Average net farm income throughout decline from parity. As price floors were gradually reduced, net farm income generally fell (USDA, ERS, Income and Wealth Statistics).

Overall, few scholars have addressed agricultural parity programs, though the topic merits substantial multidisciplinary, mixed-methods investigation, from archival history to agricultural economic statistical regression. Winders (2009) analysis focuses largely on the way different commodity associations lobbied Congress, with important historical and geographic descriptions. Yet, the claim of differences among corn, cotton, wheat, and other major commodity crop growers, based on Congressional records, conflates lobbying with what happens on the ground for farmers themselves: largely two separate realities. For example, Congress reduced core farm program benefits in every Farm Bill from the early 1950s until the programs ended in 1996 (Hansen-Kuhn, 2020), and yet those voting for those reductions referred to these Farm Bills as good for farmers. Despite geographical and

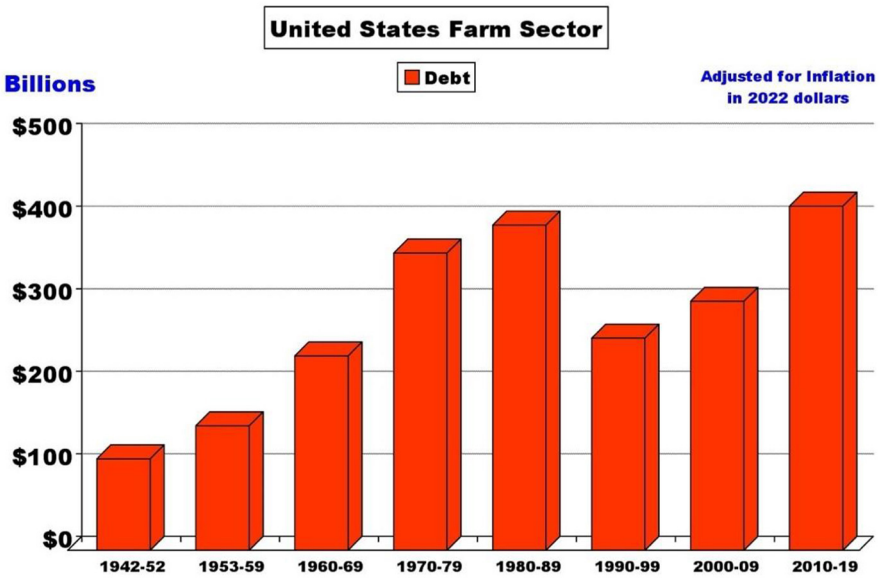

FIGURE 3
As parity was gradually eroded through agricultural policy changes, US farm sector debt rose, and currently farm sector debt is over $400 billion (USDA-ERS, Balance Sheet).

agricultural differences among corn, cotton, and wheat farmers, these producers forged improbable but important coalitions throughout the twentieth century based on the shared struggle for fair farmgate prices, such as during the United Farmer and Rancher Congress in the 1980s, which united farm justice demands from more than 1,000 delegates representing all the lower 48 states (Naylor, 1986). The price issue was the top priority, affecting most other issues in major ways.

The Family Farm Movement, like any movement, was not monolithic. Indeed, what makes it historic was that such divergent constituents comprised it, following intensive and extensive outreach, pre-internet knowledge sharing, political education, pre-cell phone communications, dialogue, debate, consensus-building, community organizing, and travel—to rural places across the Midwest as well as to D.C., by tractor no less. This movement deserves its own paper, books, and documentaries, well beyond the scope of this paper, which aims merely to introduce the topic and instigate such research. Of note, Jesse Jackson and the broader Rainbow Coalition featured prominently in these farm justice movements, as did the leadership of Ralph Paige and other Federation of Southern Cooperatives/Land Assistance Fund leaders and members, who deliberately united racial justice, farm justice, labor justice, and land justice movements (Slotnik, 2018). Drawing upon her 2017 Practicum research trip to Iowa to study home archives of the family farm movement, Tracy Watson co-authored with Brad Wilson "Two hidden histories of rural racial solidarity movements" (Watson and Wilson, 2021), chronicling how Black farmers and community leaders worked with white counterparts to stop racist militias feeding off the 1980s rural farm crisis.

Farm justice movements have largely dwindled, alongside the overall percentage of the population who farms for a living. Yet, vestiges remain and are merging and growing, through such projects as Disparity to Parity. In 2019, drawing on 7 years of collaboration with National Family Farm Coalition and member and ally farm justice organizations, and in the wake of NFFC director Kathy Ozer's and Federation's director Ralph Paige's untimely deaths, Graddy-Lovelace co-initiated a public research project to archive and pool farmer knowledge on parity policies. Working with NFFC, as well as FSC/LAF, Institute for Agriculture and Trade Policy, Food and Water Watch, Farm Aid, and others, this expanded to become Disparity to Parity (D2P) (disparitytoparity.org), a community-*led* action research collaboration to recenter parity and to update it for racial/gender equity and ecological resilience. Nevertheless, many food, environment, and agricultural groups do not focus on or even mention market management, yet. While advancing alternative agri-food systems remains vital, reforming—and even transforming—the dominant agricultural system remains foundational to human and planetary survival.

Parity for whom? Rethinking supply management through a racial justice lens

Between the parity years of the 1940s and the ensuing decline from parity in the following decades, the number of farm owners changed dramatically. After the increases described above, the number of farm owners dropped 26 and 20% for the 1950s and 1960s (USDA-NASS, Census of Agriculture, various years). The reversal from the parity years was more impactful for nonwhite farm owners in the South, where 37 and 48% were lost in the 1950s and 1960s. The loss of tenant farmers increased dramatically as

well, with an 85% reduction between 1950 and 1990, and, unlike the parity years, these reductions did not lead to an increase in the number of owners. For nonwhite tenants in the South, 96% of those surviving to 1950 were lost by 1970. The following subsection will describe some experiences of Black and immigrant farmers throughout parity years and beyond, highlighting the need for more inclusive supply management policy, the resilience of rural communities, and the power of agrarian voices.

Internationally, the US was emerging as an agricultural technology leader. Green Revolution technology created higher surpluses in the US, causing a central contradiction in US policy: on one hand managing supply to prevent glut, on the other hand disposing of that surplus for geopolitical gain. As parity systems were active, most farmers growing parity crops received price supports. A historical overview of Agricultural Adjustment Act (AAA) programs examines the inequitable distribution of benefits in the U.S. South (Pennick, 2011). Non-recourse loans, price supports, grain reserves, and acreage set-asides, outlined above, were implemented throughout the region. However, these programs were tailored to white landowners and systematically excluded Black farmers (Sligh, 2021). In the face of institutional racism and subjugation by white officials, the collective mindset allowed Black families and cooperatives to strengthen rural communities and pursue land and farm-based economic development (White, 2018). However, the continuing farm justice movement in the South persists only because of the steadfast commitment of our community partners and countless others (Barnes, 1987). Cornelius Blanding, Executive Director of the Federation, argues that although the concept of fair prices is an urgent priority.

> The word [parity] does not speak to the needs and lived experiences of our members. For a select few farm elders who recall the cotton, peanut, or tobacco quota programs from a generation or two ago, like Mr. Ben Burkett, the concept of price-floors and supply management make sense. But for middle-age or younger farmers, the concept is historic and improbable. Moreover, for those struggling to hold on to land, or who have suffered the trauma of racist dispossession, "parity" seems too abstract and removed from the urgency at hand. They are ready, however, to resume prior activism around fair prices—alongside the struggle against broader racisms in agriculture and land policies (Blanding, 2020).

Jerry Pennick chronicles the racism of this injunction amidst the long history of USDA anti-Blackness, from slavery and sharecropping to Jim Crow racial terrorism and coordinated land dispossession (Banks, 1986): "let us put to rest the argument that the Black farmers' [Pigford] discrimination settlement against the USDA should be enough. That argument too is steeped in racism. The fact is that, even though the USDA admitted that it actually did discriminate based on race, the Black farmers who could individually prove that they experienced race-based discrimination, on average received <$50K from the settlement—or even enough to buy a good tractor and no Black farmer was made whole" (Grant et al., 2012; Tyler and Moore, 2013; Pennick, 2021 on Pigford civil rights class action lawsuit against the USDA). This trend continued into 2022, when the Inflation Reduction Act included $2.2B to farmers and ranchers who have faced "discrimination" and $3.1B for debt relief to "disadvantaged" growers; but this casts too broad a net to ensure restitution for Black farmers, who have, as documented extensively, faced acutest bias (Pennick, 2021; Rappeport, 2022).

Ben Burkett remembers growing up during parity years and farming with his father on their land in Petal, Mississippi. He explains that cotton allotments regulated how much each farmer could plant, which helped manage supply and reduce overproduction. However, the system favored larger landowners, most of which were white (Burkett, 2021). According to census data from the USDA, Black farmers have for the last few decades operated about one third of the national average of acres farmed, and this number may have declined since the most recent 2017 census, given rising farm debt and land loss for African Americans (Economic Research Service, 1986 and National Agriculture Statistics Service 2019). Despite the racist implementation of allotment and other supply management programs, Black farmers did benefit from solid price floors. For small and medium-sized farmers, a guaranteed fair price might determine whether they can cover their costs of production. With the erasure of supply coordination, farmers are unable to predict or prepare for rock-bottom farmgate prices.

While acknowledging the inequity ingrained in New Deal AAA programs, Pennick and Gray (2006) also conducted interviews with Black farmers about their experience with cotton programs in post-parity years (in the early 2000s). The cotton program discussed in the text involved counter-cyclical payments (often called subsidies) (USDA, Farm Service Agency, 2003), which supplement farmer income given low global cotton prices. Black farmers in the program acknowledged their dependence on the payments to continue farming, though they still struggled to cover the rising costs of production (Pennick and Gray, 2006). Respondents also revealed that they consistently received less money than neighboring white farmers. One participant stated, "The government should investigate those agencies on how the price support programs are determined. Whereas, whites get a high base on land, when blacks lease the same land their payments are lower" (Pennick and Gray, 2006). Finally, when asked about the impact of cotton prices on the producer experience, "in virtually every instance they said that a fair price would solve the problem and the cotton subsidies, therefore, would not be necessary (Pennick and Gray, 2006). To conflate counter-cyclical payments as in this study with price supports is incorrect: subsidies reinforce farmer vulnerability and dependence, while well-designed, just, and equitable supply management policy guarantees a fair price and a stable income.

The Federation, along with ally organizations and coalitions across the US and around the world, works to ensure secure markets and fair prices for their products to revitalize rural communities. Blanding explains that cooperatives allow small-scale farmers to aggregate not only tools and resources but production: "farmers with limited resources. Can buy collectively and gain economies of scale, then lower the costs of production. And the more you can lower the cost of production, the easier it becomes to get to that fair price" (Blanding, 2020). The Federation brings together cooperative networks and state cooperative associations to broaden the impact of aggregation and knowledge-sharing.

Additionally, alternative systems are bolstered by activities such as institutional purchasing from facilities like schools and hospitals, which secure fair prices and reliable demand in the absence of mandated price floors. The work of Black farming cooperatives in the South does not stand alone. The following case shares an ethos of survival within an exclusionary agro-industrial system and offers crucial lessons in the power of practitioner-led solutions to structural problems.

Given the volatility of largescale policy initiatives within shifting administrations, changes in farm policy tend to fall short of systemic reevaluation. Fostering a cooperative mindset as a core principle of alternative systems facilitates locally controlled supply management as a tool of survival. Coalition-building among farmers is offering an alternative to the exploitative culture of competition and racism while reimagining the country's traditional agrarianism. We see this principle come to life when factoring in the experiences of Rural Coalition's member organization World Farmers. Based in rural Massachusetts, their mission is to honor the dignity and passion of immigrant and refugee farmers to grow food vital to their culture and communities, and to provide support to each farmer in their endeavors to do so (Krikorian et al., 2022). Their programming first began because of the bravery of a refugee farmer in asking for land when her family and community had a great need, and the kindness of an immigrant farmer who offered land because they knew what it was like to lack (Freedoms Way 2020). That land became known as Flats Mentor Farm (Cox and Krikorian, 2022). Now, World Farmers supports farmers along every step of the learning process, facilitating mentorship spaces across farmers and cultures, cultivating a shared space among individuals of like-backgrounds so that farmers can learn together and from each other, and can be inspired by those who have come before them. The Flats Mentor Farm land site serves as an example of this, where seeds are shared across cultures, produce grown without boundaries, and families made from differing mother tongues and traditions.

Unfortunately, organizations like Rural Coalition members groups and the Federation of Southern Cooperatives, who aim to support small Black and immigrant farmers at the community level, work within a vacuum of established supports for growers of color. With a majority of dominant food system tailored to large corporate interests, rural communities continue to band together around what could be seen as basic principles of parity through supply coordination, collective bargaining, and market control on small levels, even when national policies disempower and discourage them to continue farming (Ray et al., 2003; White, 2018). With USDA's goals focused on all-out production for the benefit of agribusiness input sellers and grocery buyers, federal farm support remains inadequate and counterproductive. These programs are typically underfunded, understaffed, unequipped and often misguided. Thus, communities that should benefit from real agrarian policies must rely on each other for support. Especially as history has brutally misrepresented and excluded immigrant farmers and farmers of color, a growing distrust in the institutions makes learning from grassroots practitioners even more crucial.

On a macro-level, learning from immigrant and Black farmers is crucial to redefining our understanding of agricultural policy here in the United States. The United States global food system is informed, upheld, and led by the work of BIPOC and immigrant farmers who have contributed to a system that does not value, acknowledge, or support them often enough. The use of confusing, roundabout diction and policy is intentional to keep the white-focused status quo (Conrad, 2020). However, as discussed throughout this article, we must center diverse agrarian voices, as they have continuously paved the way for revolution and agrarian viability throughout a (neo)colonial oppressive state (White, 2018). In the work of updating parity programs and expanding them explicitly for racial justice, this would also require centering Black leadership in agricultural policies of supply management, quota governance, farmgate price calculations, outreach to farmers, program assessment and evaluation, and which crops to prioritize.

This direction would also require an anti-racist international agricultural policy orientation and commitment—moving from racialized feed-the-world geopolitics or a competitive farmer-vs-farmer zero-sum game paradigm to a transnational solidarity with farmers around the world.

India farmer uprising

The historical import of the India Farmer Uprising eluded U.S. journalism, scholarship, and even food and agricultural civil society, for many reasons: from media urban bias to a misunderstanding of the crux role of farmgate prices, to, we argue, a geopolitical racial bias. India has twice the population of the continent of Europe, and over five times the linguistic and (agri)cultural diversity. If the same numbers of people were occupying the capital city in Europe for over a year, it would have dominated the news. Accordingly, we position the Indian Farmers Movement (called a Revolution on the ground in India) as of world-historical importance, both for the scale and diversity of its mobilization and due to its content: the universal need for fair farmgate price floors so farmers can live and grow on the land.

After years of agrarian distress, falling incomes, growing rural debt, and landlessness that had taken the lives of over 300,000 farmers (Thomas and De Tavernier, 2017) farmers throughout India were hit by a global pandemic and subsequently, large-scale lockdowns. The restrictions crippled a majority of the agricultural sector as many small to medium sized farmers lost access to crucial food markets. Subsequently, three farm laws were introduced by the Indian government in 2020 during the lockdowns to forcefully open the previously protected agriculture sector to privatization and corporate takeover, referred to by the government as "agricultural marketing reforms." These laws aimed to end stocking limits for agro-processors, allowed corporations to create tax-free market-yards, and gave legal validity to corporate contract farming. The claim made by the ruling Bharatiya Janata Party (BJP) and its Prime Minister Narendra Modi was that these reforms would increase farmer incomes, broaden their marketing choices, spur technological investment that improved farm productivity, and attract foreign direct investments to Indian agriculture (Agarwal, 2020; Varghese, 2020, 2021).

However, farmer unions in Punjab and Haryana–the two main breadbasket regions of the country – expressed fears that the laws threaten to dismantle the existing minimum support price (MSP) system that provides farmers with price floors for twenty-three crops. Their fears were justified, as the government had a

detailed plan to create tax-free corporate market-yards to procure grains while the government owned market yards–also known as *mandis*–were taxed. This naturally favored corporate buyers who could now procure the grain below market price without taxation. What concerned the farmers was the fact that similar reforms were introduced in the Indian state of Bihar in 2006 and had failed miserably (Januzzi, 2011). Instead of investment, corporations and big traders used the laws to squeeze farmers, significantly reducing the incomes of farmers well below the state average. Meanwhile Bihari farmers' grain, wheat, and rice were being carted to Punjab and Haryana by traders and corporations to be sold in government *mandis* (market-yards) at minimum support price (MSP) rates.

Many argued that dampening the influence of the MSP over the market would allow for increased corporate expansion through market liberalization–which has been creeping into India since the early 1990s through neoliberal policies pushed through the implementation of the New Economic Policy in 1991 (Martin, 2017).

Beginning in November 2020, over 250 million workers across 10 central trade unions joined farmers in protesting the anti-farm laws. Thousands of Indian farmers made the difficult, yet brave decision to leave behind their precious land and march to Delhi's borders to voice their concerns to the central government. It was an arduous journey, as many farmers had to endure water cannons, baton charges and roadblocks (Singh, 2021). Despite seemingly insurmountable obstacles, however, most farmers managed to not only set up camp near Delhi, but established fully functioning communities within them (Sud, 2021). Through collaborative efforts, the encampments transformed into mini-temporary cities that were supplied with food, milk, water, and other necessities by the neighboring villages. The various camps had also established regular supply lines for villages deep in the hinterlands of Punjab, Haryana, and Uttar Pradesh.

Meanwhile the police and paramilitary guarding the roads were supplied with assault rifles, tear-gas, and surveillance drones, to keep the farmers in-check. At various times during the year, the government utilized disinformation campaigns to smear the movement—labeling farmers as insurgents and terrorists, slapping fake cases on protesters and using police intimidation to break up the encampments. Farmers persisted, and eventually formed the Samyukta Kisan Morcha (SKM), a coalition made up of over 500 organizations including farmers unions and workers unions across a spectrum of differing ideologies. After almost a year and a half of struggle, the movement broke ground as the central government announced the repeal of the controversial laws.

Although there were celebrations to be had, farmers also understood that the repeal of the three laws was incomplete without the implementation of a parity price system for crops. Currently, the movement is demanding that the government enforce the MSP for 23 crops as a legal right for farmers (Agarwal, 2022). This would mean that no buyer, whether government or private, would be allowed to buy below the regulated sale price, thereby ensuring that the MSP would then become the minimum, not the maximum support price. Increasingly, more farmers are resonating with the message of parity amid falling incomes, rising debt, and a price-cost squeeze that has pushed the small farmers toward destitution.

The success of the Indian Farmers' Uprising has become a convergence point for agro-justice, proving to be a pivotal point in the fight for parity in India. Importantly, the movement's success sets a precedent for international agricultural policy's future. Amid a broader neoliberal push for the removal of key price supports in the Global South, the victory of the Indian farmers and their push for a parity price system provides a strong foundation for the reinvigoration of farm justice movements globally (Soni, 2022).

Analysis of parity amnesia: Subsidy conflations and distractions

For whom and in what contexts are parity policies illogical—not just improbable, but not even worth struggling for? When, where, and by whom have fair farmgate prices been a central rallying cry? When, where, and by whom have they been considered irrelevant? This paper makes room for these questions, so instrumental to agricultural governance and agri-food systems, and yet so rarely asked.

The allegedly free market depends upon governmental deregulation of industry, regulation of supports, and multiple enabling state-infrastructures that work to subsidize the profits and stability of industry, particularly in the agri-food sector. The inquiries guiding this research reveal an overall erasure of the very histories, movements and programs falling under the umbrella of parity and supply management. Most of those who have survived the gauntlet of chronic agrarian crisis and continue to farm earn their livelihood not from farming but from off-farm income (Figure 4) and/or assets of land ownership—and from payments from the government, deemed "subsidies," such as Direct Payments, Countercyclical Payments, or Trade Payments. Confusingly, the term used to describe these checks from USDA, "subsidies," has been conflated with price floor, supply management, and parity programs, in the absence of which such payments are needed. There is understandable social and political frustration that these checks-from-the-government flow to the richest, whitest, most landed farm owners. Yet, this frustration has further compounded the misrepresentations of this slippery term, "subsidy."

"Subsidies" have become the nemesis of agri-food policy analysts, from civil society, from climate activists to public health officials, from the WTO itself, to biodiversity accords seeking to just switch "environmentally harmful subsidies" (complete with their own acronym EHS) to environmentally helpful subsidies. As co-authors in this paper have researched, explained (Naylor P. E., 2017; Wilson, 2018), and experienced, this conflation leads to a large-scale distraction from the reality that systemic commodity crop overproduction itself subsidizes the agro-corporate buyers, who profit mightily off the falsely cheap glut, be it feed for industrial livestock or flex crops for ethanol production or other industrial agri-food stuffs (palm oil, soy, etc.). Here the broader trend of capitalism unfettered to cheapen commodified goods, products, services, labor (Patel and Moore, 2018) applies directly to agricultural farmgate prices. This phenomenon has had cascading detrimental effects, particularly for farmers of color, who face this chronic agrarian crisis atop viciousness of systemic racism—particularly anti-Black discrimination in

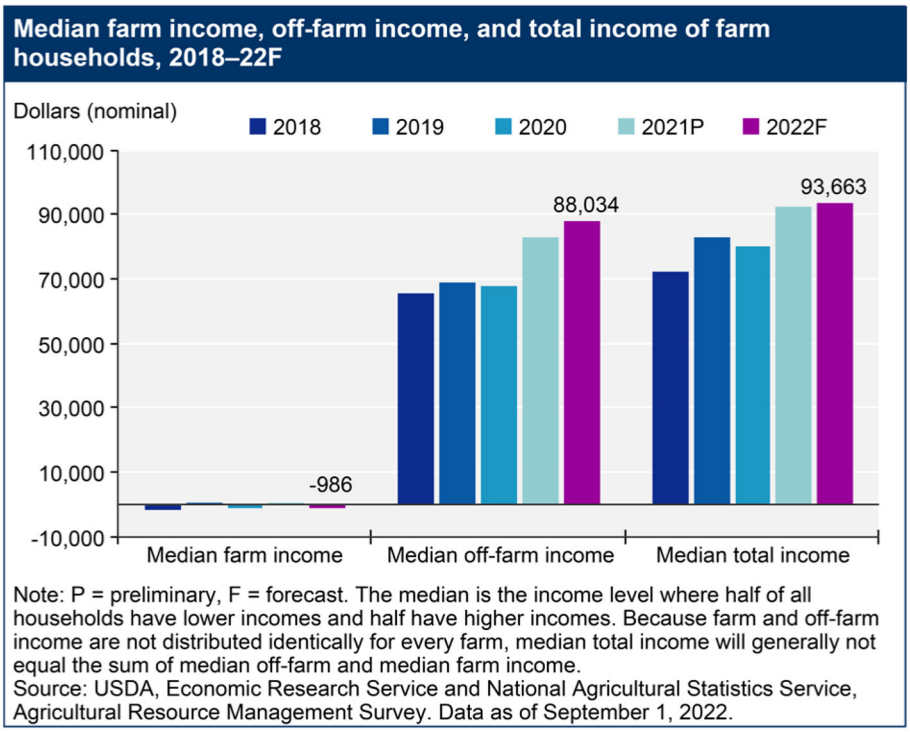

FIGURE 4
Farm households typically receive income from both farm and off-farm sources. Median farm income earned by farm households is estimated to increase in 2021 to $210 from - $1,198 in 2020, and then forecast to decline to -$986 in 2022. Many farm households primarily rely on off-farm income: median off-farm income in 2021 is estimated at $82,809, an increase of 22 percent from $67,873 in 2020, and to continue increasing by 6.3 percent to $88,034 in 2022. The increase in 2021 was mainly due to higher earned income—income from wages, salary, and nonfarm businesses—which rose 54 percent from $32,428 in 2020 to $50,000 in 2021. Unearned income—income from interest, investments, pension and retirement accounts, unemployment compensation and other public transfers—also increased by 7.2% between 2020 and 2021. Since farm and off-farm income are not distributed identically for every farm, median total income will generally not equal the sum of median off-farm and median farm income (USDA ERS 2022).

USDA lending, programs, and overall agri-food sector. Black-owned farmland plummeted in the second half of the twenteeth century, even faster than it did for mid-size white farmers. Concurrently, farms grew in size and became more "specialized," with larger and more monocultural fields of one crop. The number of farms with livestock and poultry fell faster than the loss of farmers themselves, even as number and scale of CAFOs grows exponentially with their feed grain input so cheap and plentiful.

If agriculture defies dominant supply-meets-demand market logic, and produces such systemic market failures on micro-economic level, does it work at macro-economic scale? It depends on what one means by "work." Food systems scholars decry the social, ecological, and rural economic externalities of land consolidation (Hendrickson et al., 2020) even as dominant development paradigms champion or at least naturalize de-agrarianization. Yet, divergences within agricultural economics show how fraught these economic interpretations are. The Agricultural Policy Analysis Center, commissioned by the National Family Farm Coalition for the landmark 2003 "Rethinking Agricultural Policy," continues to analyze and report on "the price problem" (Schaffer and Ray, 2020a) and even, reflexively (Schaffer and Ray, 2020b), on how dominant agricultural economics evades the paradox that other industries manage supply and even markets routinely. Another prominent evasion is the lack of economic analysis of what overproduction and export-fixes cost the US government and US farmers. Environmental Working Group fastidiously tracks how much the US government spends on checks to rich, massive white landholders, in important sleuthing, but where are investigations into how much money the central government is losing on exports due to its policies? As Naylor (2011) has written "without clarity on parity, all you get is charity", and direct payments, often to wealthy landowners not involved in farming. Indeed, the misunderstanding about the root causes of agrarian crisis demand attention, as George and Patti Naylor (Naylor et al., 2018; Naylor, 2020), among others, have chronicled persistently (NFFC, 2021).

Radical imagination

Preserving and defending the true accounts of these movements, linked through the thread of love for a land-based life, illuminates the scale of a greater movement that can 1 day re-enter the mainstream. As discussed throughout this paper, the irony of intersectional agricultural policy being a radical idea is deafening. As the number of farmers decreases (<1% of the

population here in the United States) (USDA-NASS, 2017), the number of people related to or friends with farmers decreases. The memory of diverse farmer organizations and mobilizations for fair farmgate prices wanes collectively. The American Farm Bureau Federation, critiqued for their anti-labor stance, racism, and agro-corporate leanings, comes to stand in for "the farmer" which becomes a patriotic myth (Ayazi, 2018; Graddy-Lovelace, 2019).

The action of farming is a practice of continual hope. To plant something in the soil, you cultivate a belief that there is space, nurturing resources, and a future in which this seedling will sprout. Much like the action of farming, the movement for intersectional agricultural policy is starting to sprout, because of the care and nurturing activists before us gave while planting these ideological seeds. These blooms toward farm justice signify a radical success against the current system which has unrelentingly destroys the livelihoods of farmers, whose very existence in this space is an act of resistance. Like sprouts growing through cracks in pavement, swaths of humanity are rising up to speak for rural livelihoods Through the influence of geopolitical racism, many policymakers remain blinded to the huge significance of these movements including India farmer uprisings, coupled with the devaluation of agrarian expertise and the "non-modern" understanding of farming. However, despite our current systems, the case studies discussed above, as well as many others occurring throughout the globe, serve as beacons of hope, resilience, and a platform to learn from rather than fight against.

The fight for parity has made its way into analysis and advocacy for the Green New Deal (Naylor, 2019; Patel and Goodman, 2020). If actualized, parity will empower farmers to cultivate food in a non-industrialized, sustainable way. Updating parity policies will be complex, dynamic, crop-specific, place-specific, and require layers of intercultural, interdisciplinary research, outreach, coordination, and extension that are beyond the scope of this paper. Yet, farmers and nonfarmers have a responsibility to each other (Graddy-Lovelace, 2021a), to collectively design and ensure supports that allow a diverse new generation of agriculturalists to grow nourishing food and steward land and water (Uyeda, 2021). Millions of people are risking and losing their lives, with full swaths of humanity mobilizing in India and beyond. To view agrarian crises as micro-movements in poor rural areas from an American perspective perpetuates geopolitical bias that underpins the global industrial agri-food system, as critiqued by LVC and by such scholar-activists as Shiva (2016). However, when we draw together the perspectives of elders, advocates, and practitioners globally, we see an immensely powerful movement against injustice, unsustainable development models, and talons of corporate control. Parity allows a path which centers the voices of farmers in land management, research, and governance, honoring these farmers' historic insistence for a fair price for their work and protection from competition.

Recentering agrarian knowledge and lived experiences within our research and shared imaginaries precedes holistic policy action that recognizes the intersections between land tenure, global health, and broader food sovereignty. As we approach our planetary limits and feel the effects rippling throughout human societies, we cannot ignore the potential of food and agriculture to empower farmers, nourish broader humanity, and sustain our global environment. Significant, multidisciplinary longitudinal research is needed on how parity pricing, cooperative supply management and coordination, and corresponding grain reserves, non-recourse loans, and quota systems could be updated to serve the needs of a new generation of diverse growers and their communities, to prevent the economic and ecological fallouts of commodity crop overproduction and agrarian crisis. This research needs to be multi-scalar, international, inter-local, and comparative over time and space. It needs to plumb the archives, from state official USDA collections to movement archives (such as the Amistad Archive of FSC/LAF) to movement elders' basement files yet undigitized. The research also needs to communicate inquiries and findings across languages and places, starting with the Indian farmer uprising with its massive scale and political potential. As the Collective of Agrarian Scholar Activists from the South (2021) and others conclude, the Farmers Protests in India are glaring and telling "manifestations of rural crisis" (Saha et al., 2021) and, following their victory and continuity, crucial precedents for ways out of this crisis.

Conclusion

This paper lays the groundwork for a radical recovery, reclamation, and updating of the parity program. It began by introducing the need for intersectional agrarian policy due to ongoing humanitarian, environmental, and labor crises. At the intersections of wasted food, historical racial and gender injustices, and the overall devaluation of agrarian knowledge, this paper weaves together histories of US-based grassroots fights and the parallel though so much vaster and more diverse India Farmer Uprising. Through discussing the regulatory trade mechanisms and policies that have led us here, we saw how agrarian livelihoods have been dismissed from serious policy consideration, giving producers no other choice but to scale up or exit. However, communities around the globe, for decades, have been actively fighting for their rights to fair wages, pricing protections, and a spirit of collective bargaining. Informed through farm justice leaders and practitioners, this work ties together the cases of agrarian uprisings to showcase that they are not isolated events. Rather, in combination, these grassroots movements within their own socio-cultural and geographic contexts are forging strategies and relationships to overcome the hardships created by neoliberal economics while forging parity-based radical and revolutionary imaginations. Though the grassroots movements discussed above may express their causes with different language, the authors seek to cultivate a meaningful dialogue. This article serves as the first iteration of these stories and is intended to become an antecedent for future synthesis and research and policy decisions. Deeper analysis into parity economics, lived histories of individual leaders, and social theories are beyond the scope of this work but serve as potential avenues for additional analysis.

The authors that have come together to tell this story remain hopeful. We focus on the massive revolutionary success of the Indian farmer uprisings, on the spirit of social change and love-for-neighbor present in agrarian communities, on the recent

breakthroughs of labor rights movements, and on the paradigm-shifting power of collective bargaining. We see the roots of agrarian justice solidarity taking hold, uniting those who steward land and water, who cultivate nourishing food, and those movements who seek social, environmental, and political change. Farmers are a crucial element of social good, and they must be valued for their work, critical as it is to human and planetary survival. We argue that this valuation needs to be policy-based. By bringing farmers into the agricultural policy space, updated and expanded parity principles and programs can lay the foundation for repairing rural communities, expanding agroecological practices, preventing glut and wasted food, and making farmer viability possible for a greater number and diversity of farmers.[1]

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

GG-L, JK, AJ, KS, and AV were involved in original drafting of this project, conducting research, and authoring sections. BW created original figures as well as authored text sections. IS and EP also contributed original text sections. GN and PN contributed wonderful edits and comments to this work. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

1 https://www.iatp.org/sites/default/files/2020-11/Delegate%20Approved%20Resolutions.pdf (accessed October 10, 2022).

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Growing food, growing food systems: The role of non-profit farms

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The study of non-profit food organizations has focused primarily on food policy, urban gardens, coops, and farmers' markets in cities. Despite significant research on these kinds of food non-profits, research specifically on non-profit *farms* – organizations that produce food for local communities – is nearly non-existent. We argue that non-profit farms are a category that deserves more research attention. This article asks what services non-profit farms see themselves as providing to their communities, along with a supply of local food. We focus on the missions of non-profit farms, using farms on the GuideStar database of non-profit organizations. We also examine, through interviews and website analysis, the role of non-profit farms in the Hudson Valley, long a hub of non-profit farms. We conclude that local non-profit farms are hybrid organizations that perform services that are similar to local community non-profits, supporting local social welfare, environment, education, and community development roles, along with providing local food access and, in some cases, supporting food system change.

KEYWORDS

non-profit farms, alternative food networks, community food systems, local food infrastructure, non-profits mission, non-profit governance

Introduction

Several hundred farms in the United States are organized and governed as non-profits. Yet, despite the many critiques of industrial agriculture as driven by the logic of profit, and the many analyses of alternative food networks as seeking to overcome this logic, little attention has been paid to the role of farms that are "non-profits": that is, organized specifically around a mission rather than for profitmaking. For this reason, we argue that non-profit food organizations in the US are a category that deserves more research attention, looking specifically at how their mission-based mode of governance (Bulkeley and Newell, 2015) impacts their role in the local food system. Part of a larger study of US food non-profits, this analysis looks specifically at non-profit *farms* that produce food for local communities. We analyze a database we have compiled of nearly 300 non-profit farms, to understand the role of these farms in the US alternative food system. In addition, we examine, through interviews and website analysis, the missions and community role of non-profit farms in the Hudson Valley, long a hub of non-profit farms. Looking at the conceptualizations of alternative food economies and modes of governance related to alternative food systems, we ask what role non-profit farms play as "alternative modes of governance" (DuPuis and Gillon, 2009) in "alternative food networks" (Goodman et al., 2012) and "civic agriculture," (Lyson, 2004; Donald et al., 2010). Through our analysis of the GuideStar database of non-profit farms, and local interviews in the Hudson Valley of New York, we conclude that non-profit farms' missions are varied and extend beyond – and sometimes besides – the

alternative food movement emphasis of food system change (Nemes et al., 2023). Our data analysis and interviews indicate that non-profit farm missions tend to mirror those of non-profit organizations as a whole, while contributing to local food production. In other words, non-profit farms see themselves as meeting a wide-ranging set of community needs. While non-profit farms are sometimes explicitly part of local food movements, that is often a secondary role.

Non-profit farms and alternative modes of governance

Critics of the industrial food system identify its productivist logic and emphasis on maximizing profit as harmful to both the environment and to human health (Magdoff et al., 2000; De Schutter, 2010). In the United States, those seeking to reform the industrial food system have built numerous alternative food initiatives (Allen et al., 2003) to reform how Americans produce and consume food. Those initiatives have also engendered a field of academic literature analyzing their activities and impact. Initiatives in Europe (Renting et al., 2003; Goodman et al., 2012) and in particular peasant initiatives around the world (Holt Giménez and Shattuck, 2011) have worked toward changing the global food system and have been topics of analysis. These research projects have examined how alternative food systems go about creating "alterity" – systems of economic production that are based less on profit and aim to meet social needs of community, healthy food access, resilience, equity, etc. – through "decommodified" (Hinrichs, 2000; Goodman and Goodman, 2009), "communified" (Warde, 1997), "nourishing" alternative food networks (Whatmore and Thorne, 1997). Many analyses point to the ways alternative food networks are built around values that create a "normative landscape" (Goodman et al., 2012) or at least tempers productivist logics (Hendrickson and Heffernan, 2002; Goodman et al., 2012; Hendrickson, 2015; Watts et al., 2017; Rosol, 2020). Yet, some critics have challenged the view that alternative food networks can create values-based exchange systems, arguing that land markets force farmers to focus on profit (Guthman, 2004). According to this perspective, alternative food production becomes "conventionalized," organized around profit logics. Recent scholarship has challenged this critique, arguing that alternative food systems can be hybrid, incorporating both profit and normative goals, neoliberal as well as radical values (Misleh, 2022; Nemes et al., 2023).

Given this long conversation in the academic literature about alternative food systems, values, and profit, it is surprising that no study has examined a group of farms that exist legally outside of the logic of profit and specifically for normative purposes. Non-profit farms, organized as 501(c)3 "public charities," act according to a different "mode of governance," (Bulkeley and Newell, 2015). Instead, non-profit charities structure their decision-making based on commitment to a social mission. Yet, studies of alternative food systems have paid little attention to farms organized as non-profits. Given the burgeoning interest in food system governance (DuPuis and Gillon, 2009; Hospes and Brons, 2016; Andrée et al., 2019), it is surprising that no study has looked at non-profit governance, either at the system or individual organizational level. While examinations of food system actors have included food non-profit organizations, none have directly addressed their specific governance structure. While some investigators have focused on modes of governance at the network level (coops, food hubs, CSAs, etc.) in the creation of organizational alterity (Renting et al., 2003; Watts et al., 2017; Rosol, 2020), none have addressed the fact that some of these organizations are non-profits. For example, Allen et al. (2003) study of California alternative food initiatives did not explicitly consider non-profit governance as a significant factor in the alterity of these organizations, despite the fact that a number of them were organized as non-profits. Rogus and Dimitri, in their survey of urban agriculture, treated private and non-profit farms as one population, generalizing from those combined findings about the nature of all urban agriculture (Rogus and Dimitri, 2015). They note that a substantial number of urban farms are non-profit, but they do not explore the ways this status affects the actions and mission of these farms. This lack of attention to the alternative governance structure of non-profit farms is surprising given that many studies of the alternative food system draw upon ideas about the social embeddedness of capitalism (Granovetter, 1973; Polanyi, 2001), and many analyses of the alternative food system have noted the ways that alternative economies are embedded in social, particularly local, institutions (Lyson, 2004; Jarosz, 2008; Goodman et al., 2012; Hinrichs, 2013).

A non-profit is "a group organized for purposes other than generating profit and in which no part of the organization's income is distributed to its members, directors, or officers."[1] Studies of non-profits recognize the fact that they are specifically governed according to a social mission (Renz et al., 2022). For example, Boris et al. (2017, p. 3) describes the role of non-profits in civil society as "fostering community engagement, and promoting and conserving civic, cultural and religious values." According to the National Association of Non-profits, these organizations are the "building blocks of democracy…where Americans come together to solve problems" (National Council of Nonprofits, 2019). Non-profits are defined primarily through tax law in the US and in other countries, and those laws vary from country to country, making comparisons difficult. In addition, most studies of non-profits focus on the United States and Europe, in part due to the fact that international charities tend to register in those countries that are the primary source of donor funds (Renz et al., 2022). This particular study focuses on non-profit farms in the United States. In the US, non-profits are tax-exempt under federal tax law, in that their income – from enterprises or donations – is not taxed but is used to meet the mission of the organization. Non-profit organizations are generally run by a director who is responsible to a board (Renz et al., 2022).

Besides studies of cooperatively organized farms (Rosol, 2020) few have looked at alternative modes of governance at the farm level. Non-profit farms also fall – surprisingly – into the cracks on

1 https://www.law.cornell.edu/wex/non-profit_organizations#:~:text=A%20non%2Dprofit%20organization%20is,members%2C%20directors%2C%20or%20officers

research about civic agriculture (Lyson, 2004; Hinrichs and Lyson, 2007; Hinrichs, 2013), civic markets (DuPuis and Gillon, 2009), shortening food chains (Renting et al., 2003), and re-localizing food systems (Hendrickson and Heffernan, 2002). Despite a large and growing literature on the civil society role of farms, and a concomitant literature on the role of non-profits as the backbone of civil society–there has been little or no research looking at the contribution of non-profit farms to civic agriculture or alternative food systems. While urban gardens and agriculture have received a great deal of research attention (see Golden, 2013; Dimitri et al., 2015), almost no research has been done on those organized as non-profits. Even less work has been done on non-profit farms outside of urban areas. On the other hand, several studies note the non-profit status of various local food system organizations, including food hubs (Hinrichs, 2013), food cooperatives (Moragues-Faus et al., 2020), farm-to-institution organizations (Richman et al., 2019) and food policy alliances (Sussman and Bassarab, 2017).

Building on these discussions, we ask: to what extent does non-profit organization, as an alternative mode of governance, affect a farm's ability to function according to values-based goals? And, what values do non-profit farms contribute to the "normative landscape" (Goodman et al., 2012) of alternative food systems in general? Are these farms part of the alternative food movement, challenging the existing food system and seeking to build alternatives "that are environmentally sustainable, economically viable, and socially just" (Allen et al., 2003)? Do non-profit farms contribute to the efforts to re-regionalize and re-localize the food system? Do these farms meet community needs, make local food systems more resilient, and build local infrastructure? Our goal in this paper is therefore to distinguish this type of farm both from other alternative food non-profit organizations, and from the local private alternative food system. Both in terms of how these farms serve their local communities and how their modes of governance affect their role in local food systems, we ask to what extent do non-profit farms, as an alternate mode of food governance, contribute to and support alternative food systems. In other words, there is a great deal of work to be done on non-profit food and farm organizations as part of the Third Sector (Etzioni, 1973). This study is the first in a larger study of the role of non-profit organizations in alternative food networks.

Method

In order to understand the role of non-profit farms, we compiled a list of non-profit farms in the United States. Our list of 295 farms represents all of the farms that submit IRS form 990 tax forms to the Internal Revenue Service that we could find on the GuildStar database of 990 tax forms, and which reported income.[2] Any non-profit organization with over $50,000 of income a year is obliged to submit these forms. Because these farms fall into a number of non-profit categories, it was necessary to do more than simply sort non-profits by taxonomic indexes. Instead, we carried out significant examination and sorting of organizations by topic, by name and by searching websites. Through this process, and because non-profit farms categorize themselves along so many different missions, it is likely that some farms did not make our list. Therefore, our list of farms represents nearly all of the farms in the United States that have over $50,000 in annual income, along with those with less income that report to the IRS. We are confident that our retrieval and examination process enabled us to build a database that represented the vast majority of larger food-growing non-profits in the United States. We have confined our study to the United States for two reasons: first, because non-profit laws and regulations differ from one country to the next, so that conclusions about non-profits in one country is likely to differ from another country and, second, because our access to data on non-profit organizations is restricted to the GuideStar list of non-profits in the United States (GuideStar USA, 2022).

Given that there is no overview of non-profit farms in the United States, this first study will provide a general sector analysis examining the existence and status of these farms. We will then look at non-profit farms as non-profits, to understand to what extent their non-profit status affects their activities. Then we will look at non-profit farms as farms, to understand their role as food producing organizations. Next, we will address the question of the role of non-profit farms in food infrastructure and, subsequently, in alternative food networks. We will examine to what extent the ways that non-profit farms are meeting local human service needs are or are not congruent with a role in supporting alternative food networks. We conclude by finding that non-profit farms are organized around a wide variety of missions, meeting local expectations of non-profit services like environmental preservation, food access and social welfare while also, in some cases, supporting food system change.

Non-profit farms in the US

Much of the research on the non-profit sector – its growth, structure and change – comes from analysis of IRS form 990s required by non-profit organizations. We defined the category "non-profit farm" as an agricultural production organization (1) which qualifies as 501c3, and has submitted IRS 990 tax forms to the government, (2) produces food for donation or sale, and (3) is not a farmland trust or a community garden, an organization that makes land available to private farmers or gardeners. We compiled a list of non-profit farms in the United States from the GuideStar list of non-profits (GuideStar Search) which is the most comprehensive and up to date list of non-profit organizations and is the list most commonly used to analyze non-profit organizations. Because farms were not under a particular category, we also carried out internet searches of non-profit farms, as well as making sure that non-profit farms directed by underrepresented groups were found in the GuideStar list. Because many non-profits that make <$50,000 also sometimes report on IRS 990 forms, our list of non-profit farms includes a number of farms (46) that report <$50,000. We omitted farms that did not report income on their most recent IRS 990

2 The Guidestar list represents organizations that have submitted 990s or 990EZ forms to the IRS. The submission dates vary. We decided to include farms that have submitted 990s and 990EZ forms, and which appear on the Guildstar list, from 2019–2021.

form, since it would be unlikely that those farms would be actively growing food either for contribution or sale.[3] The GuideStar list does not represent one calendar year. Instead, farms on the list are from years 2019–2021. The GuideStar list, while reporting data from several different years, is the best data available on non-profits in the United States. Based on these databases and searches, we discovered 295 non-profit farms that reported income on the GuideStar list.

Through web searches and IRS 990 forms, along with information provided in interviews, we also compiled a list of non-profit farms in the Hudson Valley. Some of these farms were not represented on the GuideStar list, since their income was <$50,000/year during this period. We researched each of these farms for available data on GuideStar as well as through information reported on their websites. We also interviewed eight of these farms in 2019, focusing in particular on their mission and governance. This enabled us to gather information not available on databases.

Non-profit farms as non-profits

There are more than 1.8 million organizations registered as non-profits in the United States (Independent Sector, 2020). Those required to report income and assets to the IRS bring $2.6 trillion in revenues and nearly $6 trillion in assets to the US economy, representing 5.6% of the country's gross domestic product (National Center for Charitable Statistics, 2020) and 8% of the total US labor force (Gazley, 2016). Up until the COVID pandemic, the non-profit sector was growing, both in terms of organizations and revenue. In fact, the number of non-profits grew 75% between 2000 and 2016 (National Council of Nonprofits, 2019). Growth has slowed since then (National Center for Charitable Statistics, 2020). However, over the longer term, non-profits have become, and are likely to continue to be, a significant actor in American civil society (Boris et al., 2017). Non-profits "are a vital source of civil society…Their basic role as enablers of public engagement and promoters of the common good is the cornerstone of our pluralistic democracy" (Boris et al., 2017, p. 1). A more critical perspective on the turn to non-profits sees it as part of neoliberal arrangements, where government has been "hollowed out," in response to the perceived or real shortcomings of government or market institutions. Whether or not the reason is "government failure" or "market failure," the last few decades have been characterized as communities increasing their dependence on the non-profit sector to provide various community services, including food access (Salamon, 2002; McCarthy and Prudham, 2004; Allen and Guthman, 2006). Other services include education, community health, environmental protection and social welfare (National Center for Charitable Statistics, 2020).

The first observation one can make about these farms is that they vary greatly in terms of history, finances, origin, staff and resources. In our web research, we found that many of these are old, historic farmsteads preserved by their towns. Others are founded on former estates or former institutions. A few are the vision of one or two people, while others are the products of larger community efforts. Their founding years range from 1961 to 2019, and they differ greatly in their financial resources and their missions. For example, these farms differ greatly in terms of their financial assets (Figure 1). Some farms have few, even negative assets, while the wealthiest farms have assets over $10 million. One reason for this discrepancy is landownership. Farms that own land, especially in areas with high land values, have high value assets.

TABLE 1 Budgets (expenses): Percent general non-profits vs. non-profit farms.

Expenses	% Non-profit General	% Non-profit Farms
<$500,000	67	63
$500,000–$9.99 mil	25	36
>$10 million	5	0.3

Source: The Urban Institute, "The Non-profit Sector in Brief, 2019"; GuideStar analysis.

Nevertheless, non-profit farms share some financial characteristics with non-profits as a whole. Looking specifically at the non-profit farms that reported more than $50,000 in income in the GuideStar list (249 farms) we can compare them to published figures on non-profits as a whole (Table 1).[4] The budgets of non-profits in general vary widely, with 5% having expenses of more than $10 million dollars a year, 25% with between $500,000–$9.9 million dollars and 67% with a budget of <$500,000 a year (National Center for Charitable Statistics, 2020). In other words, non-profits as a whole vary widely in terms of income. Non-profit farms, in comparison, tend to have fewer very large and very small non-profit budgets (expenses), with only 0.3% having over $10 million and 63% with budgets <$500,000. 36% of non-profits farms fall into the middle range in terms of budgets. This indicates that non-profit farms tend to be larger than the smallest non-profits as a whole, but not as large as the largest non-profits. The cost of land maintenance and stewardship is likely to mean that non-profit farms must maintain higher budgets than non-profit organizations as a whole.

While taxonomies categorizing what non-profits do vary, non-profit organizations as a whole tend to be broadly characterized under eight basic groups: (1) arts and culture; (2) education; (3) environment and animals; (4) health and hospitals; (5) public services; (6) international; (7) foundations and (8) religion (National Council of Non-profits, 2016). Under this taxonomy, the category "agriculture" falls under

3 A few farms do grow and donate food while not receiving income. We have not included those farms (<5) on this list. However, it is likely that some of these farms receive foundation and other support despite budgets that are zero or negative.

4 The Urban Institute data on nonprofit expenses only covers nonprofits over $50,000. It was necessary therefore to only include farms with expenses over $50,000. It was not possible to compare nonprofits vs. nonprofit farms in terms of revenue because The Urban Institute reports these differences in finances only in terms of expenses.

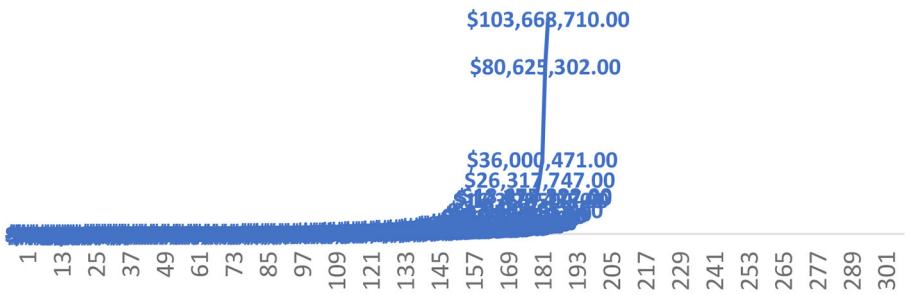

FIGURE 1
Net assets of non-profit farms.

"environment and animals." However, it is possible to find non-profit farms characterizing themselves along all of the eight major categories, as will become evident in the analysis in the next section.

Non-profit farms as farms

It is difficult to compare non-profit farms as an economic sector to for-profit farms. First, given the types of services non-profit farms provide, it appears that much of the income on these farms comes from programs and donations not from sales of food, as opposed to income from for-profit farm operations which mostly comes from selling what they grow. While data on income from non-profit farms in GuideStar represents different years, it can give us some indication of the total amount of income from these farms and the general percentage of income from donations. For the 295 farms that reported income in the years represented in the GuideStar list, the total income was $296,255,980 while contributions represented 66% of that amount, $196,839,104. Table 2 represents the income categories of for-profit and non-profit farms. It is clear that non-profit farms are represented at all income levels while for-profit farms mostly are making incomes of <$100,000 per year. However, this data is not entirely representative, since non-profit farms that make <$50,000 per year are not required to file with the IRS. It is likely that the number of non-profit farms making <$50,000 a year is significantly larger than the 45 farms in this category that have filed with the IRS in recent years. In fact, according The Urban Institute, only slightly more than one third of all non-profits report to the IRS each year (National Center for Charitable Statistics, 2020). Because non-profit farms have somewhat higher income in the middle range, it is likely that they represent somewhat more than a third, but not that much more.

Our analysis of the IRS 990 list reveals that non-profit farms are spatially concentrated in the Northeastern region of the US, although California also has a large number of non-profit farms (Figure 2). The concentration of non-profit farms in the Northeast is likely related to the extent of farm loss and development threat experienced in this region over the last 50 years. This fits in strongly with one of the major missions of non-profit farms: to preserve local agriculture and greenspace.

TABLE 2 Gross income, for profit (2021), and non-profit (2019–2021 data).

Gross income		Non-profit farms	For profit farms
<$350,000	137	47%	89%
$350,000–$999,000	83	29%	6%
Over $1,000,000	68	24%	5%
Farm gross sales	**For profit**	**Non-profit**	**#**
$1,000,000 or more	3.9	27.8	75
$500,000–999,999	3.5	15.2	41
$250,000–499,999	4.4	18.1	49
$100,000–249,999	6.5	20.4	55
<$100,000*	81.7	18.5	50
			270

*Does not include all non-profit farms with gross income <$50,000. Source: Census Bureau; analysis of GuideStar data.

The role of non-profit farms in food infrastructure

Our analysis indicates a concentration of non-profit farms in certain states. In fact, the states with the highest number of non-profit farms tend to have a higher percentage of urban land use than states with fewer non-profit farms. However, there are many highly urbanized states that do not have a high concentration of non-profit farms (Table 3). In addition, several more rural states, such as Ohio and Washington, have a large number of non-profit farms, indicating that reasons for concentration sometimes have to do with factors beyond urbanization. Nonetheless, the largest percentage of non-profit farms are concentrated in the

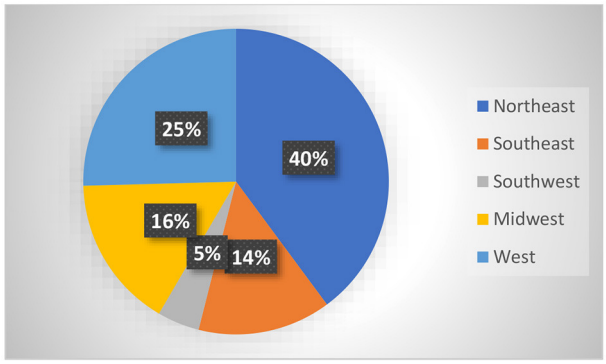

FIGURE 2
Non-profit farm concentration, by region. Source: Analysis of GuideStar data.

TABLE 3 States with high concentrations of non-profit farms compared to agricultural attributes.

States	NP farm hub states	Ranking % urban land use	Top 10 food infrastructure?	Top 10 community food systems?
New York	36	11	N	Y
California	31	21	Y	Y
Massachusetts	21	3	N	N
Pennsylvania	16	9	N	Y
Hawaii	11	20	Y	N
Ohio	11	8	N	N
Virginia	9	18	N	Y
Connecticut	10	4	N	N
New Hampshire	9	14	N	N
Washington	7	24	Y	Y

Source: Analysis of GuideStar data; Census Bureau; Union of Concerned Scientists.

Northeast Region (Figure 2), which is the most urbanized part of the US.

The location of non-profit farms is somewhat, but not entirely, related to those places in the United States with well-developed food infrastructure. A comparison of states ranked highly for food infrastructure by the Union of Concerned Scientists (UCS) with non-profit farm hub states indicates that those states are not necessarily correlated with strong statewide food infrastructure. Statewide food infrastructure, as measured in the UCS rankings, includes conventional organizations such as farm bureaus. In part, this has to do with the fact that non-profit farms tend to be concentrated in states that, with the exception of California, are not the top agricultural states. However, states with a high number of non-profit farms are also not necessarily located in states with significant *alternative* food infrastructure, as measured in the UCS "community food systems" ranking. Only three of the ten top non-profit farm hub states are in the top 10 states in terms of alternative food infrastructure, measured by the number of farmers markets, food policy councils/hubs/networks, composting facilities and heathy food retailers.[5] These data indicate that, while non-profit farms often have missions like those of alternative food system organizations, the presence of non-profit farms is not necessarily associated with alternative food systems. While this data is not conclusive in terms of the contribution of non-profit farms to the social infrastructure of civic agriculture as a whole, it does indicate that states with high concentrations of non-profit farms are not necessarily associated with states that have strong alternative food networks.

Mission

A look at the missions of non-profit farms helps provide an answer as to why non-profit farms are not major contributors to non-profit food infrastructure in many regions. We are defining "mission" as the primary and secondary subject areas listed in IRS 990s. Based on that analysis, we find that people establish farms as non-profits to fulfill a number of different missions. Non-profit farms' missions fall into the following categories:

1. Agriculture, General (29%): a number of farms identified their mission as "agriculture" but did not specifically identify in the IRS 990 forms with alternative food networks or community food systems. In these cases, non-profit farms are providing food for local communities and are therefore "alternative" in that they are part of local food systems. However, these farms did not identify themselves with the alternative food network community.
2. Education (24%): many non-profit farms identify their main mission as educational. In many cases, this means that their primary mission is environmental education, often providing summer camps for children as well as historical education about the role of agriculture in the region. Farms that specifically listed alternative agriculture or food systems as their secondary subject area/mission we placed in the alternative food networks category. However, some of these farm education programs may teach about sustainable food systems as part of their environmental education mission while not identifying it in their IRS 990 form.
3. Alternative Food System (22%): these farms specifically identify with alternative food systems. These farms specifically identify with food justice, youth organizing, community food systems and other missions that seek food system change.
4. Social Welfare (14%): many farms identify their primary mission as social welfare. These are farms that focus on providing jobs and food for low-income and marginalized communities. In some cases, the mission of these farms is rehabilitation of former inmates and/or training for those differently-abled.
5. Environment and Farmland Preservation (11%): a number of farms identify missions closer to environmental and conservation goals associated with farmland preservation as land. These farms also grow food but were founded primarily

5 https://www.ucsusa.org/resources/50-state-food-system-scorecard#bycategory

as a way to preserve a farm under threat of development or as a way to create greenspace for a community. These organizations function closer to nature preserves.

Figure 3 indicates that non-profit farms have a wide variety of missions, most of which are not specific to alternative food networks. We defined farms that defined one of their missions as either community agriculture, sustainable food systems, food justice or food sovereignty as alternative food networks. Other definitions of alternative food networks might change these results. For example, we categorized all non-profit farms that defined their mission as food assistance in the "social welfare" category. Others might see providing fresh food to marginal populations as a major aspect of food justice and food sovereignty. If one categorized alternative food systems as including general agriculture/local food systems, farmland preservation, and environmental education, then nearly all of these organizations would qualify as members of alternative food networks. However, like Allen et al. (2003) we find it is important to distinguish between those alternative organizations providing local food access and those seeking system change.

If we look at non-profit farms as non-profits, we see that their missions are very close to local non-profit organizations as a whole. Non-profit farms provide the same kinds of services to their communities as many other local non-profits: social welfare, education, environmental protection and historical preservation. In national analyses of non-profit missions, as noted above, non-profit farms fall under the environment category. This fact makes it clear that non-profit farms are hybrid organizations that function both as non-profits and as members of local food systems. Like many non-profits (and many farms) their status as alternative or conventional is less than clear.

Non-profit farms in the Hudson valley

Our interviews and examination of websites in the Hudson Valley confirmed many of these findings. We found that many non-profit farms in the Hudson Valley were founded to meet a wide variety of missions and goals. While 990 forms allow for a general analysis of the role of non-profit farms in their regions, they do not provide information on more specific issues related to these farms. We gathered interviews with 8 non-profit farms in the Hudson Valley and did a survey of IRS 990s and websites of other non-profit farms in the Hudson Valley, for a total of 17 farms. The interviews covered a wide range of topics, looking at mission themes, presence or absence of particular governance structures, source of income, organizational collaborations, intended audience and land provenance.

Our analysis of Hudson Valley non-profit farms does indicate that they play a major role in the local food landscape that is the Hudson Valley. Besides the iconic Stone Barns, which has a more national alternative agriculture focus (Barber, 2014; Francis, 2017) the Hudson Valley contains fifteen other non-profit farms.

Generally speaking, the organizations interviewed have both much in common and are also quite distinct from one another, with different structure in terms of history, land ownership, leadership and governance structure, mission and finances. They also vary a lot in age (from 5 to 48 years old, median 13 years), mission, stability and focus. However, these farms also have a lot in common. Commonalities between many of the organizations include: preserving farmland, a focus on CSAs, an emphasis on farm-based education, and the increasing importance of social justice and/or food access.

Mission

For many non-profit farms in the Hudson Valley, the organizational mission includes environmental goals such as landscape preservation and community recreation as well as growing food (Table 4). Many of these farms also offer education programs, from culinary training to summer camps. In this way, non-profit farms in the Hudson Valley share many characteristics with the approximately 40 nature preserves and 18 state parks in the Hudson Valley region that have been established as green space, recreation, historical, education and watershed protection landscapes. In some cases, Hudson Valley non-profit farms' focus on greenspace conservation and environmental education is closer to the mission of nature preserves than to either for-profit farms or urban non-profit farms. These environmental education and preservation missions are intertwined with their activities to grow and provide access to fresh food. As a result of this closer link with environmental goals, some non-profit farms in their mission statements and websites emphasize farming practices that protect local watersheds, such as improving soil health and pasture management as a form of green infrastructure to manage water cycles. These farms are therefore contributing to local communities by providing a variety of ecosystem services.

Many of the non-profit farms in the Hudson Valley were established as part of larger greenspace and farmland preservation initiatives. The specific goal for founding many of these farms was therefore to protect land otherwise threatened by development. For many of them, preserving greenspace is a goal laid out in their mission, as stated, for example, in the Rockland Farm Alliance's mission statement to "promote sustainable agriculture in Rockland County by protecting and revitalizing farmland." Frequently these farms also function as recreational parkland. Many of the farms also have hiking trails and offer other forms of community recreation, more similar to a community nature preserve than to a private for-profit farm.

At least five of the eight organizations interviewed identified preservation and sustainability of farmland as a key aspect of their mission. In the case of non-profit farms in the Hudson Valley, it is unclear to what extent farmland preservation and links to the alternative food movement developed in tandem with their founding or if these farms enrolled themselves in the alternative food movement as their greenspace mission evolved. Some of these farms focus on providing food for the local community and/or to local food banks, as well as food and farm education, without active participation in larger-scale food system change. Others, such as Glynwood and Stone Barns, see themselves as leaders in the development of alternative food systems in the region. On the other hand, some interviews indicated a mission that was

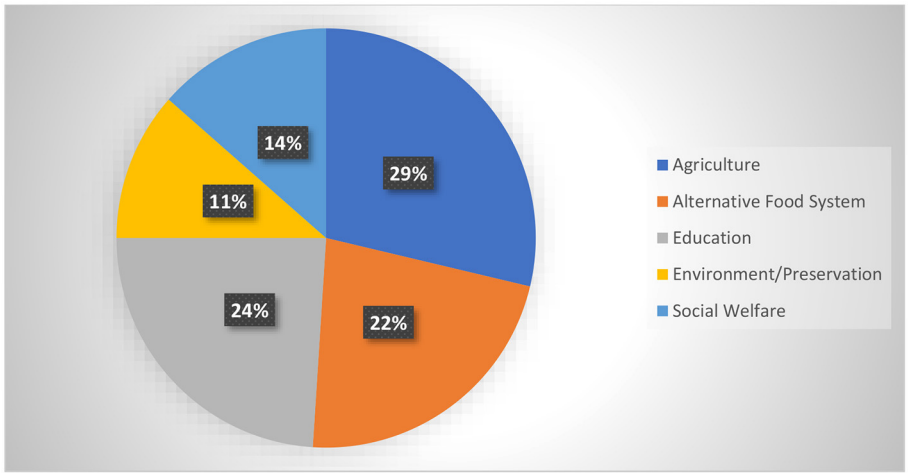

FIGURE 3
Primary missions of US non-profit farms. Source: Analysis of GuideStar data.

TABLE 4 Missions (multiple) of Hudson valley non-profit farm organizations.[6]

Hudson valley non-profit farm mission focus	Farmland preservation/ sustainability	Education	Food access/ food justice	Art	Religious/spiritual
# of Farms	16	11	10	2	1

Source: Interviews and website analysis.

closer to maintaining the history of agriculture in the Hudson Valley, as opposed to representing the alternative food movement. Therefore, some farms, rather than aligning with the alternative food movement, see themselves primarily as maintaining farm vitality in the Hudson Valley region and preserving farmland in the community.

Despite these differences, nearly all of the farms interviewed had or currently have a CSA/food share program. The proliferation of CSAs on both non-profit and private farms in the Hudson Valley, along with the proliferation of farms seeking access to burgeoning local farmers markets, has created strong competition between non-profit and for-profit farm CSAs for committed consumer members. As a result, some of the farms interviewed were considering phasing out or have phased out their CSA. Reasons include a decline in membership and financial challenges. Nevertheless, the 2019 pandemic created a rush on CSAs, leading to all CSAs in the region being sold out early in the season. This may have led a number of these farms to reconsider canceling their CSAs, at least for the time being.

Three of the eight organizations interviewed use the word "education" directly in their mission statement. All but two of the organizations noted education as a main part of their programming. Five organizations work to educate children, and three of these also have educational programming for adults; the other two educate families and adults, respectively. Of the organizations that work with children, some work with school children on food-based education in school districts that have a high proportion of students on subsidized lunch programs. These food-based education programs emphasize the use of produce grown at the farm in the school lunches and tasting activities for the children. Additionally, a few of the organizations cited "hands-on education" as part of their programming. Other educational programming included farm camps, vet tech training, educational care of animals, teacher education and nutrition education. It is also worth noting that these education programs make up a large portion of some of the organizations' budgets and are often grant-funded. This is more typical of nature preserve programming.

Interestingly, two of the organizations interviewed and three more in our web-survey mentioned the support of art and artists as part of their mission. This is more in keeping with the tradition of local non-profits in the Hudson Valley, including nature preserves. Arts philanthropy in the region is high, and therefore a non-profit seeking funds for art is likely to jive with local giving interests.

Almost all the organizations interviewed identified social justice as an important aspect of their mission, whether it is included in the written statement or not. A number of the

6 This data is not comparable to the general NPF data above, since we asked each NPF to identify all missions, not just their primary one. For that reason, also, the number of missions exceeds the number of farms.

organizations we interviewed are reconsidering their mission in terms of expanding their social justice mission.

Governance and decision-making

There are several aspects of non-profit farms that make them closer, in terms of organizational structure, to non-profits than to for-profit farms or food policy non-profits. In particular, governance structures for the farm were quite similar to other non-profits, especially those dedicated to the conservation of greenspace in the Hudson Valley. The number of people on the boards range from 8 to 17. There's a spectrum of relationships that organization directors/managers have with their boards, ranging from working boards that are involved in the everyday details to oversight boards that are primarily helping to ensure that the organization is keeping to its mission and financial/federal responsibilities. A number of farms interviewed have an Executive Director separate from the Farm Manager who is in charge of farm production.

The relationship between managers and boards was also closer to that of a non-profit nature preserve than to a private farm. However, all of these farms had a person in a leadership role. Three out of the eight organizations have founders that also serve as the leaders of the organization. For the rest of the organizations, there is an Executive Director running the organization with support from the board. Generally speaking, younger organizations tend to have working boards with a more direct relationship between the founder and Executive Director, whereas the older organizations tend to have oversight boards with more autonomy for the Executive Director. Even though we did not specifically ask about fundraising responsibilities, a number of the boards also have a role in terms of fundraising and development. Like many non-profits, Boards are expected to be major contributors. For example, one interviewee indicated that they asked their board members give/get financial contributions, stating that "the best board member has time, talent and treasure. This is hard to come by."

In terms of staffing, these farms are different from other non-profits in terms of the type of staff. The number of staff varies widely, from four people to 30, depending to a great extent on the number of acres cultivated and the extent of the education programs. These numbers include seasonal, year-round, full time and part-time staff. Median staff number is 14. Two organizations have board presidents that are essentially acting as the leaders of the organization.

The relationship between the farmer on a non-profit farm and governance board can be challenging. As one interviewee noted, "The many advantages of farming at a non-profit do not come, however, without some difficulties and responsibilities that an independent farmer might not have to face. Lines of communication with the many different people involved in the organization must remain open and require care and understanding to ensure that they facilitate economically and ecologically sound farming." As another interviewee put it, "the oversight that a non-profit needs is not necessarily congruent with a farmer mentality." In an informal conversation as to whether farmers would see the benefits of transforming their farms into non-profits, one non-profit farm staff member noted that many farmers started farms in order to be their own boss, and that non-profit governance structure would not be conducive to that kind of farmer autonomy. Most of the organizations noted that relationships with the board of directors was a challenge. This included the function, autonomy and reliability of the boards and the relationship between staff members/founders and their boards.

Friends of groups

During the course of preparing for and conducting these interviews, the term "Friends of" groups came up frequently. This kind of group is most often associated with preserves in the area as opposed to farms. The National Recreation and Park Association states that "'Friends groups' are generally formed by a group of citizens with common interests in the stewardship of a local park or preserve. Their activities can range from fundraising and volunteer work to significant operational support. At times, friends' groups form on a temporary basis to support development or conservation of a specific park."[7] The presence of Friends of groups is another characteristic that makes non-profit farms in the Hudson Valley more like nature preserves in terms of their governance.

Land provenance and fiscal sponsorship

It has long been established that a major challenge of peri-urban agriculture is the price of land. Therefore, the provenance of land for non-profit farms in the Hudson Valley, especially in the high-priced commuter suburbs of the Lower Hudson Valley, are particularly pertinent to the ways in which the business of non-profit farming is conducted in this region. In several cases, farms did not own their own land. Instead, they existed either on land leased from town/city, county or state governments, from non-profit organizations, or from a university. Lease prices tend to be nominal, as the goal of the lending groups is not to make the highest profit (which would be to sell the land for development) but to preserve agriculture in the community. Most of the farm organizations, however, must earn income either from their food sales, their education programs, or from fundraising in order to meet both rents and wages. An informal web survey of several non-profit farms in the United States indicated that the COVID-19 pandemic has severely impacted their programming and therefore their income. In this way, non-profit farms are similar to preserves and other non-profits, in that they depend on education program funding, a strong presence of fundraising boards and fundraising events such as galas, the attraction and cultivation of wealthy donors, and the writing of grant proposals.

Land ownership is also noteworthy in the fact that it affects how the majority of these organizations are run and managed. Because many lease land from government or other organizations, this leads to requirements on how they gain access to the land, whether leased or unleased, the lengths of their leases, what kinds of activities

7 National Recreation and Park Association. *Park Advocate Handbook*. Retrieved January 20, 2020 from https://www.nrpa.org/uploadedFiles/Americas_Backyard/park-advocate-handbook-100711.pdf.

they can pursue or infrastructure they can build, and who has the ultimate say on their programming. Leasing government land also necessitates a partnership that comes with its own benefits and challenges. Nine farms cultivate their own land, and their activities and programming are to some extent determined by how they obtained the land. Many of these other farms were originally family estates and the land was donated by the heirs of these estates. For example, the Verplank family gave Stony Kill Farm to the State of New York for SUNY to use as a teaching farm in the 1940s. Common Ground Farm now leases some of that farmland. Glynwood, Stone Barns, and Stony Kill Farm were all formed from families giving land to preserve the farm and its open space. In the case of Stone Barns and some other non-profit farms derived from estates, these families also provided an endowment which helps to support some of the farm operations.

Organizational budgets vary, from 350K to about 14M. The relative percentages of sources of funding also varied from organization to organization. Some places received most of their funding from contributions, whereas others received most funding *via* earned income. Some had endowments while others received municipal support. All of the organizations we interviewed shared that funding and fundraising is a constant challenge. This included challenges associated with the dwindling of CSA income; how to bring in more earned income; ways to encourage more individual giving; and the need to "get bigger" in order to have foundations fund their work. Several organizations mentioned aging infrastructure in need of updates, renovations and upkeep, and/or the need for additional infrastructure to support the growth of their programs and initiatives.

Collaborations

Rather than asking specifically about the role their farm played in the local food system, we asked a general question about the ways in which they collaborated with other organizations in the region. Most of these organizations were involved in collaborations with other local organizations, such as non-profit and government entities (Figure 4). We asked about two types of collaborations in our interviews. The first we termed "partnerships with municipalities," which include relationships generally structured as a result of land ownership and/or governance. This includes relationships with state, county, town or city municipalities, or relationships with individuals or organizations that own the land which the farm cultivates. The second type was termed "local, state or national collaborations/partnerships," which sought to understand other kinds of collaborations or relationships these organizations might have that did not necessarily relate to land ownership or governance. The responses in Figure 4 indicate that non-profit farms in the Hudson Valley play a role in local food system infrastructure. However, these organizations went beyond that role, their collaborations having as much to do with their non-profit role as with their agricultural role.

1. Partnership with municipalities/other agencies

   Organizations that farm on town/county/state land have an explicit partnership with a governmental organization; this informs at least some part of their decision-making and programming. Three of the eight organizations interviewed have partnerships with county/town municipalities through the fact that the land on which they farm is owned by the county/town/city. Other partnerships include relationships with city council and town governments, chambers of commerce and tourism departments.
2. Collaborations with local, state, and national partners

   All eight of the organizations interviewed also collaborate with a number of external state, national, non-profit, and private organizations. Those external organizations include environmental organizations like local watershed agricultural councils and Soil and Water Conservation Districts. Connections also include agricultural organizations such as local agricultural boards, the state agricultural commission and Cornell Cooperative Extension, and farmers markets. Their role as environmental and agricultural educators puts them in contact with school districts and local universities. Finally, their role in food access puts them in touch with food banks and food pantries. As greenspaces in the local landscape, they often have relationships with local tourism organizations and sometimes co-sponsor tourism events. Their relationship with municipalities often puts them in close relationship with local and state officials, who are sometimes involved in governance of the organization.

While farms interviewed mentioned some collaboration with other organizations involved in alternative food networks or sustainable agriculture, it was clear that, for most of these farms, major linkages were with local community organizations and governments. The two largest farms, Stone Barns and Glynwood, were the exceptions, existing as strong members in national and regional networks.

Social justice: Continuity and challenges

Even for local for-profit farms, the primary audience must be the local community of food consumers who buy their products, since that is their source of their financial support. As a result, many local private farms in the Hudson Valley are part of the "normative landscape" of farming of the region, supporting community, environmental and sustainability missions. Nevertheless, non-profit farms, like most non-profits, are more closely tied to a social mission. Many of the organizations we interviewed expressed a desire to expand their mission even further, to provide access to programming and resources for specific populations in their community, particularly low-income populations and people of color in their region (Figure 5). When asked what audience they would most like to draw to their farm, 6 of the 8 organizations stated that they wanted to work with more people of color and low-income families and individuals. One interviewee stated that "unless we can really reach into black/brown communities and underserved communities, we aren't doing our job, as there's a lot of ignorance and not enough knowledge of what's really going on."

Nearly all of the interviewed organizations listed additional audiences that they would also like to reach, including families with

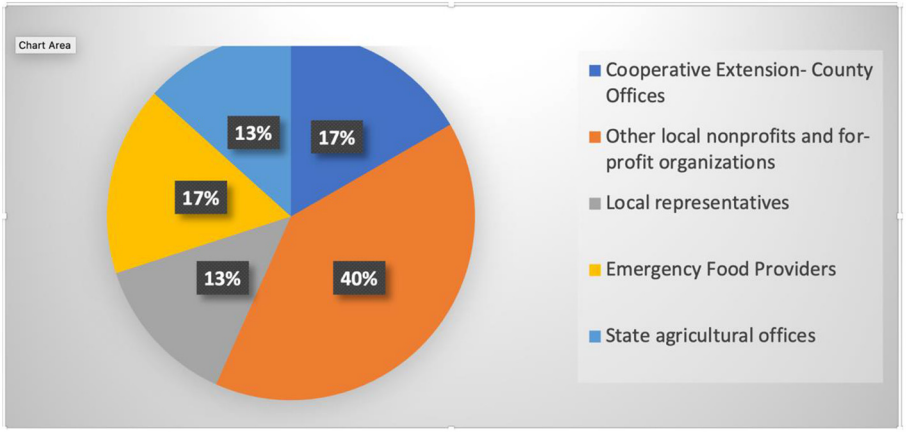

FIGURE 4
Collaborations reported by interviewed and observed for web-researched organizations in the Hudson Valley (excluding partnerships/collaborations related to land ownership). Source: Interviews and website analysis.

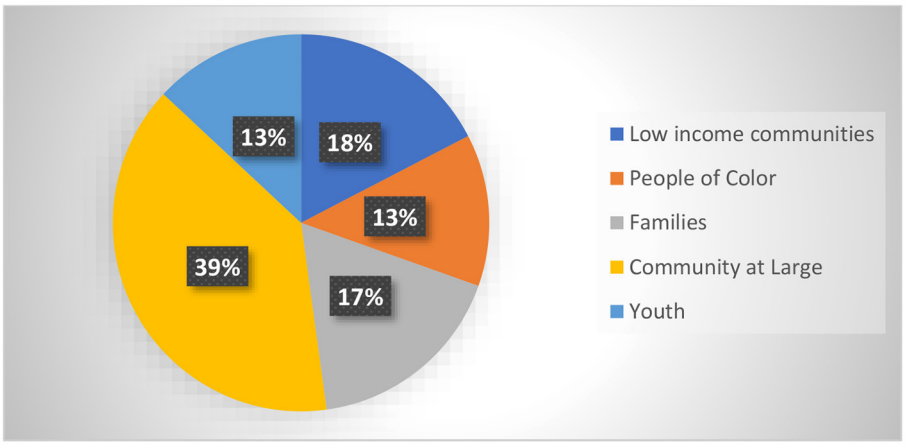

FIGURE 5
The most desired audiences for interviewed and web-researched organizations in the Hudson Valley. Source: Interviews and website analysis.

children, food and farming professionals, the general public and "foodies." At least two of the organizations noted that for the most part, their CSA audience consists of white, middle-class families or individuals. In addition, because Boards of Directors and Friends' Groups are so closely related to philanthropic support, most of the individuals involved in non-profit farm governance are better-off members of the community.

Lastly, three organizations identified families as a key part of their intended audience. In particular, like local nature preserves, many of these farms saw themselves as destinations for families with children. As a result, many farms kept farm animals on the premises, although livestock production was not a major farm goal. The idea, however, was for the most part that these farms served the larger local or regional community, including food and farming professionals, families including low-income families and underserved communities, tried and true foodies, as well as young people. As noted above, the larger farms serve a national or even international alternative agriculture community.

Interviewees, however, admit that the CSA audience has always been mostly white and middle class, and that the ability to link to low income and food insecure families in the Hudson Valley was a challenge. On the other hand, farms near low-income areas were strongly active in food access activity, including providing vegetables to local food banks and other food access organizations. In this way, non-profit farms in the Hudson Valley pursued what they defined as their social justice goals.

However, generally speaking, most of the organizations agreed that they needed more engagement with the communities that they work with (or would like to work with) to determine community needs. This could range from offering scholarships for programs to ensuring they have the right staffing and infrastructure to meet these needs. They also hoped to intensify their collaboration with key players in the community. However, the tensions between

a governance structure that relies on the resources provided by better-off donors to meet the needs of less-well-off clients is an issue commonly discussed in the literature on non-profit governance (Salamon, 2002).

We asked interviewees to reflect on their successes in meeting their mission. They tended to have two perspectives on what would be defined as a successful outcome. The first was that some organizations felt they had succeeded in improving the wellbeing of the underserved audiences with which they worked, ranging from improved health outcomes as a result of programming such as school-based programs that lead to a "self-enforcing cycle of benefits [to] kids and increased buy-in from the community," to large donations of fresh produce to food pantries. These missions reflect the national analysis of non-profit farms which shows that human services are often part of the mission of these organizations. Other notable accomplishments included preserving farmland and coalition building.

Changes

We asked interviewees to reflect on whether and how their mission is changing. A few, major themes emerged. These included cost of farmland in the Hudson Valley, climate change, CSA membership changes and the increasing interest and need for the inclusion of diversity and attention to food justice. Other trends that were common were: shifting demographics, a growing trend toward collaboration and the increase of economic disparity, both on a local and international level. One interviewee noted that "there's a problem of scarcity, of rich people having a lot and poor people not. If someone is food insecure, it isn't going to totally help them if you just give them food" (they need housing, etc.). Yet, the nature of fiscal sponsorship and land provenance – dependent on wealthier community members – added to the disconnect between alternative food networks and social justice goals (Guthman, 2008), and their funding sources means that these farms struggle to meet the needs of a diverse audience of wealthy sponsors, middle-income families and low-income community members.

The interviewed organizations shared ways in which they were altering their programming or organizational practices in order to respond to these challenges. Major themes included more collaborations with a wider variety of organizations, more climate resilient or regenerative agricultural practices, inclusion of more diversity on all levels of programming, alternatives to the CSA model and increased assistance to young and emerging farmers.

Conclusion

Despite these challenges, it is clear that non-profit farms play a distinct and useful role in their communities. It is clear that, as a whole, non-profit farms provide valuable resources to the community, enhance sustainability and provide environmental education, regional greenspaces, and watershed protection while also providing critical access to fresh foods. Individually, however, these farms vary widely in terms of their mission. Some grow food primarily to train farmers; others to provide work for those who are unable to gain a living. Still others focus on environmental education or hands-on learning for children. Many grow food to reconnect their communities with the soil or their community's agrarian heritage. A number of farms donate food to food banks, several of them give away everything they grow. Most farms combine a number of these missions in service to their community.

On the other hand, this initial look at non-profit farms indicates that this mode of governance is not without its drawbacks. First, non-profits depend on donations and therefore non-profit missions are heavily influenced by donors, whose interests may outweigh the interests of other stakeholders in local food systems. This is particularly important when major donors are also board members, which is often the case. Since missions are determined by non-profit boards, board members who are also major donors, or founders who set missions while donating large endowments, are likely to have a major influence on farm mission. However, as interviews indicate, non-profit organizations are also keenly aware of the need to serve their local communities and have worked hard to be responsive to local stakeholders (Faulk et al., 2021).

In addition, the extent of to which these farms are playing an active role in local food movements or food policy is not always clear. Many of the best known of these organizations – such as Stone Barns and Glynwood in the Hudson Valley – are leaders in the food policy field. Others appear to be more committed to local philanthropic, service or religious communities, or simply want to connect their communities together to the land and nature. This approach contributes to the conversation about whether or not alternative economies can fill all the social needs not met by private or governmental systems. Recognizing the variety of non-profit farm missions resonates with recent arguments arguing against dividing food organizations according to fixed ideas about alterity (Nemes et al., 2023). These recent analyses seek to go "beyond the impasse," advocating for an understanding of the hybridity of alternative food network organizations which, simply by their presence, influence food system futures (Misleh, 2022). The recent analysis of the role of local food systems during the COVID 19 food chain breakdowns is an example of the ways that organizations with simple missions to grow local food play an important role in a changing economic and environmental future (Clapp and Moseley, 2020). Looking at these farms from a non-profit mode of governance perspectives adds some depth to these conversations. If "alternative" is a mode of governing based on any of a wide variety of values (Nemes et al., 2023), then non-profit farm governance is the most able to pursue those non-market ideals.

From this broader perspective, one can recognize that many of these farms play a role in their local communities outside of strictly food system issues. For many farms, their social welfare role is closer to traditional charities, such as by supporting those who are not otherwise able to gain an income, or by donating food to food banks. It is therefore difficult to distinguish between non-profit farms' role as farms and their role as non-profits. As non-profits, these farms often perform in ways that are similar to

local community non-profits that provide social welfare services. In accordance to these recent, less fixed approaches, one can assess the importance of non-profit farms as hybrid organizations supporting local community, environment, education, social welfare and community development roles, along with providing food. In addition, in their role of supporting communities, non-profit farms have a front row seat to view the problems with the current food system and the communities that system fails to serve.

Further research will be necessary to determine whether an efflorescence of non-profit farms could make a larger contribution to the transformation and re-regionalization of local food systems. Would several non-profit farms in one community end up competing for the limited donation dollars available? Would a farmer want to perform the other jobs necessary to fulfill a social welfare mission, such as community education or food bank donations, in order to fulfill a mission? In a rare essay on his experience managing a non-profit farm, one farmer noted, "Farming for and with others is a complicated and difficult undertaking" (Welton, 2014). And, as noted above, farmers often choose their vocation in order to be their own boss.

What remains clear is that non-profit farms will continue to play a unique and major role in local foodsheds in many communities. They will continue to pursue their hybrid education, human service and environment goals, while growing food for food banks and/or to supplement their income to meet their other missions. There are many questions left to be answered in terms of the who, how and in what ways these farms serve their communities, and whether an expansion of non-profit farms would enhance local food systems. This analysis is a first step toward answering these questions.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

AC: data collection and management. ED and AC: analysis and editing. ED: writing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Optimization and reflexivity in interdisciplinary agri-environmental scholarship

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Introduction: The Chesapeake Bay and Upper Bann watersheds in the United States and Northern Ireland, respectively, exemplify how agricultural systems contribute to groundwater and surface water pollution, which leads in turn to water quality issues in downstream water bodies. Interdisciplinary research, public outreach, and stakeholder engagement have received increased attention and consideration as pragmatic approaches for addressing these types of complex agri-environmental dilemmas. However, such approaches are far from guaranteed to improve water quality, as political-economic constraints, power asymmetries, cultural differences, divergent incentives, research gaps, and personality differences all complicate the process, and this can ultimately impact water quality efforts.

Methods: We present a holistic approach to addressing these challenges in the Chesapeake Bay and Upper Bann watershed management efforts by integrating the methodological strategies of optimization and reflexivity. Our use of these approaches, widely recognized as respective successful practices in quantitative and qualitative research, is novel in that it focuses directly on the researchers themselves as they discuss, evaluate, and develop potential solutions for complex agri-environmental water quality dilemmas. More specifically, our quantitative optimization is explored via a Functional Land Management (FLM) approach to land and natural resources management, while our qualitative reflexivity is explored through the process of participant observation.

Results: This paper provides a behind-the-scenes perspective on how interdisciplinary teams can improve their cooperation efficiency when addressing complex agri-environmental issues. In being reflexive, we sought to "optimize" on the methodological, ethical, social, and environmental possibilities of our scholarship. We found that our reflexive work on this project furthered our interest in FLM, a tool that embraced complexity and creativity over rigidity and oversimplification - the very same principles that guided our reflexive work.

Discussion: Throughout our collaborative investigation of FLM as a potential solution to soil and water quality issues, we came to appreciate that in order to better understand agri-environmental challenges issues, we also needed to better understand ourselves—our own disciplinary, cultural, and ethical standpoints. Reflexive approaches to research can provide practical guidance in this process

by encouraging us to critique and analyze our assumptions, our methodologies, and the socio-historical context of our research.

KEYWORDS

agricultural sustainability, rural sociology, environmental science, water quality, interdisciplinary research

1. Introduction

Water impaired by nitrogen, phosphorus, and sediment, predominantly due to agricultural soil management, is a costly problem worldwide that negatively effects waterways, their organisms, and the economies of many nations. Sustainable Development Goal 15 ("Life on Land") accordingly calls on governments and stakeholders to "protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss (Nations, 2012)." Improving soil health is also vital to attaining other Sustainable Development Goals, including "1 (End Poverty), 2 (Zero Hunger), 3 (Good Health and Wellbeing), 5 (Gender Equality), 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 9 (Industry Innovation and Infrastructure), 11 (Sustainable Cities and Communities), 12 (Responsible Consumption and Production), and 13 (Climate Action; Lal et al., 2021)."

Governing agencies in the United States (US) and across the European Union (EU) have tried to reduce agricultural runoff pollution to water bodies by developing specific policies through EU Directives, the EU Common Agricultural Policy, EU member nation legislation, US national policies, and US state-level environmental legislation. For example, in the US Chesapeake Bay Watershed, policymakers have established fixed-time limits on the restoration of impacted surface water bodies. The US Environmental Protection Agency has mandated water quality improvement goals issued through the Chesapeake Bay Total Maximum Daily Load (TMDL), thereby setting limits on the maximum amount of nitrogen, phosphorus and sediment loads to the Chesapeake Bay that must be met by 2025 (USEPA, 2010). Similarly, the EU Water Framework Directive uses five classifications to evaluate water quality status (high, good, moderate, poor and bad) among all water bodies (surface and groundwater) in EU Member States, and requires all Member States to reach "good" ecological, quantitative, and chemical status and protected area objectives by 2027 (Carvalho et al., 2019). Besides mandatory requirements under the EU Nitrates Directive (an agriculture-focused section of the Water Framework Directive), voluntary agri-environmental measures have been increasingly integrated into the EU Common Agricultural Policy since the late 1980's (Hart et al., 1994; Angileri et al., 2011; Meyer et al., 2014), while the more recent integration of compulsory environmental cross-compliance regulations reflects the EU's efforts to pursue its environmental targets (Solazzo and Pierangeli, 2016; Bertoni et al., 2018). Soil scientists have made significant contributions to policymakers' understanding of these problems in recent decades (Keesstra et al., 2016; Lal et al., 2021; Bouma et al., 2022). Nonetheless, while progress has been made, research and policy measures have been inadequate in light of the sheer scale of the problem. Part of the problem could be due to how we (as agri-environmental researchers more broadly) collectively work together.

Interdisciplinary research and outreach efforts are receiving increased attention and consideration as a solution to inform policy making by addressing complex agri-environmental challenges like the reduction of waterway pollution from agriculture (Andersen, 2016; Keesstra et al., 2016; Annan-Diab and Molinari, 2017; McBean and Martinelli, 2017; Szell et al., 2018). Indeed, "all this is only possible if researchers look over the hedge toward other disciplines, to the world at large and to the policy arena, reaching over to listen first, as a basis for genuine collaboration (Keesstra et al., 2016, p. 124)." Yet few accounts exist of researchers' interpersonal experiences in interdisciplinary research efforts (Datta, 2018) and little empirical evidence exists that interdisciplinarity works as intended (Lyle, 2017). Oftentimes, there is a failure to support—or allow for—the risks involved and time frame needed to overcome unequal/undistributed disciplinary contributions (Anonymous, 2017). In Datta's (2018) experience on an interdisciplinary project, he found that respect, trust, vulnerability, attentiveness to others' feelings, professional flexibility, timely leadership, and courage were essential to a successful outcome. Adequately addressing these issues can be particularly challenging for many researchers, given the power asymmetries between different disciplines (Morris et al., 2019) and between academic ranks.

To further invigorate collaborative and holistic research on agri-environmental challenges, we present a critical examination of an international-interdisciplinary collaboration between biophysical scientists, engineers, and one social scientist (the lead author). In contrast to Lyle's (2017) solo-authored participant-observation paper, which emerged from her feelings of marginalization and solitude on an interdisciplinary medical device team, our group sought to co-author a paper that integrated our respective disciplinary backgrounds through conscientious and deliberate reflection (Leavy, 2015).

In what follows, we first discuss our methodological approach: a collaborative workshop on the social and methodological potential of Functional Land Management (FLM). Our quantitative approach was complemented by the lead author's participant-observation role, whereby he encouraged the team to be more reflexive about our a priori assumptions and disciplinary lenses. In the subsequent section of the paper, we situate this methodological discussion in agri-environmental context by looking at two case studies where we do our respective work: the Susquehanna River Basin within the Chesapeake Bay watershed (United States) and the Upper Bann watershed (Northern Ireland; Figure 1). This section is followed by a more in-depth discussion of

the discursive themes and tensions that permeated throughout our collaborative process. Throughout the paper, in the spirit of interdisciplinary synthesis, we use the technical concepts of "modeling" and "optimizing" as metaphors for our group's collective aspiration to be exemplary scholars—always striving to be more rigorous and more reflexive. We conclude our discussion with a set of key questions and considerations that can help to inform future international-interdisciplinary collaborations in agri-environmental scholarship.

2. Methods

The overarching purpose of our collaborative scholarship was to re-envision both the environmental possibilities and the ethical implications of different rural land use strategies. We laid the foundation for this work by assembling an international-interdisciplinary workshop for select researchers from Ireland, Northern Ireland, the Netherlands, and the United States. The explicit purpose of the workshop (held in June 2018, in Wageningen) was to explore different methods for optimizing soil-based ecosystem services by agricultural land, or "soil functions" (Schulte et al., 2014, 2015), according to societal demands for production and environmental preservation. Throughout the process, we found that the strength of our collaborative network was grounded in our ability to engage in an iterative, dialectic, and non-sequential conversation across two key dimensions: optimization and reflexivity.

2.1. Optimization

The application of quantitative methods toward addressing large-scale social, economic, military, and environmental questions exploded with the postwar advancement of computing technologies. Indeed, in highly developed societies with large populations, optimization is a valuable tool for addressing complex, macro-level problems. Optimization, or mathematical optimization, is a process whereby (A) the choice of the optimal component (with regard to some criterion) is made from a collection of potential alternatives or (B) the optimal choice is derived from a combination of components, where the result of the combination is greater than the sum of its parts and effects of antagonist trade-offs are minimized. Multi-objective mathematical optimization, heuristic problem-solving, targeting, and other techniques for operations research and numerical problem solving are quite widely used in the study of natural systems (Craig et al., 2001; Moles et al., 2003; Veith et al., 2003, 2004; Williams et al., 2004).

To this end, the specific optimization approach that we investigated at the workshop was FLM—a policy support framework that seeks to optimize the agronomic and environmental returns from diverse soil and landscape settings (Schulte et al., 2014, 2015; O'Sullivan et al., 2015; Coyle et al., 2016). While people generally understand that soil delivers multiple functions to society and associated ecosystems, it is much less appreciated that soils vary in their ability to deliver these services (Blum, 2005; Bouma, 2015). FLM can potentially remedy agri-environmental misalignments by matching the supply of soil functions to societal demands (Schulte et al., 2014, 2015; O'Sullivan et al., 2018). FLM focuses on five soil functions (services) as outlined by Bouma (2014): (A) primary productivity; (B) water purification and regulation; (C) carbon cycling and storage; (D) habitat for biodiversity; and (E) recycling of (excess) nutrients/agro-chemicals. FLM thus provided us with an ideal conceptual and methodological framework with which to compare and contrast soil and water quality practices across different landscapes.

2.2. Reflexivity

Despite their many advantages and obvious necessity, there are also many limitations that come with implementing the solutions identified through optimization and quantitative methods as a whole. Accordingly, a parallel objective throughout our collaborative process involved reflexivity, i.e., researcher self-awareness with respect to their standpoint, disciplinary training, values, emotions, and social position throughout all stages of data collection and analysis (Guillemin and Gillam, 2004; Walsh, 2009; Emerson et al., 2011). While all professionals use tacit knowledge to address "complexity, uncertainty, instability, uniqueness, and value conflicts," they often find it difficult to publicly embrace and explain their use of experiential and improvisational skills (Schön, 2017, p. 18; see also Ramage, 2020). For Burawoy (1998), reflexive approaches to science are grounded in the assumption that researchers will always disturb the local setting when they come into contact with others, and that such disturbances should therefore be embraced, reflected upon, and used as a springboard for further analysis and inquiry. Here, a researcher's interaction with and interpretation of the social world is seen as a phenomenon to be recognized (or considered), critiqued, and analyzed, rather than a "bias" or "confounding variable" that must be eliminated.

The core mechanism for the reflexive component of our investigation was the method of participant observation, a qualitative data collection technique through which the researcher immerses in the studied "socio-cultural space" by "taking part and continually reflecting on what is happening," as opposed to "pure observation," where the researcher excludes themselves from the observed environment (Walsh, 2009). This approach is particularly valuable when working in interdisciplinary contexts, particularly with respect to open communication, microethics, insider/outsider relations, differing professional priorities, transparency, and the need for shared goals (Pardee et al., 2018). The participant-observation contribution to this project was primarily made by the lead author, who took detailed field notes while encouraging overall team reflexivity through writing activities, discussions, and co-authoring this manuscript.

In the following section, we consider two paradigmatic case studies in agri-environmental management where our team members have long sought to affect change: the Chesapeake Bay and the Upper Bann watersheds. Indeed, it was our shared frustrations with the soil and water quality governance in these regions that brought us together at the workshop.

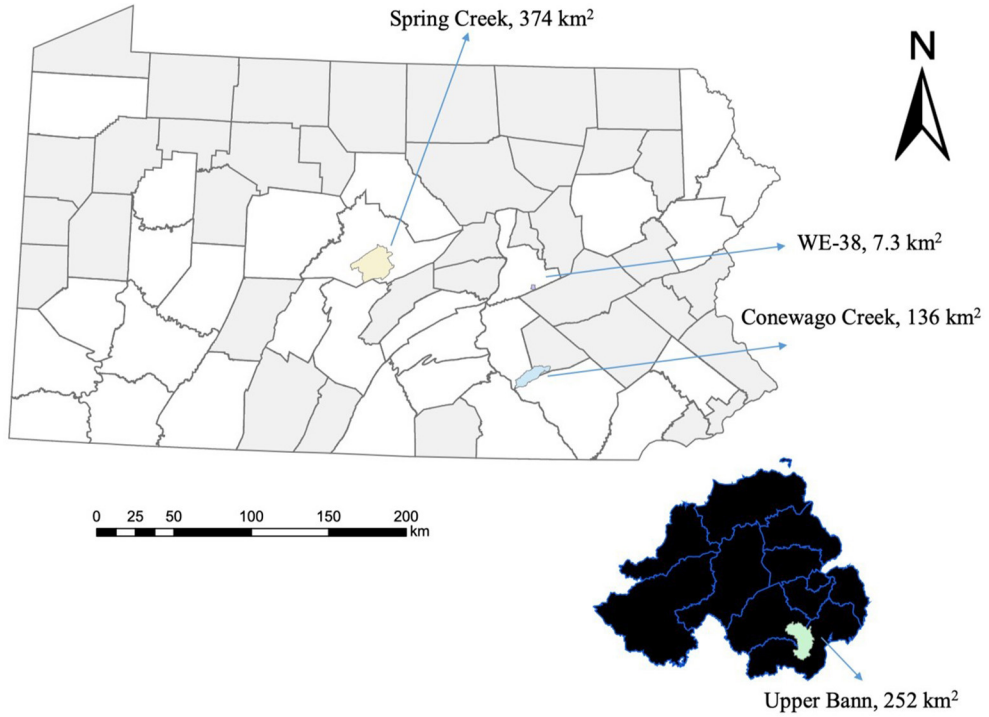

FIGURE 1
Respective land area for Spring Creek and Conewago Creek (part of the Chesapeake Bay watershed) as compared to the Upper Bann.

3. Case studies

3.1. Chesapeake Bay

The 165,759 km^2 mile Chesapeake Bay watershed is the largest estuary in the United States. It spans six U.S. states and the District of Columbia (Washington, D.C.) and provides drainage for over 100,000 tributaries, including the Spring Creek and Conewago Creek (Figure 2) regions (where we do much of our empirical work). To improve water quality throughout the Chesapeake Bay, policymakers have established fixed-time limits on water quality improvement. The federal US Environmental Protection Agency has mandated water quality improvement goals issued through Chesapeake Bay Total Maximum Daily Load (TMDL) targets (USEPA, 2010), thereby striving to decrease nitrogen, phosphorous and sediment loads to Chesapeake Bay. The Chesapeake Bay Program partnership has set restoration goals under the Chesapeake Bay TMDL to reduce these forms of pollution by 2025 (USEPA, 2018). To meet water quality improvement requirements under the TMDL, the US Environmental Protection Agency incentivizes farmers to implement best practices, for example, riparian buffers on their land. All farms in Pennsylvania, for example, are required to write and comply with a nutrient management plan, which includes determining appropriate land-application plans for their manure. These management plans are focused on nitrogen rather than phosphorous. Much (if not most) phosphorous over-application comes from year-round land application of livestock manure in excess of crop needs due to the higher nitrogen:phosphorous ratio in manure vs. crop needs. Since nutrient management plans and manure application rates are determined based on crop nitrogen requirements, over-application of phosphorous becomes inevitable. However, switching the plans to be based on crop phosphorous requirements leaves farmers with excess manure that they are unable to land-apply. The Chesapeake Bay watershed thus provides an exemplary case of how global production and consumption systems contribute to acute nutrient management crises that are both distributed across regional settings and concentrated in local watersheds. Action must soon produce results. A 2017 federal evaluation of Pennsylvania's progress toward meeting TMDL goals resulted in federal enforcement actions being implemented on agricultural and urban/suburban land uses, as the state fell short of meeting its TMDL requirements in these sectors (USEPA, 2022). Reducing excess agricultural nutrient pollution to meet water quality standards is similarly challenging for many European nations. Thus, our second area of interest was the Upper Bann study catchment (<300 km^2) in Northern Ireland (Barry and Foy, 2016).

3.2. Upper Bann

The Upper Bann was chosen as a complementary case study *via* exploratory collaborations between researchers from the United States, Northern Ireland, the Republic of Ireland, and the Netherlands (these partnerships evolved from Pennsylvania's development of the Fertilizer Forecaster tool—see Easton et al.,

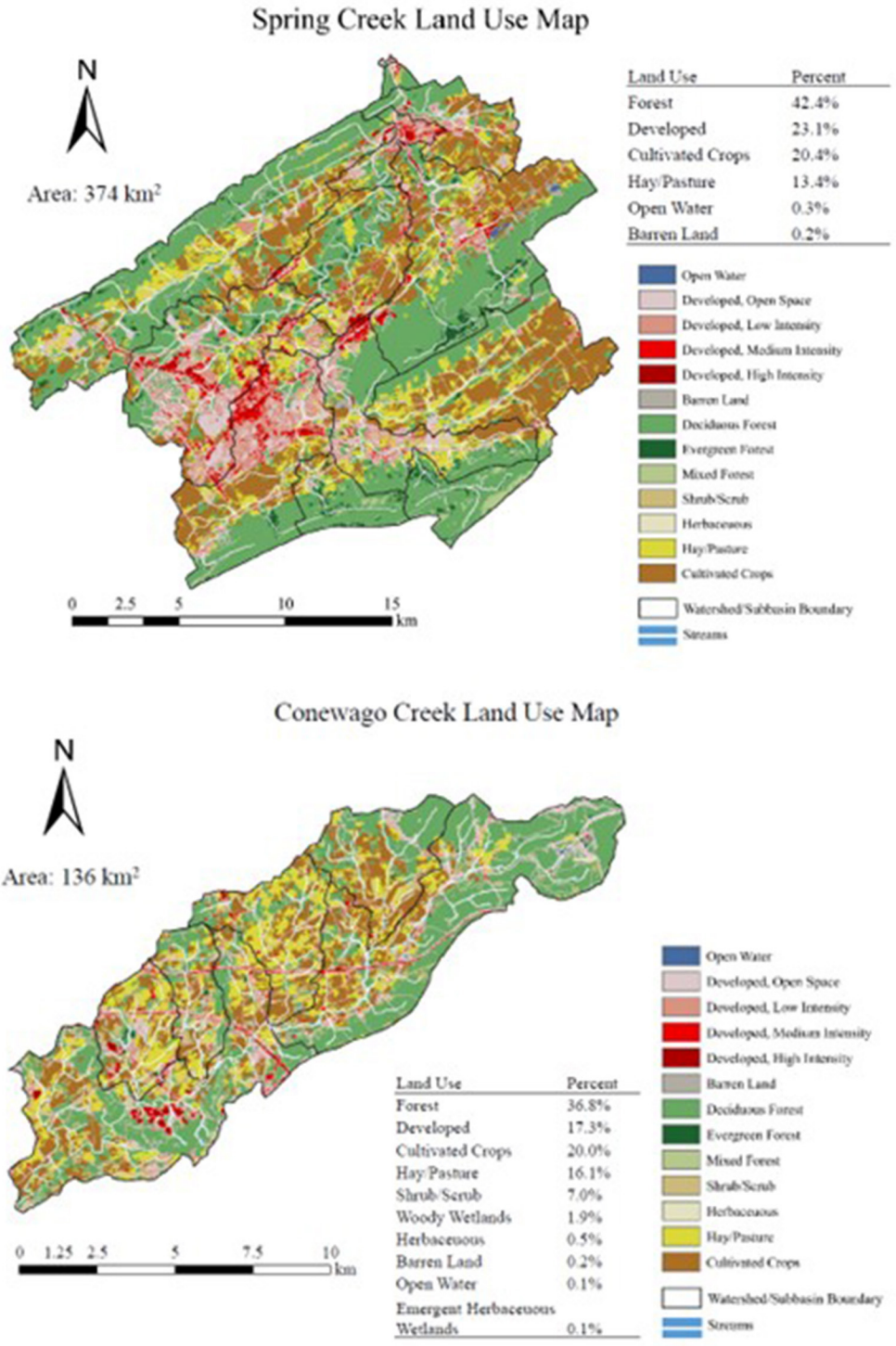

FIGURE 2
Spring Creek land use map and Conewago Creek land use map. Both regions are part of the Susquehanna River Basin and have been a key focus area for the Chesapeake Bay scholars on the team.

2017; Drohan et al., 2019). The Upper Bann is comprised of moorland, with some forest at higher elevations transitioning to intensive grassland pastures for dairy cattle, beef and sheep in the lower watershed areas (Figure 3). The overwhelming majority of the Upper Bann's surface water bodies do not have a "good" status per the EU Water Framework Directive, and many rivers fail to achieve good status due to elevated phosphorus and impacted macroinvertebrate communities. This is a widespread problem across Northern Ireland, where only 31.3% of 450 river water bodies and 23.8% of 21 lake water bodies have reached good or

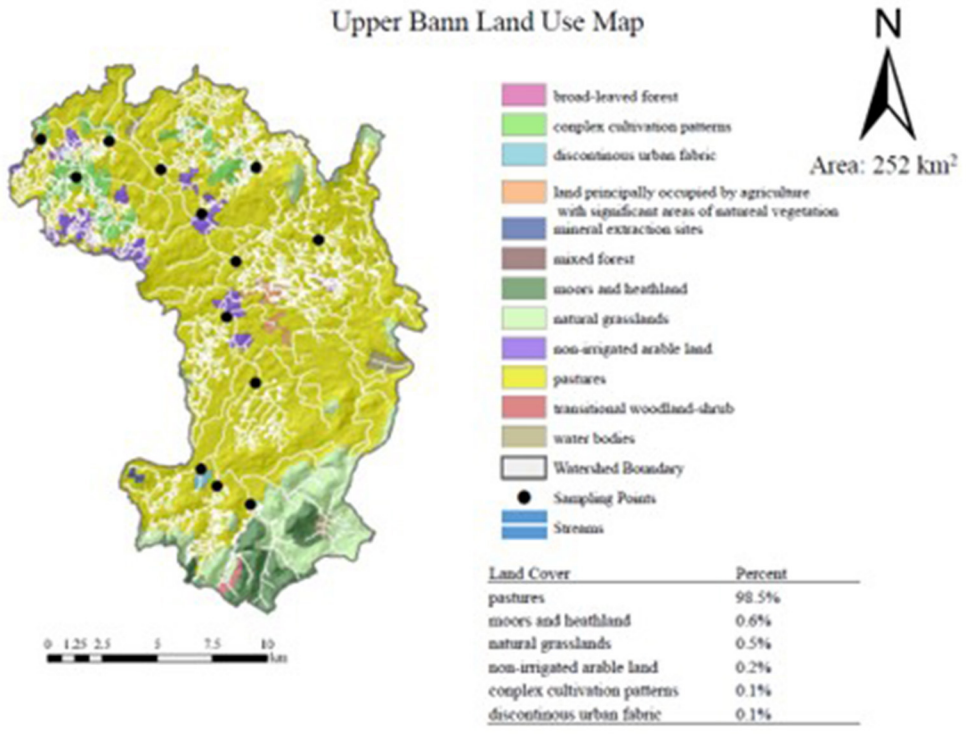

FIGURE 3
Upper Bann land use map.

higher status as of 2018 (DAERA, 2018). In the Upper Bann, there has been a decades-long deterioration in water quality, associated with increased inorganic nitrogen and phosphorus fertilizers, resulting in increased nutrients and sediments transported to water and reduced ecological status. In order to address these water quality issues, EU policymakers developed an overarching Water Framework Directive—a framework for the community action in the field of water policy (Directive, 2000/60/EC)—focused on the ecological quality of water. The EU Nitrates Directive (2000/60/EC) more specifically addresses water quality in relation to agriculture, monitors nitrate concentrations in water bodies, with a total territory approach taken to its implementation in Northern Ireland. Under this directive, which does not consider local soil quality, polluted waters (or those considered to be at risk of pollution) include (A) surface waters with a concentration of $> 50\,mg\ l^{-1}$ of nitrates and (B) Groundwater containing/could contain $> 50\,mg\ l^{-1}$ of nitrates. In addition, the Phosphorus (use in agriculture) 2006 Regulations were implemented in Northern Ireland to mitigate the impact of agricultural phosphorous on aquatic ecosystems in Northern Ireland. These measures have shown limited effectiveness.

In short, legislative and land management efforts to reduce water quality pollution from agriculture vary considerably between the EU and US. A comparative analysis of these two governing frameworks provided our group with a promising approach toward developing more comprehensive research and policy tools at the workshop.

4. Results

Our results section proceeds as follows: first, we actively reflect upon our own a priori assumptions and perspectives regarding the social and environmental challenges that confront agri-environmental researchers in the Chesapeake Bay and the Upper Bann. The purpose of being transparent and reflexive about our own preconceptions in this section is not to treat them as "expert opinions" to be disseminated as "truth." Rather, we sought to better understand the lenses and sociotechnical frames that shaped the ways in which we interpreted and approached these issues in the first instance. Second, as based upon our collective experiences at the workshop, we reflexively consider both the potentials and limitations of FLM and participant-observation to address these agri-environmental challenges as we understood them.

4.1. Team perspectives on case study I: Chesapeake Bay

Our project group engaged in extensive discussion and writing activities about our different assumptions and perspectives regarding the role of farmers, policymakers, and scientists in the Chesapeake Bay. From our collective standpoint, many farmers are willing to use less nutrients due to cost savings, but only if and when this practice can ensure continued yields. We also recognize that Chesapeake Bay farmers' approach toward agri-environmental issues has been shaped to a large extent by family

farming traditions, the type of information that the government shares with farmers, and the reality of dealing with daily on-farm nutrient challenges (i.e., full manure storage facilities).

Consumer waste and dietary choices also have a tremendous impact on agricultural practices, albeit less directly. We further noted that extension and outreach activities by scientific organizations have helped in a great way to change the way farmers think and connect farmers with science and policy. Nonetheless, we remained concerned that farming practices and/or technological solutions proposed by scientists and researchers fail to convince the farmers for multiple reasons: practical factors such as socioeconomic constraints, access to quality information, implementation challenges (Baumgart-Getz et al., 2012; Liu et al., 2018; O'Sullivan et al., 2018), a lack of connection to empowering networks, countervailing belief systems, (dis)trust in science and mainstream institutions (Baumgart-Getz et al., 2012; Schall et al., 2018; Eanes et al., 2019), and/or concerns about policy "lock-in" from long-term engagement in conservation programs (O'Sullivan et al., 2015).

Our group also discussed the different social factors that have encouraged conservation practices and what the overall effectiveness of these practices has been. On the one hand, we agreed that conservation practices have long been used by farmers in Chesapeake Bay watershed to minimize impacts to ecosystems, and many farmers have shown a willingness to work toward consensus on these issues with extension agents and policymakers (USDA, 2013). Nonetheless, numerous hindrances, as mentioned above, have limited and constrained these farmers' avenues of potential options. Our group also considered the possibility that the voluntary contributions of individual landowners to agricultural land use change simply may not be a sufficient way to address the aggregate problem. We nonetheless recognized the importance of respecting and acknowledging the unique and locally-situated knowledge of rural landowners.

We arrived at a loose consensus that farmers had the most influential voice in the water quality debate, policymakers largely played second fiddle, and existing policies on non-point source pollution were largely dependent on voluntary action. During the workshop, EU participants discussed a lack of certified staff who could conduct on-farm inspections to ensure compliance with nutrient management plans, resulting in farms only being inspected an average of once every 8 years instead of annually. Here, one of the Americans in the group commented that in the US, there's a lot of pressure on the government to not overregulate. At the federal level, despite the fact that Pennsylvania fell behind in its 2025 TMDL goals for the Chesapeake Bay, the previous US administration's "The Waters of the US" policy had been rescinded by the US administration in office at the time of workshop (held in 2018). Moreover, the USDA Natural Resources Conservation Service and state environmental protection staff used to help with management planning, for free. Now—with essentially all farmers being required to create a nutrient management plan—there are substantial shortages of staff and farmer-paid contractors to fill this role.

Where policymakers have taken action, many of us agreed that legislation was oftentimes aimed at a quick and easy fix through "one-size-fits-all" approaches as opposed to customized guidelines that considered local soil, hydrological and environmental conditions (these concerns were also raised with respect to the current situation in the Upper Bann). Additionally, the continued shift from local agricultural production *via* small farms to widely-transported products from large-scaled concentrated animal feeding operations places increased strain on the effort to balance soil nutrients and reduce nutrient exports from farms. Many rural communities appear to be deeply divided in their support of these types of facilities, and their long-term political viability—particularly in an era of persistent rural depopulation, farm loss, and rural/urban economic disparities—remains an open question.

In terms of the impact that scientists had on the US water quality debate, our group felt that scientists were more likely to be influential when they worked within (rather than against) the current political-economic system. In practice, this has meant more grant funding for individual and local-level approaches (e.g., P-index and best management practices) as opposed to "paradigm shifting" proposals, although there are a handful of major grant programs for large and ambitious programs. Even still, several among us commented that many scientists were not effectively communicating and collaborating with farmers and policymakers, and that—despite many ongoing and fruitful efforts to build bridges—a "large disconnect" remained between these groups. While extension educators can minimize this gap, it is often unidirectional, with knowledge flowing from universities to farmers but not back in the other direction. In this way, the knowledge created at universities may not fill all farmer needs because those needs are unbeknownst to scientists. Mismatches in needs and solutions can therefore be significant.

4.2. Team perspectives on case study II: Upper Bann

When compared to the Chesapeake Bay, communities on the Upper Bann face comparable yet quite distinctive ecological problems—particularly with respect to water quality—that have been met with very different socio-institutional approaches. Strengthening the ongoing partnerships within and between our respective US and EU teams provided us with a unique window of opportunity in which to examine these challenges.

In reflecting upon the socioeconomic context of the Upper Bann, our group agreed that farmers' actions were strongly shaped by both increases in fertilizer prices and EU policy changes (e.g., the Nitrates Directive). Here, there was a sense that stronger regulatory action was being taken in response to decades of deteriorating water quality. Moreover, despite the social and political influence of farmer organizations in Northern Ireland, our group agreed that EU policymakers had more flexibility in designing policy solutions as compared to their American contemporaries. At the same time, we remained concerned that there was inadequate support, training, and incentives being provided to farmers (due in part to budget cuts, among other factors). When farmers did act, water quality could still be compromised due to scientific knowledge gaps (e.g., in relation to soil types or weather changes) and misaligned

regulatory controls. To the latter point, the European scientists in our group shared the concern of American scientists' with "one size fits all" and "blanket target" regulatory policies that disregarded local soil and landscape diversity.

Moreover, in addition to the agri-environmental challenges that Northern Ireland is already facing, our group noted that the situation could well be further compromised by policies that continue to intensify agricultural production. Indeed, Northern Ireland's Water Framework directive might struggle to maintain water quality given the large numbers of livestock on the land, the low carrying capacity of many of the soils, and the lack of an economic incentive to build large manure processing facilities that are required to address the phosphorus surplus that exists in many catchments. Moreover, there are high temporal and spatial risks with slurry spreading, as there are huge difficulties in finding times when farmers can spread slurry sustainably. The poultry sector in Northern Ireland has nonetheless continued to expand, increasing competition for (and intensification on) what little land is still available. Optimism was nonetheless shown as the neighboring Republic of Ireland was shifting toward a more inclusive, multi-stakeholder approach to water quality challenges.

Our group also agreed that Irish scientists faced similar constraints as compared to American scientists, namely, a considerable difficulty in impacting policy discussions and short-term funding cycles that led to reductionist/one-dimensional methodological approaches.

4.3. "Optimizing" on land use: Using Functional Land Management to address socio-technical knowledge gaps and political-economic imperatives

At the workshop, we discussed how FLM land and soil function optimization could be used to identify key drivers (e.g., land use, policy, and economic indicators) that could help Chesapeake Bay and Upper Bann farmers better manage nutrients and reduce agricultural runoff. In theory, this would enable us to: (A) build the base water quality and land use data sets for our FLM scenarios; (B) identify the US (federal and state), Northern Ireland and EU policies that can facilitate farm to watershed scale water quality improvements; (C) generate FLM land use scenarios and assess how watersheds in the Chesapeake Bay and the Upper Bann respond to alternate water quality policies; and (D) initiate the development of a new framework from which to critically evaluate and compare watershed decision-making.

Workshop participants who were new to the concept sought to learn how FLM could be adapted, applied, and scaled to different political and geographic contexts, while also helping to identify knowledge gaps and the need for additional expertise. Accordingly, during the workshop, we reviewed US, UK and EU policies impacting key soil functions, discussed modeling approaches that could be used to evaluate policy effects on water quality outcomes and inform decision-making, and set goals for next steps, project publications, grant development, and public outreach.

During our preparatory meetings in advance of the workshop, members of our group were particularly interested in learning more about what was particularly new about the FLM approach, and how it might improve on existing farm conservation planning, various modeling techniques, best management practices, and stakeholder analysis tools that had already been in use for decades. The implication of these concerns was that good quantitative modeling of different environmental scenarios doesn't necessarily lead to social change. The upside of FLM is that it can help construct different types of scenarios which encompass the baseline, intensification of agricultural production, resource efficiency (Schulte et al., 2014), and water quality improvement potential of different agri-environmental practices by cropping/land use shifts. Additionally, FLM can be used to assess how watersheds respond (shifts in soil function, commodity kind and value) to water quality improvement policies. By quantifying nutrient export for each FLM scenario using the Soil & Water Assessment Tool (SWAT), further information can be obtained regarding how each nation's water policies differ, can offer improvement over the status quo, or could be adjusted to achieve water quality improvements.

An approach like FLM has a great deal of appeal in a political-economic environment in which farmers are asked to take voluntary action, policymakers' efforts have been limited and ineffectual, and scientists have struggled to make their voices heard. In a nutshell, beyond its utility in supporting policy design and land use planning, FLM provides farmers with accessible data on the possible consequences of different land use scenarios, thus enabling them to make their own decisions about which types of economic and/or ecosystem benefits they want to prioritize. While an FLM-oriented approach may not offer the type of regulatory enforcement that many stakeholders in the water quality debate might prefer, it does help to democratize scientific decision making and empower farmers who want to improve their environmental performance. Identifying and clarifying these values provided a useful context for the more technical goals that we set out to accomplish over the course of the workshop.

Throughout our collaborative process, we were keenly focused on what the incentive structure would be for farmers to use FLM. One of our many concerns, for example, was that EU agri-environment incentive schemes for farmers in Northern Ireland would end or be modified with Brexit. Potentially, FLM might be used to identify other win-win land use opportunities that might go unnoticed, for example, by helping to convert marginal landscapes to hemp or biofuel production. Our group also talked about the different ways in which to quantify the social dimension of water quality controversies by using network analysis to study decision-making processes among farmers.

During the workshop, FLM presenters also spoke extensively about how they incorporated farmer outreach into their projects. Here, they discussed their work in setting up lighthouse farms—"global outdoor laboratories" that showed local residents how alternative land uses could be both sustainable as well as profitable. While each lighthouse farm scored highly on one category of sustainability, none were perfect in every indicator, which further helped to illustrate the different range of options that landowners might consider. FLM presenters also showcased "FarmDESIGN," a bio-economic whole-farm modeling software that displays the

flows of resources (cash, labor, and food) between a farm enterprise, the farm household and the farm's direct local environment, allowing for identification of optimization scenarios in terms of economic and environmental performances (Ditzler et al., 2019). The presenters emphasized that while there's always a tradeoff between habitat protection and economic production, there was still lots of room to expand on both, and that the idea was to leave it to the stakeholders and the farmers to decide.

Among the most dynamic sessions at the workshop was a hypothetical map activity where the presenters issued the following challenge to group members: "How can we establish a financially productive 'healthy beef' farm that preserves biodiversity and minimizes greenhouse gas emissions?" Interestingly, the conversation shifted into a lively and engaged discussion about the policy incentive structure for EU member states, farmers, and rural communities. Actual environmental remediation, system options, and technical solutions were scarcely even mentioned. One of the presenters made a comment during the workshop that put all of these complexities, concerns, and hypotheticals into a much broader context:

> "Sometimes people want a very clear, defined answer… I'm hoping that people see that there are different ways. FLM offers a lot of possibilities… it's developed in-action… [and] we're adding more components to the toolbox [as we go along]."

4.4. "Optimizing" on humility: Acknowledging the limitations of Functional Land Management and participant observation

Despite the clear upsides to using quantitative modeling tools like FLM, group members maintained a sense of humility regarding the ability of these tools to resolve the complex social dimensions of agri-environmental problems. Some of the methodological limitations that our group identified were as follows: that scientists didn't always understand the limits of particular data sources, that lots of data on rural land management was private and thus unavailable, that mathematical models could oversimplify problems and overpromise on solutions, and that spatial data layers couldn't capture the nuances of complex agriculture fields or micro topography. Optimization methodologies also require computational power, so they may not always be a practical solution in underdeveloped regions. Moreover, people who don't rely on computational solutions can often solve the agri-environmental problems by contributing their own expertise and local knowledge.

Throughout the process, group members also noted a mixture of confidence and skepticism about the future of FLM and our collective ability to overcome agri-environmental challenges as a whole. FLM might have a more immediate impact on scientists and policymakers than farmers, and any type of change to agri-environmental policy faces numerous obstacles and hurdles. FLM is also emerging at a time when climate change poses an increasing threat to agricultural production, many high-use landscapes have already been severely degraded, the global demand for animal protein and ultra-processed foods is accelerating, and local policy environments face strong pressures to embrace sustainable intensification. Overall, however, participants came away from the workshop very impressed with the diverse set of practical applications that FLM could provide for farmers.

Lastly, it is important to acknowledge our group's concerns and skepticism toward the participant-observation work that informed this paper. Many members of our group expressed concerns about the narrative in the first draft of the paper, specifically, that it highlighted individual statements without providing sufficient context or speaking more broadly to the collective experience of the group. Indeed, what the lead author expected to be a short turn-around time from the workshop to submission for publication ended up being a far lengthier process of iterative revision, negotiation, and (re)submission, highlighting the steep learning curve that those conducting new interdisciplinary research projects must overcome.

Par for the course, all participant-observation researchers must confront the limitations of their ambitious project ideas, their potential lack of acceptance in the field, mistakes, ambiguities, missed opportunities, gaps in their data, and their status as outsiders (Lareau and Shultz, 2018). The solution to these problems, ironically, lies in being reflexive, honest, and transparent about them.

5. Four years on: Post-workshop deliverables

In the aftermath of the workshop, Author 2 presented on the importance of global perspectives in addressing water quality issues at Teagasc's Catchment Science 2019 in Wexford, Ireland; Author 2 and Author 5 published a paper that compared P management in the US, Ireland, UK, New Zealand, Norway, Finland, and Sweden (Author 2, et al.); and Author 2 is also working on a paper examining how elements of the EU's Nitrate's Directive might improve Chesapeake Bay water quality. Above all, however, we agreed that the most significant outcomes were the training of our graduate students from Penn State (Author 8) and Wageningen (Author 10). After the workshop, (Author 8) (Penn State) would go on to lead the US team's application of FLM principles in sub-watersheds of the Chesapeake Bay (Author 8 et al.). She also led this team's effort to expand the framework to Susquehanna River Basin, which examined scaling issues with the FLM framework (Author 8 et al.). Author 8 et al.'s third manuscript, in progress, explores the use target phosphorus management and riparian buffer installation in Northern Ireland.

Author 10, a Wageningen student, was hosted at Penn State by Author 7 in Spring 2019. Together, they applied a mixed-method approach, combining Social Network Analysis, signals analysis (i.e., analysis of information flow and their influences), and a qualitative content analysis of stakeholders' interviews to assess information flows around best management practices in dairy farming in central Pennsylvania. Their results reveal both governance opportunities and gaps, which they use to provide insights for better tailored policy interventions (Author 10 et al., in progress). Author 10 is now completing a PhD in collaboration with Teagasc (Ireland), Wageningen, and Penn State. One member of our group noted that

TABLE 1 Agri-environmental challenges in the Chesapeake Bay and Upper Bann: governance contexts, team perspectives, and post-workshop outcomes.

	Chesapeake Bay	Upper Bann
Governing bodies	United States (US) national laws (e.g., Clean Water Act) and policies (Chesapeake Bay Total Maximum Daily Load targets), and US state-level environmental legislation	European Union (EU) Directives (e.g., EU Water Framework Directive and EU Nitrates Directive), the EU Common Agricultural Policy, EU member state legislation
Team perspectives on key social and agri-environmental challenges	Farmer concern for yields; family farming traditions; access to quality information; implementation challenges; (dis)trust in science and mainstream institutions; dependence on voluntary action; lack of support staff; anti-regulatory culture; "one-size-fits-all" policies; concentrated animal feeding operations; ineffective science communication; consumer waste; dietary choices	Inadequate support, training, and incentives being provided to farmers; scientific knowledge gaps; misaligned regulatory controls; "one size fits all" policies; agricultural intensification policies; lack of economic incentive for manure storage; competitiveness in agriculture; ineffective science communication; short-term grant funding cycles; Brexit disruptions
Team perspectives on what's currently working	Conservation-oriented farmers; Extension and outreach	EU policymakers' flexibility in designing policy solutions; recent shifts toward a more inclusive, multi-stakeholder approach
Post-workshop: Using *optimization* to improve agri-environmental management	Adapting Functional Land Management (FLM) principles in sub-watersheds of Chesapeake Bay watershed; expanding the FLM framework to the Susquehanna River Basin and exploring its use at different levels of scale	Exploring the use of target phosphorus management and riparian buffer installation in Northern Ireland
Post-workshop: Using *reflexivity* to improve agri-environmental management	Using active listening skills when engaging with stakeholders; doing qualitative content analysis of stakeholders' interviews to assess information flows around best management practices in dairy farming in central Pennsylvania	Improving our understanding re: the impact of different governance contexts, which can help to expand the possible solution spaces for stakeholders

> "Author 10's scholarship has been a key outcome, along with the potential for future collaborations between our organizations. Such a tangible outcome as has happened with Author 10 hasn't happened previously… That's provided a formative experience for her. She also had direct engagement with farmers immediately after the workshop."

6. Discussion

FLM continues to serve as a useful tool for agri-environmental research and stakeholder engagement (O'Sullivan et al., 2022; Valujeva et al., 2023). It also provides a complementary framework for digital soil mapping (Smith, 2020), i.e., "the creation, and population of spatial soil information systems by the use of field and laboratory observational methods coupled with spatial and non-spatial soil inference systems (Lagacherie and McBratney, 2006)." Active training and use of these tools is of increasing importance, as they take advantage of recent advances in machine learning, satellite imagery, precision agriculture, and other adjacent fields to improve analytical accuracy (see Smith, 2020; Kaya et al., 2022; Keshavarzi et al., 2022). Technical skills alone, however, are not enough to address global socioeconomic and environmental challenges.

Throughout our own investigation of FLM as a potential solution to soil and water quality issues, we came to appreciate that in order to better understand complex agri-environmental problems, we also needed to better understand ourselves—our own disciplinary, cultural, and ethical standpoints. In speaking to the socioeconomic blindspots of our respective scientific fields, for example, group members commented that their respective discipline was too focused on production as opposed to environmental consequences, that scientists didn't have an adequate understanding of socioeconomic challenges (and thus had difficulty making their work relevant to policy), that there was not enough focus on farmer adaptive capacity (financial, social, human, and physical capital), and that some scientists had an overall naivety about the complex motivational factors that guided citizens' choices. Rather than gloss over these complexities, we chose to embrace and actively confront them, and we found that our collective scholarship became more dynamic for having aspired to do so (see Table 1).

One of the key challenges of interdisciplinary research was brought into focus by the process of writing this paper. The lead author occupied something of a hybrid role, as he was a full Co-PI on the research team but also a "stranger (Simmel, 1950)" in that he was the only qualitative researcher on the project. Throughout the collaborative process, the lead author experienced a continual tug of war between his desire to be a "team player" and his need to keep a critical gaze from a healthy distance. Indeed, after reading the lead author's first draft of the paper, some of the natural scientists struggled with the terminology, and found it difficult to identify their own voices within the paper. However, ultimately it was acknowledged that this was a result of their lack of relevant experience. The co-authorship process helped us to close this gap, make clarifications, and work in unison toward achieving true synergy.

While many FLM workshops include growers, policymakers, and other stakeholders, all the attendees at our 2018 workshop were academics, and this allowed us to speak more freely and openly. To be sure, for researchers to be transparent about what occurs during these types of "backstage" moments can be intimidating. One of us noted that they felt so close to their research that it was hard to step back and communicate at an appropriate level of definition and engagement. The second author of the paper noted post-workshop that

> "A manuscript such as this one is a type of mirror for a scientist. The image is not of the individual in this case but the collective thought process. While it is comforting to find similarities in thinking, and not surprising that there are also contrasting opinions, it is discomforting that we as scientists feel severely limited in affecting change."

The post-workshop process of writing, revising, and (re)submitting this manuscript admittedly took much longer than anticipated, and this did result in opportunity costs vis a vis our respective disciplinary work. Nonetheless, waiting several years until we completed the manuscript also provided us with additional opportunities to reflect on what had been accomplished, not just in terms of the scholarship and graduate student training, but our own personal and professional growth. One co-author commented that he didn't understand the purpose of the paper at first, but he later appreciated the value of doing the reflection. Another co-author noted that doing the workshop had helped her feel more comfortable doing outreach. Now, she explained, she felt more engaged when listening to local stakeholders rather than "going there and explaining."

While we agreed that the workshop had been a positive experience, we also wanted to be careful not to oversell it. Here, one of the co-authors noted that we were all predisposed to do interdisciplinary work on day 1, we self-selected into the group, one workshop alone doesn't shatter paradigms and change the world overnight, and we still face institutional barriers and challenges. She further wondered if the workshop had effectively served to validate our thinking, while also fulfilling funding agencies' expectations for interdisciplinarity and broader impacts work. In response, another co-author noted that the workshop wasn't a randomized clinical trial, and we weren't making the argument that the post-workshop outcomes couldn't possibly have happened without doing the workshop. We later came to an agreement that while the concept of hosting a workshop was not new, what was different about our approach was that we were talking about the research process itself: what went on behind the scenes, the failures, and the mundane practice of doing science, so that we could all do better.

7. Conclusion

Reflexive approaches to research facilitate creativity, innovation, and ethical practice by encouraging us to critique and analyze our assumptions, our methodologies, and the socio-historical context of our research. With more and more research and development programs being developed as multi-agent, project-based cooperative efforts, involving a variety of actors across disciplines and professions, soft skills in flexibility, adaptation, empathy, attentiveness, and humility are indispensable. Best practices in participant-observation research can thus help to improve communication and provide improved clarity on transdisciplinary research goals and objectives. By the same token, when top-down agri-environmental governance appears to be ineffectual and/or unlikely, toolkits that empower scientist-stakeholder collaboration may provide an alternative path forward. Education and training programs can play a crucial role in enhancing these capacities and formally recognizing them as professional competencies as opposed to personality traits.

In being reflexive, we sought to "optimize" on the methodological, ethical, social, and environmental possibilities of our scholarship. We found that our reflexive work on this project furthered our interest in FLM, a tool that embraced complexity and creativity over rigidity and oversimplification—the very same principles that guided our reflexive work. We have moreover argued in this paper that researchers can benefit from embracing, exploring, and acknowledging their fears. In doing so, we can model for others a new and exciting path for international and interdisciplinary agri-environmental scholarship.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

RoC: conceptualization, methodology, investigation, writing—original draft, review, editing, project administration, and funding acquisition. PD, RaC, DD, HP, and TV: conceptualization, methodology, writing—original draft, review, editing, visualization, supervision, project administration, and funding acquisition. LO'S and RS: conceptualization, methodology, resources, writing—original draft, review, editing, visualization, supervision, project administration, and funding acquisition. CG: conceptualization, methodology, investigation, writing—original draft, review, editing, visualization, supervision, project administration, and funding acquisition. FJ and ED: writing—original draft, review, editing, and visualization. AA: writing—original draft, review, and editing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Building agroecological traction: Engaging discourse, the imaginary, and critical praxis for food system transformation

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Shifting the current food system toward a more sustainable and equitable model requires an alternative imaginary. Agroecology represents such an approach, but despite the construct's promise, policy and academic communities alike continue to maintain the current system. We contend that shifting away from the existing, dominant food system requires researchers to engage stakeholders with discourses that give meaning to an agroecological imaginary. We provide a methodological case study for how interested analysts may build agroecological traction through critical praxis. We advance our argument theoretically, methodologically, and empirically. Theoretically, we draw on scholarship arguing that food system transformation requires a discursive imaginary. Methodologically, we outline how Critical Discourse Analysis (CDA) as both a theoretical and methodological framework, illuminates the discursive power that shapes the future of food. We first used CDA to analyze United States Agency for International Development (USAID) policy, and subsequently presented those results to focus groups comprised of USAID-funded university-based research-practitioners. Empirically, we suggest that our methodology represents one possible mechanism or strategy to encourage the dialogue necessary to secure a new critical food system praxis. We conclude by offering recommendations for future inquiry.

KEYWORDS

agroecology, critical discourse analysis, critical praxis, social imaginary, policy

Introduction

For decades, the global food system has favored an industrialized monocropping system reliant on genetically modified seeds and synthetic fertilizers and pesticides (McMichael, 2009; Fairbairn, 2010). This approach led to widespread acclaim for its ability to increase crop production rapidly (Borlaug, 2002). Proponents of this system tend to prioritize yields and efficiency as primary goals, given anticipated population growth (Holt-Giménez et al., 2012). However, some have argued against the feasibility of this framework given its rising ecological costs (Franzluebbers et al., 2020). More, the current approach has yet to eliminate food insecurity and malnutrition, not because of insufficient quantities of food, but because the distribution of, and access to, those products are inequitable (Holt-Giménez et al., 2012; FAO et al., 2022). The 2022 State of Food Security and Nutrition in the World report found that progress on mitigating and eliminating food insecurity has stagnated across the globe in recent years (FAO et al., 2022).

To this end, The Food and Agriculture Organization of the United Nations (FAO) and other international organizations responsible for that effort encouraged governments to shift their support and policies for food and agriculture toward sustainability and equity.

One sustainable and equitable alternative vision for food and agriculture is agroecology—a collection of sciences, a set of ecological and community development practices, and a social movement for food system transformation (Wezel et al., 2009, 2020). Research addressing agroecology has indicated it can restore degraded environments, help regions mitigate and adapt to climate change, improve nutrition and food security, and honor important cultural traditions obscured by the current agricultural system (Leippert et al., 2020; Anderson et al., 2021; Bezner Kerr et al., 2022). However, the scientific and policy communities alike have so far failed to prioritize agroecology or to accord it legitimacy (Montenegro de Wit and Iles, 2016; Pavageau et al., 2020). One explanation scholars have offered for this situation is that powerful actors across public and private entities, including educational institutions, are seeking to maintain their control of the current food system (Montenegro de Wit and Iles, 2016; Constance, 2018; Pavageau et al., 2020). For example, some sustainable agriculture scholars have criticized land grant universities (LGUs) for their role in helping to build and maintain the current approach (Buttel, 2005; Montenegro de Wit and Iles, 2016).

Powerful actors often employ discourse control to perpetuate the current food system praxis. This is so because public discourse plays a vital role in shaping the possibilities for global food system change (Constance, 2018). We argue that to affect material change in the existing food framework, citizens must "see" and "think" differently from the current system's underlying assumptions. That is, the existing dominant discourse mediates the degree to which agricultural policy and praxis prioritize agroecology (Anderson et al., 2021). We contend that an agroecological food system is unlikely to be realized without a major shift in thinking among governmental, private, and educational organization leaders. To view agroecology as a legitimate possibility, our gaze needs to move toward different discourses that might enable that possibility.

With this process in mind, we offer a methodological case study that suggests how researchers can support the positioning of agroecology as realistic and valuable through *critical praxis*. Theoretically, our work builds on the idea that descriptions of food systems may variably influence possibilities for shifts in them, including toward agroecology (Anderson et al., 2021). That is, we view discourse as critical to changing the dominant food system imaginary. Second, as the current system reflects patterns of inequality, we view a critical lens to examine food system power as necessary. We identify discourse as one mechanism of power (Foucault, 1980). Given the importance of discourse as a significant agent influencing agroecological opportunities, we contend that Critical Discourse Analysis (CDA) can serve as a form of critical praxis. This article begins with a review of the literature that highlights the fact that the food system is discursive in character. Thereafter, we describe how CDA as an integrated theory and methodology can assist researchers in illuminating powerful features that influence discourse concerning the food system. We then describe how we employed this form of analysis as a form of critical praxis to raise awareness among focus group participants concerning how their work is embedded in a larger ecosystem of power. We conclude with recommendations for future inquiry to expand on this work as well as a discussion of this study's limitations.

Food system imaginaries and the role of discourse

Discourse and the social imaginary

Discourse is comprised of a system of interacting statements that influence our understanding of the social world (Foucault, 1972). The language, symbols, and ideas embedded within discourse contribute to meaning making as these discursive artifacts conjure mental images of people, events, and objects in individuals (Hall, 2004). Discourse can also be a vernacular, disciplinary, or otherwise, to allow people to share common understandings (Hall, 2001). In this sense, discourse reflects relations of power that influence how individuals and collectives view reality (Lather, 1991). For example, within the field of international development, a prevailing discourse in the Global North frames the Global South as underdeveloped and in need of rescue (Escobar, 1984). By fostering an image of each group, one as developed and one as underdeveloped, a power dynamic is established among those involved in international development before they meet (Escobar, 1995). Similarly, Western scientific understanding has long been privileged as ideal leading to the erasure of non-scientific knowledge including experiential, spiritual, artisanal, and indigenous forms. Such an erasure means solutions and possibilities tend to reflect only one mode of knowledge (Santos, 2007). In this way, discourse controls the possibilities of alternatives in the world (Fairclough, 2003).

Since discourse can reveal what is known or believed, knowledge and power are intricately and inexorably linked (Foucault, 1980). Reflecting this constituting power, discourse reflects purpose and is therefore never neutral (Hall, 1992; Maclure, 2003). Given its role in promoting specific beliefs, discourse is related to ideology, or put differently, a mental model for organizing the social world in terms of certain values and interests (Hall, 1986; Fairclough, 1992). Ideology in turn can influence behavior as it shapes perceptions of reality and the future. Thus, like discourse, ideology can replicate relations of power (Hall, 1986). For example, neoliberal ideology has driven the U.S. government's domestic and foreign policy since the 1980s. Tenets of neoliberalism include smaller government, fewer social services, and a focus on market supremacy, efficiency, and productivity (Harvey, 2007). Within the global food system, neoliberalism and globalization together have led to increasing productivity toward global exports, freedom for transnational companies to dominate production, and free trade agreements that disrupt national markets (McMichael, 2005).

Both discourse and ideology are epistemological in character. The imaginary is a form of knowledge about the world that is socially manifested (Stephenson, 2011). Imaginaries can be changed, but as they often go unnoticed, they must first be brought to consciousness. Once this process has begun, if individuals are to move toward an alternative, they must actively reconsider existing values and norms (Stephenson, 2011). Deliberation is thus vital for changing the possibilities of our world, but too often such reflection focuses only on "what should be" and not "what should we do" (Levine, 2022, p. 50). We argue research can support such epistemic deliberation toward critical praxis, and we offer one approach to engage people within the

prevailing discourse and social imaginary. The next section outlines the current food system and the dominant discourse concerning it. Next, we propose agroecology as a possible answer to the "what should be" query of what might replace a production-dominated food system. We then illustrate how CDA can contribute to deliberations concerning "what should we do" and more importantly, how such a prospect might occur through research that supports critical praxis.

Agroecology and discourse

This section elaborates on agroecology as a science, practice, and social movement. As a collection of academic and scientific knowledge, agroecology incorporates agronomy to restore soil health, sustainable agriculture to reduce pesticide and synthetic fertilizer use, and environmental and ecological science to leverage natural processes and foster increased climate resilience (Wezel et al., 2009; Altieri et al., 2015; Gliessman, 2016). Agroecological practices include ecological and community development practices. Ecological processes include integrated pest management, composting, and crop diversification, among other locally-specific-initiatives (Food and Agriculture Organization, 2019; Barrios et al., 2020). As a practice of community development, scientists, policymakers, and community residents, including farmers, come together in the agroecological approach to co-produce solutions that incorporate various knowledge systems such as place-based information, experiential, artisanal, and indigenous among others (Altieri and Toledo, 2011; Martínez-Torres and Rosset, 2014; Coolsaet, 2016). Such knowledge co-production can contribute toward epistemic justice because this practice affords similar standing to these ways of knowing as that accorded scientific knowledge (Santos, 2007; Coolsaet, 2016). Moreover, such collaborative and generative methodologies are required to co-produce solutions to help actors imagine possibilities that address the complex issues embedded in securing change in the current food system (Bendfeldt et al., 2021). Finally, as a social movement, agroecology reveals how the food system can be changed to reduce climate change impacts, improve health and nutrition, restore environments, encourage democratic decision-making, and include disparate values, cultural practices, and knowledge systems, while also increasing production yields (Wezel et al., 2009).

Such epistemic inclusion is unusual in the dominant food system because science has dominated agricultural knowing (Pimbert, 2018). As we established above, what we know and how we know it are intertwined with power and discourse. Recently, scholars have also defined agroecology as a discourse. In their 2021 book, Anderson and collaborators offered a typology of seven agricultural frames that support or challenge an agroecological approach. The most supportive conception is food sovereignty, a liberation and rights-based framework challenging the current food regime's inequality, its discourse, and its underpinning neoliberal ideology (Patel, 2009; Wittman, 2010). Agroecology and food sovereignty are complementary movements, and agroecology is a primary approach to achieving food sovereignty (Altieri and Toledo, 2011; Altieri and Nicholls, 2017). Participation is the second enabling frame, reflecting the importance of participatory governance approaches to ensuring that citizen needs and views guide agricultural development and implementation (Anderson et al., 2021). The third supporting construct, cultural resonance, reflects the fact that agroecology is culturally and locally specific, including deriving solutions from science and various knowledge systems, including farmer experiential knowledge (Foran and Escobar, 1996; Coolsaet, 2016; Pimbert, 2017; Anderson et al., 2021). The fourth frame, holism, reveals that agroecology requires a food system approach (Anderson et al., 2021). Holism acts as a mediating frame and involves attention to how the food system affects numerous sectors within society, not just agriculture (IPES-Food and ETC Group, 2021).

The fifth conception, livelihoods, suggests that life is more than economics and includes other social and cultural values, including views of justice, which are necessary to combat existing food system inequalities (Holt-Giménez et al., 2012; Anderson et al., 2021). Yet livelihoods can often be defined as economic alone, thus limiting agroecology (Anderson et al., 2021). The sixth construct, ecological modernization, sensitizes observers to the fact that while an environmental agenda is central to the agroecological approach, when that element alone is advanced in isolation or promoted by focusing on technical innovations for environmental management, agroecological transformation is likely to be stymied (Anderson et al., 2021). More, when ecological modernization is prioritized, powerful actors can co-opt the agroecological agenda (Alonso-Fradejas et al., 2020). The final frame, "feed the world," tends to align with the current food regime. Tenets include increasing production yields, food distribution through free trade mechanisms, and a view of food as an economic commodity, rather than a human right (Fairbairn, 2010; Anderson et al., 2021). Those adopting this conception are unlikely to seek meaningful change to address the inequalities created by the current food system (Holt-Giménez et al., 2012). We turn next to a discussion of how Critical Discourse Analysis can be used as a form of critical praxis to elucidate the discursive power mediating agroecology's meanings and possibilities for adoption.

Engaging critical discourse analysis as critical praxis

Critical Discourse Analysis (CDA) is a theory and methodology that affords scholars a mechanism to illustrate the power relationship among individual texts and larger sociological phenomena. The approach illustrates how individual texts, or "discursive events" influence, reflect, reproduce, and challenge larger social phenomena in the social and material world (Fairclough, 1992, 2003). To attend to the multi-scalar power of discourse, CDA theory employs three interactional levels, textual, discursive, and social practice. The textual level examines word choice, syntax, and verb choice in texts. By examining these characteristics, scholars can identify how a discourse conveys value and importance in descriptions of actors, events, and ideas in both instructive and normative ways (Fairclough, 2003). Such descriptions may include positive or negative attributes known as evaluation. Evaluation can aid the researcher in discovering whose interests a discourse upholds and the way it reproduces power relations (Fairclough, 2003). An analysis of verb tenses, known as modality, helps analysts assess expectations for behavior and reality. Epistemic modality communicates assertions about the current reality and the future, such as what will happen, what could happen, and what may happen. Deontic modality, meanwhile, communicates behavior expectations, such as one must, should, and could (Fairclough, 2003).

The second level of CDA is known as discursive practice. It allows researchers to identify how texts reproduce discourse, and in turn, what ideologies underpin the logics they contain (Fairclough, 1992). For example, in our case study, we investigated how a policy text drew on agroecology precepts to identify the feasibility of pursuing that approach within that policy framework. The third level of CDA, social practice, describes how discourse and the everyday praxis of those who consume discourse, maintain, modify, or contest existing power arrangements (Fairclough, 1992).

Scholars have used CDA to examine how policy, educational, and food system texts perpetuate or challenge structures of power. For example, Fairclough's (1993) work revealed how university job postings can reproduce neoliberal ideology, thereby guiding university praxis around specific values. Ayers (2005) reported similar findings in their examination of a community college mission statement as learners became repositioned as future employees. In his analysis of an apology speech by the Australian prime minister, Luke (1995) revealed how such governmental addresses can in fact perpetuate the injustice for which they sought to make amends. In their look at the discourse of partnerships within policy texts, Vavrus and Seghers (2010) analyzed how the construction of partnership represented ideological tenets and discovered how those replicated values excluded the voices of the poor for whom the policy was intended. In their analysis of British food and farming policy since Brexit, Maughan et al. (2020) revealed how despite Brexit representing a period of change and possibility, the 20 policy texts they analyzed failed to seize food justice possibilities, including undertaking participatory policy work with food system actors.

Research as critical praxis

Critical praxis emerged from Paolo Freire's work to illustrate how education can be a form of emancipation for oppressed individuals. The concept includes a process of conscientization during which dialogic pedagogy supports oppressed individuals to reflect on their identities, and the larger sociocultural, political, and economic context, to identify how they might pursue action in pursuit of social change. Freire advocated for a dialogic process aimed at uprooting systemic oppression by engaging in sympathetic inquiry with the experiences and knowledge of those traditionally oppressed. Failure to do so, he charged, fertilizes existing structures (Freire, 2005). Thus, to Freire (2005), research was akin to education when it employs similar dialogic aims toward emancipatory ends. Methodologically, this tends toward dialogic techniques such as focus groups and structured, unstructured, or semi-structured interviews (Whitehead, 2007).

At times, for researchers committed to critical praxis, this includes investigating the system within which they are employed (Kincheloe et al., 2018). Some critical scholars also consider such pursuit of change to be an ethical responsibility (Lather, 1991; Kincheloe et al., 2018). We are not the first to engage CDA as a form of critical praxis. Pimbert (2018) has applied critical inquiry to focus on university praxis in the field of food systems. Pedagogically, Weiner (2003) used CDA to examine various texts and the power relationships they may reveal. In so doing, in one example, students articulated identity representations, investigated how discourse reproduced norms, and grappled with the imbrication of discourse and power. In another instance, researchers employed CDA to examine their teaching praxis to avoid reproducing inequities (Paugha and Robinson, 2011). Our case study focused on university praxis as it relates to agroecology. We sought thereby to contribute to conscientization among USAID-funded actors about the agroecological imaginary, how its possibilities may be bounded by policy, and how participant praxis unfolds in concert with policy and discourse.

Methodology

Using CDA, we examined nine texts related to the United States Agency for International Development's (USAID) policy framework, "The Journey to Self-Reliance" (J2SR) from 2018–2020 or what is known as a synchronic corpus (Baker, 2010; Mautner, 2016). These texts comprised the entity's complete policy, its private sector engagement executive summary, a blog post treating those two documents, two requests for applications (RFAs) for projects arising from the policy and administered by land grant universities with whose principals we conducted focus groups, and four fact sheets on local government partnerships, self-reliance project design, learning for self-reliance, and strategic transitions post self-reliance. We investigated USAID and the J2SR policy because agroecology can contribute to agrarian self-reliance (Altieri et al., 2012; Anderson et al., 2021). Yet, conceptions of self-reliance vary and may represent ideological currents (Duffield, 2007; Hébert and Mincyte, 2014; Galtung, 2019). Thus, we sought to determine how USAID represented self-reliance and agroecology in the discourse it offered. We sampled across the agency's program lifecycle from project design, policy guidance, marketing materials, project solicitation, and evaluation. We also included a document on what happens in the institution's view, when its efforts successfully help an aid recipient achieve self-reliance. We included a range of genres, or types of texts, in our analysis including a full-length policy, an executive summary, a blog post, fact sheets, a frequently asked questions sheet, and requests for applications for projects to which only U.S. universities could apply. We found all texts on USAID's J2SR website, except for the two Requests for Applications (RFA), which we found *via* a Google search as the agency had archived them.

We analyzed USAID's policy texts for their choice of vocabulary, verb usage (modality), positive and negative attributes (evaluation), and how each described various actors (representation) (Fairclough, 2003). We also examined how the corpus challenged or supported various frames of agroecological discourse (Anderson et al., 2021). Our investigation of textual elements enabled us to identify ideologies and relations of power USAID reproduced in its texts. We presented our CDA findings to focus groups of land grant university actors working on USAID-funded international development initiatives to elicit not only their responses to specific issues but also, and more importantly, to solicit their reflections regarding their praxis in light of what they had learned. As we have noted, discursively embedded power structures are typically invisible, which is why discourse analysis and other methods of critical praxis are important. By sharing the CDA findings, we sought to raise awareness among these university actors of their role in maintaining, challenging, reproducing, or modifying the social relations of power underpinning possibilities for the agroecological imaginary.

We identified our population using specific criteria. The first was land grant universities to which USAID had awarded an Innovation Lab between the years of 2018–2020. Of those institutions, we identified those with a sufficiently broad focus to engage feasibly

with the imaginary of agroecology, excluding those concentrated on one agricultural crop or commodity. Ultimately, we selected two LGU Innovation Labs awarded during our stipulated time frame. To establish our population, we included all faculty engaged with two Innovation Labs. We then recruited participants from each university via purposive sampling (Patton, 2014). Due to the COVID-19 pandemic, we conducted our focus groups via Zoom. We employed a mix of semi-structured and open-ended questions to encourage conversation among participants (Longhurst, 2003). Our four focus groups included 14 participants, nine of whom identified as economists. We began each session by asking participants to describe their relative familiarity with the USAID policy texts we had analyzed. Thereafter, we presented our findings from our CDA of those texts. After the presentation, we asked participants to respond directly to those findings and to reflect on their praxis as they did so.

We anonymized all members with pseudonyms. Using Atlas.ti Windows (Version 9.1.7.0), we analyzed our focus group conversation transcripts using inductive and in vivo coding to identify themes (Saldaña, 2013; ATLAS.ti Scientific Software Development GmbH [Atlas.ti 21 Windows] ATLAS.ti, 2021). As patterns emerged, we developed memos explaining those, and once patterns persisted, we created codes. We then returned to the beginning of the transcripts to analyze the data again according to the identified codes. We repeated this process until saturation, that is, when we could not identify any new codes (Saldaña, 2013).

Findings

This section presents findings from the CDA we undertook of USAID policy documents and the focus groups we conducted as part of a larger study. For this article, we highlight the specific CDA findings related to the J2SR corpus. That analysis illustrates two themes. The first theme demonstrated the dominance of the neoliberal imaginary in the USAID framework. The second suggested that USAID's use of participatory rhetoric in its policy was shaped profoundly by those same neoliberal assumptions. Following a brief discussion of these twin themes, we share findings from the two focus groups we conducted that suggested it may be possible to use the results of CDA to promote the cognitive openness and dialogical conditions for a new critical praxis to emerge. We do not claim to have achieved that praxis or to have transformed the perspectives of our focus group participants in such terms; instead, our aim here is to highlight how our findings suggest that engagement with CDA may serve as one path on which other praxis-oriented scholars may build to promote such possibilities among policymakers and implementers. We have organized our focus group findings to capture participants' levels of agroecology awareness. We have also sought to illustrate how our contributors reflected on, and at times resisted, the agroecological imaginary. Finally, we share their reflections on how they could imagine incorporating agroecology into their praxis.

Self-reliance and agroecological possibilities

We found that USAID policy reflected broad acceptance of the prevailing neoliberal imaginary that presumes a need to move away from aid as a form of social support. For example, the USAID Policy Framework we analyzed, aptly entitled "Ending the Need for Foreign Assistance," posits that, "everyone, everywhere aspires to be independent - to be self-reliant" (p. 5). This quotation exemplifies the use of high epistemic modality in CDA terms, which occurs when a text leaves little room for an alternative imaginary. Put simply, the assertion is that everyone does and should aspire to a state of self-reliance as conceptualized by USAID.

The USAID policy we investigated firmly embraced and evoked market-based approaches and private sector leadership as drivers of a development as self-reliance agenda. For example, USAID's framework argues, "there is no area of USAID's work in which the private sector does not play an essential role" (p. 40), and the executive summary of the agency's private sector engagement strategy indicates that, "this policy signals an intentional shift to pursue market-based approaches… can the private sector solve this problem by itself?" (p. 2). USAID's policy repeatedly embraces a market-based approach suggesting, "a key component of building self-reliance is enterprise-driven economic transformation…in some countries, this transformation begins on farms, driven by the spread of tools and technologies that increase agricultural productivity" (Policy Framework, p. 28). As mentioned above, the feed the world productivity-oriented discourse evidenced in this quotation innately inhibits attention to other ways of addressing the challenge in play. That is, when discourse elevates the market sector to a singularly privileged status in political-economic terms, that choice profoundly limits consideration of other possible modes of organizing and knowing. Indeed, that perspective limits livelihoods to a constricted view of economics, which can lead to blindness to other values and valuation strategies that might be employed to understand these basic systems-scale dynamics. In this way, the imaginary now dominant in USAID policy actively hinders consideration of agroecological possibilities.

The second prevailing theme in the USAID policy framework is the agency's commitment to local leadership, but that leadership is narrowly defined as arising from, and contributing to, market enterprise growth. The policy also emphasizes in-country resourcing, which echoes USAID's definition of independence as a sort of autarkic self-reliance. For example, the agency's project design fact sheet indicates, "The J2SR lens also gives a heightened emphasis to in-country resourcing, with enterprise-driven growth as a key driver. Finally, it places local systems at the heart of achieving sustainable, resilient results" (p. 1). Within the Agency's self-reliance learning fact sheet, the policy's architects ask, "how can local, sub-national, national, and regional voices, priorities, and contributions be integrated into how USAID fosters self-reliance?" (p. 4). The question remains ethereally rhetorical as the possibilities for engagement its arbitrators are prepared to consider are sharply circumscribed by the Agency's devotion to a narrow economistic conception of self-reliance. We turn next to a discussion of our focus group findings.

Awareness building

Agroecology, as defined by Anderson et al. (2021) was new to most of our focus participants. For example, Maya indicated that she had not previously considered an agroecological approach and therefore, "this presentation has opened my eyes to the possibility of

applying J2SR from the [agroecological] perspective." Speaking specifically to the food sovereignty frame, Juliet indicated that "I guess their (Anderson et al., 2021) definition of food sovereignty is way broader than what we are used to" revealing that for her agroecology, and the supporting concept of food sovereignty, represented new information. Elliot also indicated that his discipline of agricultural economics has guided his impression of agroecology "as economists, we have a certain framework that we are working with, and certain terminology that we are accustomed to using…So agroecology, for me, would not have suggested that it is a label for a much broader approach."

In a separate focus group, Mary indicated surprise that her work as an economist could be at odds with agroecological possibilities and that she would like to continue reflecting on the information revealed by the CDA:

> So, I did not have any prior thoughts about this topic, but you put some thoughts in my mind. And I am not so sure how to integrate them with my discipline as an economist because most of what I do has gone to the disabling column…I would not want to say, 'this is correct or not correct' at this point. But these are thoughts that I would like to continue reflecting on... Of agroecology, everything is in it, and in my discipline, we try to remove as much as possible and focus [specifically] on what we want to explore. So, the idea of the [food] system within agroecology is not my mainstream.

In the same focus group as Mary, Stephen echoed the need for continued learning before rendering a critique indicating an openness to engage with the possibilities represented by agroecology, "I'm in the same situation as Mary, this is a new area for me…So, I'm not really in a position to give a critique but it is something new [and] I can read more over time." Finally, Timothy in another focus group, indicated his confusion and interest in agroecology "I've struggled with having a concrete idea of what agroecology is, I've read about it a couple of times, I've helped friends research it, but I still do not feel I have a clear understanding of what it is." For many in the focus groups, agroecology as a holistic agenda was relatively new as evidenced by their indication of curiosity and surprise at how agroecology encompassed more than they previously understood.

Reckoning and resistance

This section moves beyond awareness toward how some participants reckoned with, and at times resisted, the concepts central to the agroecological approach. Dwayne and Violet, who were in the same focus group, questioned how the agroecological frames continuum could position "food sovereignty" and "feed the world" as opposed constructs. Moreover, Violet suggested that she viewed food sovereignty as moving away from imports toward exports:

> I do not see [food sovereignty and feed the world as] exclusive from one another… so you can still be food sovereign and feed the world. To me, you can have food sovereignty and contribute to feeding the world. So, we see that with big countries like the U.S. where we grow so much of our food and we are also exporting…So to me when I am thinking about food sovereignty, it is often to step away from imports or to be less import-dependent. So, it seems that their definition is broader than that…

Dwayne expanded on Violet's comments by sharing his conception of food sovereignty from the vantage point of his discipline of economics:

> I had the same reaction as Violet to the [agroecology] frames continuum. I have always seen food sovereignty as a more economically informed concept, and as progress away from the idea of food self-sufficiency, where countries would simply produce the food, they need. That food sovereignty means they can make their own decisions about how to meet their food needs. And that explicitly could, and likely would include active trade, both importing and exporting. So again, I did not see those as being on opposite ends of the spectrum.

Similarly, Matthew expressed confusion concerning how livelihoods, when defined as only market-based activities, could undermine agroecological possibilities, "if you focus on livelihoods largely as income from market activities? How is that disabling to an agroecological approach?" Jeremy similarly grappled with the findings. He began by offering his disciplinary perspective: "I am an economist. So, some of this is probably disciplinary bias…. In addition to my training as an economist, I am also trained as a participatory community development practitioner." He continued by expanding on how shifting away from the primacy of private-led development is antithetical to a systems approach:

> Vilifying private sector initiatives as inherently disabling and seeing small-scale farming in the long run as inherently enabling, I think, is inconsistent with a kind of holistic systems approach to development… The goal of many small-scale farmers is for their kids not to be small-scale farmers. And the goal is to make enough of a living and to see the next generation do something more reliable, and less subject to weather and economic shocks. Not to continue in the same system that we have been in for a long time. And the role of the private sector isn't necessarily to make a large profit; it's properly designed products within the private sector that are locally appropriate, because those private sector companies are run by local interests, and have a long-term commitment to an area, can provide services and opportunities that publicly funded projects that need to maintain popular support and need to compete with other public interests for their budgets just probably can't do in the long run.

Jeremy suggested that not promoting a private sector first model may fail, and that worse, the ideas espoused within an agroecological framework are not, in practice, held by smallholder farmers. What his reflections reveal is that the capitalistic and neoliberal logics of mainstream agricultural development make the agroecological imaginary difficult for some researchers to fathom. Jeremy's comments at once revealed the hegemonic standing of the current way of thinking and the importance of critical praxis if that frame is to be changed.

In a different focus group, Matthew reflected, like Jeremy, on the importance of framing livelihoods in economic terms. He indicated that he believed that economic livelihoods are a precondition for survival within the current neoliberal food system:

> I have always thought about promoting livelihoods [and] market access [for] farmers as a precondition to their survival…That's why I asked you earlier about what is disabling about [livelihoods as economics]. It might be disabling of the La Via Campesina's [food sovereignty] agenda…unless you make land a non-marketable commodity, which I am not sure is a very smart thing. It is not that clear to me [that economic livelihoods] are disabling some of the values of a food system.

Matthew's comments illustrate a deeper level of awareness of the agroecology and food sovereignty movements not exhibited by other participants, apparently resulting from his exposure to La Via Campesina, the international food sovereignty organization. His disciplinary thinking led him, notwithstanding, to dismiss those parts of the food sovereignty agenda that conflicted with his existing understanding.

Reflections on incorporating agroecology

This section examines how several participants reflected on how they might incorporate agroecology into their work. It represents the critical praxis possibilities implicit in the mechanism by which to move individuals from a stance of "what should we do" toward "what can we do" (Levine, 2022). For her part, Juliet reflected on how she could incorporate agroecology into her work. This represented a shift for her from learning about a new imaginary toward reckoning with how that conception could fit within her praxis:

> So, I do not know how to explain [agroecology] in an easy way to the different people involved in it. It is broad and very complex. It includes so many different dimensions. So, how do you tackle all those dimensions at once with so many different stakeholders?

In another focus group, Jeremy questioned how he might discuss agroecology with farmers without imposing certain values:

> Say that I go to a village in Northern Ghana, I sit down with a group of farmers who are partially disconnected from the larger agricultural world.…and I ask myself, 'do they practice agroecology? And if not, why not? What keeps them from doing it? What is it about what they do that is different from what we call agroecology? And if it is different, then what do they need to practice agroecology?'

In response, the lead author explained that agroecology centers local decision-making, and so the introduction of agroecology to these farmers, if needed, would focus on those individuals themselves deciding whether they wanted to pursue that frame's aspirations. Jeremy then opined that introducing agroecology could be an imposition, "But we want to be sensitive to this idea of not wanting to impose, and so potentially Extension could get into the world of imposition." In response, the lead author suggested that since the 1960s and 1970s, Extension had prioritized Green Revolution technologies, and how this orientation had shaped the decisions farmers took and continue to take around how they farm. In response, Timothy offered, "…that might create a justification for some sort of positive intervention to try to spur it on. And so now we must do something to try to revive something that we think may have once been there." Timothy's thought exemplifies the reflective work in which he was engaged in understanding agroecology, why continuing research on its possibilities is necessary, and how he as an international development professional might engage with that frame while managing his positionality and power. His realization revealed a possible opening to a new way of thinking. In response to Timothy's reflections, Matthew observed that the USAID's policy framework's "focus on inclusivity opens the door to what I perceive are some of the values that underpin what you call an agroecological approach." Matthew's inference indicated he was actively considering the implications of the CDA results, what they meant for agroecology, and what steps might be necessary to encourage agroecology within his development praxis.

Building critical praxis momentum

This article has discussed the possibilities of using Critical Discourse Analysis as an approach to build toward the critical praxis necessary to transform the current food system. Theoretically, we built on the recent scholarship of Anderson et al. (2021) concerning how discourse supports or challenges an agroecological imaginary. As discussed above, praxis results from a process of awareness building, reflection, dialogue, and action. The praxis of food system transformation will require engagement with alternative imaginaries, which discourse helps shape.

We have outlined one possible approach to engaging university faculty concerning how the policy discourse adopted by their funders may influence agroecological possibilities generally and shape their professional praxis, more specifically. We found that presenting CDA of policy texts to actors funded by USAID projects at land grant universities could contribute to awareness building and reflection toward an alternate critical praxis. We have illustrated how encouraging a reading of prevailing discourse can encourage reflexivity and thereby open possibilities for active consideration of the complexity and possibilities of agroecology.

Our study participants considered agroecological vernacular and practices through their disciplinary lenses and engaged with that construct in various ways. We believe that those moments of deliberation served as moments of generative awareness for many of our respondents. We suggest they represent a first step in critical praxis and building consciousness of alternative onto-epistemological realities (Niewolny, 2021). The respondents who noted their disciplinary assumptions made engaging with agroecological content difficult highlight the fact that imaginaries are composed of a widely shared set of norms, values, and beliefs. Such awareness building may support the expansion of disciplinary imaginaries beyond existing ways of knowing (Stephenson, 2011).

We caution against overstating these results, given the limited time we spent with our focus group participants. Our focus group

members' comments concerning agroecology reflected neoliberal logic, but it was outside the scope of our study to engage with participants concerning the ideological underpinnings of their responses. For example, Violet and Dwayne both suggested food sovereignty involved exporting surpluses. Jeremy indicated that the private sector is per se benevolent and fulfills a need the government cannot. Matthew argued that the food sovereignty construct is naïve. Each of these observations revealed how neoliberal ideology was deeply rooted in participants' understanding of agriculture and agricultural development. We suggest, however, that ongoing dialogue with these scholar-practitioners concerning how their responses reflect specific norms could further critical praxis. We are also persuaded that encouraging participants to engage with agroecological norms and discourse can begin to prompt active reflection on alternate systemic possibilities. We are hopeful that such epistemic work can open space for deeper intellectual and policy engagement with agroecological ideas.

Limitations and recommendations for future research

This article has explored how engaging participants with Critical Discourse Analysis through dialogue may contribute toward epistemic consciousness and active rethinking by individuals. Moreover, we suggest such efforts can begin to kindle the critical praxis required for food system transformation. Our findings are limited by the size of our sample ($n = 14$ participants), and so we encourage others to replicate our methodology with other texts and populations to determine the effectiveness of this approach. Our inquiry was also limited by the fact that we engaged participants in a discussion for 90 min. Such efforts should ideally be situated as part of a longer process in the Freirean tradition of consciousness-raising through more reflective dialogue. This is to say that critical praxis is always a journey.

We therefore also invite others to build on this work by incorporating its methodology into longer-term engagement strategies, such as semester-long courses and workshops or through repeated focus groups with the same participants. One such vehicle could be to host pre-conference workshops. We suggest that an expansion of this analysis to additional U.S. universities funded by USAID would assist in understanding agroecological possibilities from more vantage points. Finally, we contend that this framework would benefit from the participation of those who wrote the policy texts analyzed, to determine how engagement with CDA might elicit active epistemic-scale reflection among those positioned to design and fund policy initiatives.

Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: Virginia Tech IRB Data Restrictions. Requests to access these datasets should be directed to Lia Kelinsky-Jones, lkelins1@jhu.edu.

Ethics statement

The studies involving human participants were reviewed and approved by Virginia Tech Institutional Review Board. The patients/participants provided their written informed consent to participate in this study.

Author contributions

LK-J undertook the study and developed the methodological conceptualization employed here as part of her doctoral dissertation. KN provided supervision. KN and MS provided theoretical and methodological framing, literature suggestions, reviews and edits to drafts, and contributed to writing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Food justice accompaniment research: theory and social praxis in West Virginia

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Over the past three decades West Virginians have experienced a deepening economic crisis. Divestment in coal and manufacturing has resulted in widespread unemployment, state, county and municipal revenue losses, and cascading effects on social services, households, livelihoods and community life. For 10 years, FJL has conducted ethnographic research, coordinated cooperative experiments, and built pedagogical tools to democratize knowledge about West Virginia's food system amidst this crisis. Working in a so-called red state, we have fostered conversations about food justice with rural, often socially conservative communities, and have worked to raise up human resources for meaningful community-led food justice organizing in Central Appalachia. In this paper, we consider the long accompaniment process with community partners and the effects of this experience on the evolution of research questions and actions.

KEYWORDS

food, justice, social movement, praxis, accompaniment

Foodlands

In July 2017, a group of people from Calhoun County West Virginia contacted the Food Justice Lab (FJL)[1] at West Virginia University. The Grantsville Foodland was the only grocery store in the county and rumors were circulating that it was about to close. Fears over the loss of

1 FJL is an action research laboratory founded by Bradley Wilson and co-created by graduate students Autumn Long, Derek Stemple, Chad Spade, Alyssa Sobey, Mary Beth Ryan, Thomson Gross, Amanda Marple, Heidi Gum, Joshua Lohnes, Jed DeBruin, Valerie Slone, Emily Tingler, Alanna Higgins, Grace Dever and Erica Stratton at West Virginia University. Over the past 10 years, we have recruited, trained and learned from our graduate students, over 40 undergraduate part-time employees and volunteers, and numerous collaborating faculty at WVU who have dedicated themselves to action research for food system change in Appalachia. In the last 2 years we established a university center within which FJL is now housed. FJL is driven by active partnerships with community-based and statewide anti-hunger and farm organizations in WV. We have been funded by a combination of university, foundation and federal grants. To date we have conducted state level action research on self-provisioning, charitable food networks, food retail distribution, federal nutrition programming, health disparities, small-scale farm viability, and community grocery (each resulting in reports serving organizations working on these issues). We have also launched a worker-owned coffee cooperative called Firsthand, incubated a cooperative regional food hub called Turnrow Appalachian Farm Collective, incubated a beginning farmer training center called Sprouting Farms, established a long-term food system and policy monitoring GIS called WV FOODLINK, a food activist training program called Nourishing Networks and coordinated a statewide right to food coalition called Food for All.

this food access point had been mounting for years. Fresh produce and meat deliveries were inconsistent and even shelves stocked with dry goods were often bare. Though the Foodland was difficult to rely on for a healthy diet, the closest alternative was over an hour's drive away. The consternation over the grocer's imminent bankruptcy were legitimate. Tina, the director of the Calhoun Family Resource Network,[2] explained that her county already had one of the highest food insecurity rates in the state, if not the nation. Unemployment hovered around 13 % and 4000 people, over half of the residents, lived at or below the federal poverty line. As a part of her job, Tina coordinated regular charitable food distributions and many of her neighbors relied on the free food her organization distributes to make ends meet. Realizing the limits of her actions, she felt powerless in the face of the grocery closure. "It is already hard enough to improve access to healthy food in Calhoun. What is it going to be like when we lose our only grocery store?" she asked.

Over the past three decades, West Virginians have experienced a deepening economic crisis. Divestment in coal and manufacturing has resulted in widespread unemployment, state, county and municipal revenue losses, and cascading effects on social services, households, livelihoods and community life. For 10 years, FJL has conducted ethnographic research, coordinated cooperative experiments, and built pedagogical tools to democratize knowledge about West Virginia's food system amidst this crisis. Working in a so-called red state, we have fostered conversations about food justice within rural and urban, often socially conservative, communities and have raised up human resources for community-led food justice organizing in Central Appalachia. This work, following in a tradition of accompaniment, has placed us shoulder to shoulder with people like Tina in Calhoun County and other anti-hunger and food system development advocates across the state. The food system challenges that West Virginia residents face, such as the closure of a grocery store in a small town, have become our challenges. Our scholarship cannot evade the inescapable relationality of the connections we have to an ever-growing network of people who are engaging in food system change.

In this paper, we consider the nature of food justice activist scholarship based on the long accompaniment process with community partners who become involved in this endeavor by intention or happenstance and who, through their engagement, transform the contours of our process of experimentation. We also consider key intentions, decisions, and methodological refinements that went into "doing" food justice in a place that is often framed as one of the epicenters of rural authoritarian populism (Scoones et al., 2018). We unpack our doings and learnings in West Virginia through action-reflection on our approach, methodologies, and outcomes. A few words on what we mean by action-reflection here is crucial. Our gaze is turned, not upon the doings of others, but rather on our own doings with others. This distinction is critical as our goal is not to theorize based upon what others think and do or should be doing but instead theorize from reflecting on the experience of what *we* have done. As Horton (1997) argues in relation to the goal of enacting a society based upon the principle of equality: "the principle itself is not complicated, it's the application that's complicated" (p. 7).

To analyze our own complicated actions as scholars working within the fraught histories of a land grant university (Goldstein et al., 2019), we draw on field-note observations, recorded conversations, workshop documents, surveys, and interviews. This archive of observation and documentation, running parallel to our commitment to food justice, is an essential element of our praxis as it represents the shared product of 10 years of accompaniment research and cooperative experiments. Referencing Myles Horton again, "you only learn from the experiences you learn from." (Moyers and Horton, 1982, p. 251). Combined, these serve as a lens through which we reflect on three interrelated cycles of learning about how to advance food justice in West Virginia that we hope may also serve those engaged in activist scholarship elsewhere. In these cycles, we learned from participatory research with a county-based anti-hunger organization, the co-creation of a state-wide online mapping resource to democratize knowledge about nutrition assistance programs and advance the right to food, the facilitation of a series of local food justice workshops that included some 320 participants, and deep engagement with an emergent coalition of farmers, social service workers, nutritionists, doctors, state administrators, elected officials, food pantry directors, and citizen advocates working to end hunger and improve agrarian livelihoods. We conclude by arguing for more writing about accompaniment in food justice research that challenges the activist/scholar dichotomy (Reynolds et al., 2018) and creates more opportunities for shared learning rooted in activist experience and oriented toward popular education pedagogies.

"Doing" food justice

The call for social praxis in building sustainable food systems demands responsiveness to the urgent need for a broad based social movement that can unite around uprooting the political, economic and discursive structures underpinning food system inequalities and cultivate new systems and institutions that learn from and build upon histories and traditions of collective action and community resilience as tangible responses to structural oppression (Sbicca, 2018; White, 2018; Alkon and Guthman, 2019; Reese, 2019). Such a call must include time horizons that are not distracted by mainstream framing of food system problems and the unconscious centering of white-led, middle class, hyper local interventions like ethical consumerism, community gardens, farmers markets, CSAs, and food cooperatives as "solutions" which often uphold the status quo of the existing social, political, and economic order (Guthman, 2011; Alkon, 2012; De Souza, 2019). While these interventions may remain tangible pathways for people to engage in some of the more glaring problems wrought by the colonial, imperial, industrial food system, many of the protagonists of these kinds of interventions have failed to recognize their role in perpetuating perverse race, gender, and class dynamics that reproduce long-standing inequities community activists seek to address. We ground our understanding of social praxis for transforming agriculture and food systems in the movement for food justice and sovereignty.

2 Family Resource Networks formed in West Virginia to mitigate the effects of the 1996 Welfare Reform Act (PRWORA). These county level institutions are funded on a limited basis by the West Virginia Department of Health and Human Resources (WVDHHR) to coordinate public-private responses to poverty in local communities across the state.

Central to the concern of food justice scholars and activists is the critical question of how we produce or enact radical food geographies (Reynolds et al., 2020), not just identify the need for them. For us, the language, practice, and collectivities formed around the concept of food justice (and its critique), as well as its roots in the environmental justice movement (Gottlieb and Fisher, 1996) continue to resonate as a means of talking about our place in a flow activism and action research that extends far into the past and will continue far beyond ourselves. The practice of "doing" food justice over the past decade has engendered extensive critical reflection. As food justice discourse is leveraged to frame projects funded by and within the non-profit corporate-industrial-charitable complex, including universities (Bradley and Herrera, 2016; Porter and Wechsler, 2018), there is legitimate concern that it has lost some of its salience as a radical organizing framework for dismantling structural inequalities around land, exchange and labor relations and the trauma and inequities these reproduce (Cadieux and Slocum, 2015). However, challenging the watering down of food justice, activist and scholars have returned their attention to the theoretical and practical roots of social justice organizing exploring the intersecting issues of labor rights (Sbicca, 2015), gender rights (Sachs and Patel-Campillo, 2014), reparations and the movement for Black lives (Pellow, 2016), prison reform (Nocella et al., 2016), migration and bordering (Carney, 2014), land rights (Daniel, 2013), farmworker rights (Minkoff-Zern, 2014), United States Farm Policy (Graddy-Lovelace, 2017), agro-ecology, biodiversity, and smallholders (Zimmerer et al., 2015), and the indigenous foodways displaced through settler colonialism (Mihesuah and Hoover, 2019). It is this return to the roots of food justice organizing that also inspires thinking about how to produce or enact radical food geographies. Working on different fronts in the movement toward food justice can offer new pathways to people-centered and community-led strategies to rewrite the rules of the food system, to right past wrongs, to create a future where benefits and burdens of producing, distributing and consuming food is distributed equitably, and to ensure that everyone can fully participate in the decisions informing how our food system should function and our communities flourish (Slocum and Cadieux, 2015).

Three pathways of food justice scholar-activism

Building on the question of how to "do" food justice as scholars en route to these futures, we have identified three pathways for social science researchers that are currently in practice. The first—*food justice critique* (Alkon and Agyeman, 2011; Guthman, 2011; Holt Giménez and Shattuck, 2011; Heynen et al., 2012; Graddy-Lovelace, 2017) challenges modes of comprehension, policy and action that create unjust food systems, undermine liberatory consciousness, and constrain emancipatory practice related to reclaiming our collective foodways. Critique, especially when informed by participation in collective action, is a fundamental labor in bringing about more just practices and in decolonizing individuals and institutions. The second pathway—*comparative food justice research* (Heynen, 2009; Watts, 2013; Chappell, 2018; White, 2018)—includes scholarship on people in history and or currently in movement—particularly marginalized communities of color—who articulate ideologies, strategies, and practices demanding food justice, sovereignties and cooperative economies within the context of systemic oppression. Such documentation, observation, interpretation, and theorization of collective action in the face of an oppressive food system serve as a gift of knowledge for uniting a community of practice through histories, case studies, and examples from which movements can learn. The third pathway—*food justice accompaniment research* (Bellows and Hamm, 2002; Pine and De Souza, 2013; Pettygrove and Ghose, 2016; Orozco et al., 2018)—is one in which social science scholars accompany marginalized communities and use forms of research practice—methods, resources, tools, and pedagogies—in a participatory process. In this work, researchers participate directly as protagonists in collective action, contribute to movement process, and hone research methods and pedagogies toward transforming the food system through more just institutions, some of which have yet to be born.

These three pathways are not divergent, but rather complementary. Indeed, many people who identify as food justice scholars do all of these things at various moments, in various sites, and with varying intensities. Scholars participating in the recent special issue in *Human Geography* (Hammelman et al., 2020) all engage in these practices; in fact, many of our most insightful food justice thought leaders blur the boundaries between these research and activist practice. Therefore, we do not wish to prioritize any one form of food justice scholarship and activism as it may hinder the production of knowledge, individually or collectively, with diminished returns to activist practice. We certainly do not, in any way, question activist commitments or priorities. However, we do argue that the scholarly practices demanded of the researcher on each pathway are distinct and therefore worthy of further inquiry and interrogation by both scholars and activists. In other words, each pathway—critique, comparison, and accompaniment—asks something quite different from the social-scientist-*cum*-activist-scholar and therefore requires different kinds of work, time, qualities, rigors, expectations, writing and postures of learning. Moreover, as scholarly practices they are also shaped by different qualities of accountability—philosophical, academic, spiritual, and kinship—and demand the presence of scholarly attention and embodied engagement over different time horizons. And, lastly each presents potential differences in the sociality of the research labor—solitude and togetherness—as it relates to food justice activism. It is in light of these differences in scholarly practice that we call attention to a gap in what we call the practice of accompaniment research.Food justice accompaniment research

Geographers have long engaged in participatory (action) research (PAR) as a means of co-producing knowledge with individuals, organizations, and communities engaged in social transformation (Kitchin and Hubbard, 1999; Pain and Francis, 2003; Kindon et al., 2007; Caretta and Riaño, 2016). The history of the approach stems from scholar engagement in social movements and revolutionary projects that democratized knowledge production (Freire, 1970; Bunge, 1971; Borda, 1979; Elwood, 2006). Over the past 50 years, PAR has been taken up by community-engaged, feminist and post-colonial scholars (Haraway, 1991; Hooks, 2003; Cahill et al., 2007; Torre, 2009) and vigorously debated as a science, method, development, and movement strategy. Consensus however centers on the central idea

that PAR engages with marginalized communities, shares ownership over the results, contributes to community projects, supports capacity building of activists and organizations, and principally follows the lead of community members "through all stages of research through to dissemination and action" (Pain, 2004, p. 652).

The practice of accompaniment is central to the epistemological and ontological foundations of the PAR approach. Indeed, the term "participatory" refers not only to oppressed communities contributing to the process of knowledge production but broader concerns over whose voice counts, who defines the problem, who produces truth, in cycles of research. Scholars are also taking active roles in the social action led by community members. In other words, participation does not only refer to the qualities of engagement of a given community in a research process whose end is ultimately arbitrated by a scholar (and academic institutions) but rather refers to the qualities of engagement of the scholar in their commitments to social transformation led by and with the community. Accompaniment represents the dialogic relationship that develops between people over time (often long periods of time) in which direct actions, participation, collaboration, strategies, planning and cooperative experimentation, or communicating research may be a product. Importantly, accompaniment does not give primacy to any one of these products, nor to one or another method of observation and analysis, nor to social hierarchies. Accompaniment research is, first and foremost, an act of commitment, friendship and love. We resonate with White's (2018) description of her research as a labor of love: "It is my firm belief that love and research are not at odds, but that the best research is driven by passionate commitment" (p. 27).

This paper connects theories and practice of accompaniment cultivated out of intersecting movements of agrarian reform (Issa, 2007), liberation theology (Gutierrez, 1984; Goizueta, 2009) in South America, and Black liberation theology in North America (Cone, 2010) to contemporary debates in food justice praxis, scholar activism, and pedagogy. Derived from the Latin *Ad Cum Panis*, the etymology of accompaniment points to the act of breaking bread with another person, with a compañero, on a mutual journey toward liberation from oppression. The sharing of bread in this case is not a unidirectional act of charitable giving, but one of the collective nourishment and common experience that comes from bearing witness to acts of violence and restitution, pain and healing, and fellowship and struggle over time. Accompaniment prioritizes work by and with the poor, the landless, the marginalized, the dispossessed, in explicit opposition to oppressive forces and institutions. Walking in the company of the poor intentionally moves away from any notion of individual expertise toward a shared struggle for survival, one that demands a long-term commitment to people in place (Watkins, 2015).

It should come as little surprise that for decades, Black scholars, particularly feminists, have urged all scholars to adopt precisely this posture in relation to their work with communities and through modes of writing that engender a community of practice that is sensitive to passionate commitment (Hooks, 2003). Yet, as Ashante Reese (2019) notes, "[i]n food studies, there is very little writing about caring for the communities we serve" (p. 135). Describing her grieving process over the death of a young Black man in her community, Reese expresses the kind of scholarly practice and sensitivities demanded if we are to deepen our commitments to the lived reality of individuals and communities struggling with systemic oppression in our work.

> In the context of research, particularly in food studies where Black lives, Black communities, are central in conversations about food access and inequalities, grief as an experience and a methodological tool asked me to lean into the vulnerabilities that are central to decolonizing anthropology. In my experience, it was emotional and physical, but it was also intellectual in the sense that the grief was not separate from the joys and traumas of writing or conceiving an intellectual project. At the very least, grief challenged the age-old notion of "objectivity." At its most transformative, it radically changed how I saw, heard, and experienced the communities where I worked (Reese, 2019, p. 136).

Our accompaniment practice did not unfold in urban Deanwood but in the rural state of West Virginia, where grieving with communities in crisis, lamenting their loss, and trying to envision a more liberatory future together has transformed us as people, as neighbors, as activists, and as scholars.

Context

The food system in West Virginia is paradoxical. Though the state is rural and has a long and ongoing history of subsistence agriculture (Pudup, 1990; Seaton, 2014) development has primarily centered on coal, timber, gas, and petrochemical manufacturing. The mountainous topography impedes large-scale mechanized farms although decentralized calf-cow operations, poultry CAFOs and processing factories and orchard operations do contribute to dominant agro-food supply chains. In the context of a land tenure system that favors large absentee landowners, the Mountain State maintains the highest rate of small farms *per capita* in the United States, many of them with family ownership structures. Furthermore, public access to large tracts of forested land reinforce a strong culture of self-provisioning that includes hunting, fishing and foraging (Long, 2011; Hall et al., 2020).

Despite conditions that might seem propitious to community food security, access to sufficient and adequate food is highly constrained for many people across the state. Prior to the COVID-19 pandemic, 16 % of the population was food insecure and *per capita* enrollment in federal nutrition programs have consistently remained some of the highest in the United States. The rural retail landscape is in flux as corporate chains supplant locally owned grocers closing in the face of competitive pressures, leaving fewer dollars circulating through the regional food economy. Amidst this reality, work toward a "just transition" away from fossil fuel extraction has funded a number of food system projects and fostered new alignments between the state, the nonprofit sector and private capital interests. These foodways are splintering and differentiating along lines of income and social class. Even as food banking networks enroll an increasing number of voluntary organizations to distribute ever-increasing amounts of industrial food waste to the poor, local agriculture, particularly specialty crop production, has emerged as a key narrative in the state's economic development imaginary, one that also offers a promise to address public health concerns around the dearth of healthy food choices in a place with the highest rates of obesity and diabetes in the nation. Access

to local foods however is largely out of reach for low-income communities confronting a growing sense of economic and social alienation as divestments in coal and manufacturing result in widespread unemployment, massive state revenue losses, opioid addiction, and cascading effects on community well-being.

FJL accompanies people within these highly contradictory food system dynamics where different ideas and myths circulate about the past, present and future trajectory of the land and its people. The resources extracted from remote mountain communities in West Virginia fueled the rise of American industrial power, and identities remain deeply tied to those histories and imaginaries. Yet the state and wider region is also haunted by outside perceptions of cultural backwardness, homogeneity, isolation, poverty and intolerance, tropes which are also reproduced and reinforced by local elites. This "othering" process (Johnson and Coleman, 2012) has historically served to dismiss local knowledge and elevate technocratic ideas of progress and modernity driving capitalist development in the region (Eller, 2008), facilitating dynamics associated with internal colonialism including land and resource control and its associated political tactics of disenfranchisement and minority rule (Lewis, 1978; Gaventa, 1982). This place however is also one of collective resilience and agency, of progressive and radical activism, a cradle of the Civil Rights, environment and labor movements in the United States, spurred by legacies of solidarity forged among extremely diverse working class communities (Fisher and Smith, 2012; Billings et al., 2018).

In 2018, for example, a state-wide 12-day teacher strike demanding rights to fair wages and healthcare for public employees ignited a national revival in labor activism that sparked further actions across the United States. Food became a central politicized feature of these strikes because one in three children in West Virginia live in poverty and school-based nutrition programs are key sites for resolving food access failures. As legislators opposed to the strike lambasted teachers for "preventing" poor students from accessing food, local communities worked to set up feeding sites that ensured children no longer receiving free meals could still access nutritious food options. Such actions were reminiscent of the community food networks forged out of the rich networks of resistance that has also defined this region for over a century (Fisher, 1993).

It is within these many intersecting food system movements, in the midst of these histories of quiescence and rebellion that our food justice accompaniment praxis has unfolded over the past 10 years. In the sections that follow, we reflect on the cyclical process of action and reflection rooted in this practice.

Food, hunger, and the possibility of coalition

We started on our journey of accompaniment research with a local anti-hunger organization called the Monongalia County Food and Hunger Committee (FHC) in Morgantown, WV during the summer of 2013. FHC was initiated by a local nun from St. Mary's Catholic Church in 1996 in an effort to coordinate with other local churches to meet the anticipated growth in demand for emergency food after passage of the Personal Responsibility and Work Opportunity Reconciliation Act in 1996 also known as welfare reform. Our decision to work with a small anti-hunger organization forged in crisis was both an intentional and serendipitous encounter.

Three forces converged to open this road. First, informed by critical scholarship on alternative food networks, we intentionally sought work with an anti-hunger organization because we were determined not to engage in the celebration of local "alternatives," often championed by community outsiders, as a solution to deep food system inequalities experienced by poor folks in WV. We were not only concerned with their reification of whiteness and market-solutionism, but their classed character and reproduction of a particular agrarian imaginary of Appalachia which bespoke the erasure of working or precariat class realities and histories. While our decision to turn toward emergency food agencies might appear surprising given the well-established contradictions of food charity (Poppendieck, 1999; Dickinson, 2019), we had other realities in mind. Emergency food agencies served an estimated 20 % of the population in the county. Therefore, we felt the charitable food phenomenon, the people it mobilized and those it served, represented a far more significant social reality than the less than 1 % we estimated were engaging in local food networks. Second, a significant cut to SNAP allocations were reducing household allocations by $20–30 per month in Fall 2013[3] and we were concerned about the large proportion of people, principally the working poor, who depended on these funds to make ends meet. Third, a student collaborator with another FJL project, had introduced us to his mother Ginny, a social worker at a food pantry affiliated with FHC. The personal connection with Ginny opened the door for us to engage in this work.

Six collaborating FJL researchers, including ourselves, participated in the work over 2 months in Summer 2013. The research questions focused on where, why, how and with whom FHC operated. Our research resulted in 22 interviews, a collective event ethnography of a food pantry distribution day, a community food security assessment, a group mapping exercise, a report back meeting and a discussion about next steps. The report back, planned from the outset of the project, created an opportunity for dialog with the 15 women (and 1 elderly man) that formed FHC. They gave critical feedback on our research, challenged our findings, and gave guidance about ways we might continue to contribute to addressing hunger, food insecurity and the provisioning of social services to support vulnerable households. And, our experience with the FHC pressed us into another cycle of research.

Cooperative experimentation, scale jumping, and the language of access

At the end of the first cycle of research, FHC asked us for an unconventional output. In a meeting, we hosted to present the results of our research, they asked for a tool or resource hub to reflect on what they were doing to meet the needs of the people they served. One of the key reasons for this "ask" was that our

3 The 2009 American Recovery & Reinvestment Act (ARRA) increased SNAP allocations to spur consumption and stimulate the economy after the 2008 financial crisis. These were progressively phased out reaching their term in October 2013. Although much of the country had experienced an economic recovery by that point, West Virginia remained the state with the highest unemployment rate in the country.

participatory research uncovered that all of the members of the FHC produced monthly reports of their charitable or emergency food activities and "sent up the chain" to comply with the accounting and surveillance demands of the regional food bank, federal agencies, Feeding America, and their donors. Indeed, reporting was one of the most tedious aspects of their volunteer time and they felt this burden was uncompensated and quite unfair given that they had to raise the funds, distribute food, and provide services. Our observation was that the amount of accounting and reporting work by FHC members was astounding, and yet it was clear that no one in the group had been able to individually or collectively reflect upon or plan strategically with the information they were gathering. In other words, they could not use the knowledge they were producing for others to effectively advocate for the people they served.

While exogenous institutions like the regional food bank, federal government and Feeding America required data "up the chain" to comply within their emergency food systems they did not share such information "back down the chain." This opacity reflected wider trends in supply chain management and broader governance dynamics within emergency food networks. Engaging FHC to reflect on the data they were gathering revealed an asymmetrical power dynamic in knowledge flow. Clear action steps came out of this initial participatory research phase. FHC wanted a means of analyzing their own experience and those of the people they served. Furthermore, they wanted people to have access to more information on the availability of their services. They also wanted their agencies, and the work they were doing to be seen by the community and government, and they wanted a means to discuss approaches to address hunger and poverty issues. Some of those wider issues included the devastating problem of cuts to federal nutrition assistance benefits in the fall of 2013, ending 5 years of additional funding following the 2008 crisis. This was directly leading to increased demands on their services and additional pressures to "feed the line" with minimal resources, a dynamic we understood as opening spaces of political possibility within charitable food spaces (Lohnes and Wilson, 2018).

In response to FHC's requests, we drew upon our training and experience in participatory geographic information systems approaches to design a public facing resource hub for community food workers in West Virginia - an approach later described by our colleagues as community geography (Shannon et al., 2021). Through Fall 2013, we researched and evaluated existing online resources and tools from Feeding America, FRAC, JHU Center for Livable Futures as well as state resources such as 211, DHHR, and other social service agencies. Unfortunately none of these platforms met the expectations of the FHC, were not scalable to counties across WV, nor provided an integrated tool, designed for community food workers, or anti-hunger, community food or food justice advocates in support of individual or coalition work. We felt that we would have to create the public-facing online portal we and the FHC were looking for from scratch.

WV FOODLINK

WV FOODLINK became a thought project and a practical product that would consume the next 2 years of our lives. Over 30 people ultimately cooperated to create the resource hub WV FOODLINK.[4] Based upon the guidance from the FHC and our own commitments to food justice and advancing the right to food we determined that the first version of WV FOODLINK would include: (1) the location, operating hours, and prerequisites for accessing free food through nearly every emergency food assistance site in the state along with every food retail location where state benefits could be redeemed; and (2) county-level community food profiles for advocates working toward a more just food system. This led us to phone surveys of over 500 emergency food agencies, 2,500 food retailers, and processing data requests with the West Virginia Departments of Agriculture, Health and Human Resources and Education and Agriculture, the Federal Bureau of Labor Statistics, and United States Census Bureau.

In addition to data gathering and curation, the development of WV FOODLINK would be informed by over 200 qualitative interviews with anti-hunger advocates, policymakers, and grassroots leaders across West Virginia. It would also lead us back to FHC to review, comment and evaluate our efforts. In other words, while the online portal required certain capacities, skills, and technologies to create, all of which we had access to through our positions within the land grant institution, the cooperative experiment as a whole yielded a much wider set of questions, concerns, and preoccupations that had guided us to this work in our first cycle with FHC: What kinds of knowledge might be useful for organizing more just food futures from the ground up? What kinds of language might be useful in mobilizing grassroots leaders in WV? What kinds of tools might be useful in facilitating the translation of knowledge and language into action? It also led us toward a new, broader set of protagonists that might become allies in the work to advance food justice and food sovereignty across the Mountain State, perhaps even beyond.

We launched WV FOODLINK as a website in Fall 2015 and have kept it updated for the past 8 years. Following the extensive participatory GIS research process including interviews with community food workers across the state, we came to see WV FOODLINK as a resource hub for more people than just FHC, beyond the local or county scale. The need for participatory research, pedagogical and advocacy tools became clear through our continued interviews with various stakeholders across West Virginia particularly during Summer 2014 field research in the Southern coalfields. Our commitments to other organizations were deepening through relationships with anti-poverty advocates who called on us (and the arguments we could now make through the WV FOODLINK research) to provide testimony against food safety-net cuts at the state legislature. This offers an important insight on accompaniment research. Growing our relationships beyond our initial entry point in a given locality opens opportunities to learn up and serve across by traversing sites and scales of food justice organizing.

Reaching outward, demonstrating solidarity, and mobilizing our gathered knowledge and experience—while remaining humble to its limits at this early stage—enabled us to challenge militant particularism (Harvey and Williams, 1995) connect with more people, grow our learning, and recognize the use-value of what would ultimately become pedagogical tools for food justice work in the third cycle of

4 http://foodlink.wvu.edu/

accompaniment research. From the crucible of the oft mind numbing labor to create WV FOODLINK, we understood the need for ground up pedagogies that could translate large datasets and complex information about the foodways serving the poor in a way that enabled more and more people to bring the information up against their local knowledge, to leverage it, counter it and ultimately build a collective conceptual framework that would serve coalitions demanding food system change. WV FOODLINK, we thought, might be a vehicle for that.

In this second cycle of research developing WV FOODLINK, we learned a great deal more about the red herrings associated with data worship combined with the challenges of paternalism in the charitable food networks. Data worship manifested in people, especially people concerned with gaining resources such as grants, asking for an ever more detailed inventory of information about food insecurity thus perpetuating a process of gathering information for information sake; where data and accuracy merely becomes a means for funding, reproducing existing orders, or even worse, an end in itself. It was becoming clear to us in this second cycle that information requests such as "can you add this or that to the map" or "can you also get information from this database" or anything starting with "would not it be interesting to map…" was less about addressing oppressive structures and food system inequalities and more about creating an artifact to look at, a fascinating map, a means to consolidate power or a system to govern. We had already witnessed the problem of seeking data and information for governing people in the first cycle of accompaniment. Certain community food workers who sought to guard their scarce resources had expressed some authoritarian exclusionary tendencies and saw data gathering as a means of surveillance and discipline that could mitigate so-called "double dipping" or "pantry hopping." The data and the people who gathered it, used it or interpreted it were complicated, and we had no interest in it being used to reify or reinforce the whiteness and neoliberal rationalities that permeated through many emergency food organizations (Pine, 2016; De Souza, 2019). Indeed, there was danger, we felt, that the resource hub, in the absence of a pedagogical politics and successful advocacy for more resources to charitable agencies, could be used to discipline those seeking services rather than creating spaces of political possibility for a more liberatory food future across the state.

Building upon these two related concerns that emerged during the development of WV FOODLINK and our deepening relationship with anti-poverty advocates and other local food access groups, we began to articulate our principles of food justice accompaniment research. These came to form the basis of our shared fate, shared work and what we hoped might become a shared vision with many others. Doing so we came to balance our service posture to FHC and our growing community of interest across the state while standing firm and speaking clearly about our positions on food justice, food sovereignty, and the right to food. We also realized that we needed an intermediate language—a halfway house—as a means of working out what a shared vision might look like in West Virginia. At the end of cycle two, while writing a report of our activities to present out to our growing network of collaborators—a critical element of participatory action research—we consolidated our ideas into the language of *food access* to set an ideological frame that was wide enough, yet its core concepts deep and critical enough, to anchor a workshop program that could advance food justice at the community level.

Nourishing our networks: politics, pedagogies, and policy

By January 2016, FJL had developed quite a large network of friends, coworkers and co-conspirators. For the previous 2 years we had coalesced with a growing number of researchers and community partners deeply involved in imagining how to translate food justice principles into practice. The WV FOODLINK launch demonstrated that we were committed to playing a long term role in food justice organizing in WV. We had also interviewed, broken bread with and attended meetings with hundreds of people that signaled we were serious about showing up. In response to our growing concerns about how WV FOODLINK might be used and its intended purpose to serve community food workers and food justice advocates, we began to design a popular education workshop that could be held in local communities.

The goal of the *Nourishing Networks* pedagogy was quite ambitious. We wanted to create a train-the-trainers approach to raise up human resources for food system change which drew upon a process of consultation combining knowledge from WV FOODLINK and local knowledge and experience among community participants. Furthermore, we wanted to see if we could develop a pedagogy that enabled people to self-identify as protagonists in the food justice movement, collectively identify problems, assets and strategies for change, and then accompany one another into the field of action. FJL developed pedagogical tools including county profiles, workbooks, and meeting structures to address five key pedagogical elements: (1) inclusive recruitment of diverse groups of people as workshop participants, (2) collective identification of food access barriers, (3) collective mapping of existing food access strategies, (4) development of experimental food justice advocacy goals or projects, and (5) enacting accompaniment-in-practice as those experiments unfolded.

Rather than just heading out to communities with the popular education workshop we made a call for participation in a 2 days advocacy meeting called *Nourishing Networks and* 75 people from across the state signed up in a matter of days. The vast majority of those who accepted our invitation were people who had participated in our interviews and outreach and also included representatives from various agencies from the state such as the Office of Child Nutrition and Department of Health and Human Services. We also invited the FHC. The goal of the meeting was to take a group of advocates through the curriculum, get feedback and work on the approach. Moreover, through the workshop, we thought that perhaps we might be invited to communities by participants (which did happen in the case of three of our first nine workshops).

The May 2016 meeting to present the approach of Nourishing Networks was a call to action for our internal team. It shook us out of the solitary and lonely work of WV FOODLINK development and pushed us into a pedagogical posture with both friends and skeptics. Because participants signed up from a wide variety of sectors in West Virginia's food system we needed to solidify what we were trying to do both intellectually and practically. Following this meeting, the attendees challenged us to consider how we could do more local outreach across the state to support community food workers and advance capacity for advocacy. As we came to see, the *Nourishing Networks* workshop would become one of the primary rhythms, routines and accountability structures through which we would act and reflect on our accompaniment research for the next 3 years. It

pushed us back out into the challenging terrain of local coalitions and pressed us to ask hard questions about how our scholarship and activism connected with food justice practices at the community level. The heightened accountability (in a different kind of peer review process) created a context of productive anxiety for the FJL team of accompaniment scholars to advance deeper into another cycle of research.

Nourishing networks

Following our experiment with the statewide group of advocates, the Nourishing Networks workshop was refined into an 8 h program for local communities. Starting with the state-wide workshop in 2016 on WVU's campus that served to hone the pedagogy, we hosted local workshops in Logan, Wayne, Fayette, Calhoun, Wetzel, and Wood counties. In total, 320 people participated. Workshops included roughly 25–50 participants total and often depend on a facilitating team of five or six FJL members including faculty, graduate and undergraduate researchers. The pedagogy of the program revolved around a shared text with information specially curated for each local meeting which is facilitated in a small group setting composed of six to eight participants from diverse institutional or experiential backgrounds who are recruited to attend. Participants "worked through" the text to consult and share local perspectives while also challenging one another and the information presented in a dialogic process with participants and facilitators. The goal of fostering dialog was central to the development of this pedagogy. One of the key problems identified through interviews with food access organizations conducted across West Virginia was that community food workers were pressed to frenetically serve programs rather than ask questions about their efficacy to achieve food justice. As we explored with our anti-poverty collaborators, the opening for critical reflection and consciousness raising required these same community food workers to develop a critical analysis of both food access barriers and strategies in an environment that might challenge firmly held beliefs while building confidence among participants from diverse positionalities to find shared understanding of problems and potential strategies for change.[5]

The Nourishing Networks text centers on the variegated politics that shape food production, distribution and a community's access to entitlements over time (Watts and Bohle, 1993; Ribot and Peluso, 2003). It includes a conceptual introduction to the concept of food access barriers including income, identity (race, class, gender, sexuality, nationality, age, and disability), knowledge, location, and crisis. Guided by a trained facilitator, participants work through a series of prompts which ask them to consider food access barriers in their communities supplemented by maps and statistical information curated from WV FOODLINK data. Once the barriers unit was complete, the group took a similar approach to review the section on food access strategies. These prompts introduced the dominant ways access to food is shaped in the region focusing on market structures, state nutrition assistance, charitable food assistance, self-provisioning, and agriculture. Participants then consulted during the third phase of the workshop on the degree to which these strategies effectively address the barriers to food access they have collectively identified. Finally, participants continue to work through the text to develop collaborative interventions that have the potential to enhance existing strategies to address specific barriers. These included both local development projects and ideas for policy advocacy. From there facilitators worked with the groups and the workshop participants as a whole to prioritize the strategies toward broader group consensus. The workshop concluded with a list of priorities and action steps, and everyone is encouraged to make a commitment to realize these.

The *Nourishing Networks* pedagogy ultimately sought to communicate the core tenets of food justice and food sovereignty to audiences that had never been exposed to its most basic premises. It compels protagonists engaging in the process to uncover within themselves and their communities some of the root causes of hunger and food system inequities and imagine ways to begin to address these collectively. A small group or task force of 4 to five people usually emerged out of these meetings to work on a food system project that carried the work and conversation forward throughout the implementation phase. While these initiatives were not groundbreaking or radical in nature, they did produce new local cycles of action-research in their own right and led these local groups to reflect on, theorize, and build upon the priorities they set with people that may not immediately identify with food justice or sovereignty goals.

Out of these first Nourishing Networks workshops, three of local groups focused their energies on establishing new programmatic interventions, two aimed toward seniors, and one toward low income populations with diet related medical diagnoses. Wood county organized pop-up farmers markets at several senior residential locations, and Calhoun county worked to develop nutritionally enhanced food distributions to seniors through their new "silver linings food box program." Wetzel County collaborated with their local federally qualified health center to design a produce prescription program, one of the first in the state. The three other groups chose to broaden the conversation that began in the workshop by inviting more stakeholders across their county to engage in food access outreach and training. Fayette County organized a "healthy food access summit," Logan county hosted "health and nutrition fairs," and Wayne County sought to expand learning opportunities through "ag-tivity days" in conjunction with middle and high schools.

Again none of these interventions were as radical or transformative as we the organizers might have hoped. From our vantage point, after pouring hours of work into organizing and facilitating these workshops, it was not always easy to contend with the limits of the collective imagination of its participants, not always easy to celebrate interventions that seemed to merely reproduce the very dynamics at work in neoliberal responses to food insecurity in the non-profit industrial complex (Guthman, 2008). Our yearning and motivation in organizing these workshops was to see campaigns emerge for raising the minimum wage, increasing state investments in community food security, and other policy interventions that explicitly addressed the root causes of hunger associated with such forces as food apartheid, labor exploitation, racial injustice, land loss, and environmental degradation. Notably, even though these concerns had not yet risen to the foreground, the FJL team committed itself to accompany these

5 For closer review, the curriculum is available on WV FOODLINK http://foodlink.wvu.edu/nourishing-networks-curriculum/.

"less radical" priorities and continues to be available to facilitate meetings with the groups as they see fit. To illustrate the length of those commitments, 7 years later, FJL continues to play a role in local processes in three communities including Calhoun where Tina, once a participant, now continues to train more community food workers and advocates and is on the cusp of introducing a right to food resolution with the Calhoun county commission.

Moreover, like Tina, many of the protagonists engaged in these workshops have since joined the *WV Food for All* Coalition.[6] FJL is a key driver in the formalization of this initiative alongside the WV Food and Farm Coalition, WV Center for Budget and Policy, Our Future WV, American Friends Service Committee, Mountaineer and Facing Hunger Food Banks. Over the past 3 years we have worked on a range of food policy issues weaving food-based solidarities between organizations and people with vastly different goals and ideologies in the process. *Food for All* is now bringing a wide range of organizations to the table around food justice principles. *Nourishing Networks* is integrating with the work of *Food for All*, training grassroots protagonists that want to get involved in policy *and* food system change.

By linking *Nourishing Networks* to organizing with the *Food for All* coalition, we feel we have protected its pedagogical goals. Even though we had significant success in reaching large numbers of people at the local level from 2016 to 18, we also became increasingly concerned about how the curriculum was being used and adapted by various people and organizations with related but not necessarily deeply aligned goals. Staff at one of the regional food banks that had attended a number of workshops began trying to use tools available through WV FOODLINK to organize their own meetings with member agencies. Food system developers were also keen to use the curriculum to advance creative place making and a grassroots anti-poverty organization began to express interest as well. In other words, we became increasingly concerned that some of the core principles and motivations underlying the tools and pedagogy were at risk of being lost. To re-establish understanding of the principles upon which it was built we relaunched WVFOODLINK with online training modules and created a new facilitator training workshop that we have now hosted with more than 40 advocates since 2019.

Linking theory to practice has created opportunities to bring the discourse of food justice, sovereignty and rights into the *Food for All* framework. Because of our long term commitment to accompaniment, we now have the trust and confidence to shape the wider political discourse around food policy in West Virginia. In fact, during our most recent policy summit, one of our delegates to the statehouse made a public statement about introducing a constitutional amendment for the Right to Food, the day after Jahi Chapell (whom we had invited as one of our keynotes) presented on the progressive food policies in Belo Horizonte, Brazil. While FJL does not claim this work, indeed it is the protagonists at the forefront of the campaign, we did help make this road by walking alongside others, co-creating an emergent, yet to be determined food justice activism that we believe might be a helpful model for coalition building efforts elsewhere.

On accompaniment research and social praxis

Although many food justice scholars do accompaniment work in organizations, communities and movements, in general, they are not necessarily encouraged to write about it, theorize their practice, nor offer systematic insight or guidance from which others might learn. As a result, we have found a poverty of food justice scholarship that provides scholars and community activists with real material, albeit circumscribed, examples of accompaniment with communities confronting food system inequalities. One reason for this is the short-term project-based orientation of much academic scholarship and the narrow timelines expected within periods of academic evaluation or funding horizons. Yet, perhaps one additional reason is an unwillingness to expose ourselves to scrutiny by telling the honest, banal and common stories of our activities, or failures and vulnerabilities as activists, or the limits of our own knowledge as scholars. There is little celebrity, nothing real heroic, in the complicated application of pure principle in the messy world we are trying to change (Horton and Freire, 1990). Yet if change is what we seek with others, our modes of accompaniment research should be honest sites of learning. Telling stories about these efforts can then serve as new sites of learning and collaboration.

Thus far, we have described our food justice accompaniment research in three cycles of action-reflection. The first was our initial research with the FHC of Monongalia County, the second included action research and development of the WV FOODLINK resource hub, and the third focused on the development of popular education workshops Nourishing Networks and its translation into a means for capacity building for the WV Food for All Coalition. In retrospect, we can see these cycles of action-reflection relatively clearly. In the midst of our action, however, the boundaries between them were blurred as were the streams of thought, relationship building, personal and collective consciousness that came to interrupt, mold and reorient our work. Nevertheless, throughout the action research process, our orientation was to try to keep the conversation open and accompany those working in organizations, especially those that were not advancing a radical food justice agenda to make a greater commitment to those goals. In other words, we recognized the importance of a developmental approach to those whom we worked with and saw that as critical in our own self-reflection as well. Yet, this understanding of a developmental posture is impossible without a long-term and ongoing set of relationships in which one acts and reflects and learns that extends beyond any one project or set of activities with community partners and participants. Our own research and contributions to food justice efforts in West Virginia pressed us to question our approaches but also to, as intentionally as possible, reconfigure what we were thinking and doing in practice with our co-conspirators over time. One of the key areas of learning we have found focuses on the development or constructive analysis of vital pedagogical or organizing tools (poems, songs, methods, maps, curriculum, facilitation strategy, etc.) which communities use or might use as protagonists in food system change. At best such tools may become the subject of critique or be documented in comparative

6 In 2016, after the release of WV FOODLINK, anti-poverty organizations called on us, and the data we had collected, begin to testify at the state legislature against food assistance cuts and regressive work requirements laws introduced by outside interest groups. This policy activism eventually translated into a state-level food policy coalition called *Food for All*.

research. At worst such knowledge, central to liberation struggles, goes unaccounted for. Further examples of the relationship between participatory action research and pedagogical engagement by food justice scholar activists could offer insights on paths forward.

Accompaniment research as social praxis is easier said than done within university contexts. There were many moments in the research process over the decade when the urge to ease back into the rhythms, routines and expectations of the insular university was overwhelming. But universities are also not safe spaces. We (faculty, grad students, and undergrads) in the FJL were also being disciplined back into those routines of teaching, publications, dissertations, theses, and other demands and pressures of the university—especially a state institution which is the target of constant austerity measures itself. Through the decade we struggled to maintain responsible relationships with folks who were trying to negotiate a crisis like a massive budget cut for food stamps, financial crisis or pandemic while higher education itself was also being transformed. But folks we worked with outside the university context also encouraged us to keep going and called on us to play our part in their struggles. The support and the demands from community collaborators was crucial to keeping us on track. We learned that if alone, unaided, or unaccountable to one another, individual scholars and small teams working with community partners may feel too overwhelmed to carry a project forward which demands so much extra-academic and emotional labor often seen in participatory action research processes. Furthermore, confronting such an overwhelming series of challenges, no one person, let alone an isolated academic scholar, would have been able to produce the kind of tangible change that sets people in motion to advocate for food justice in the first place. What we learned through our cycles of accompaniment research—indeed a prerequisite in participatory action research—was the need for the ongoing development and growth of a team of action researchers and community members. Mutual accompaniment among faculty, students, community partners, and many others working to advance food access in their communities generated a constant flow of action and reflection which propelled the work forward and created its own routines.

Now reflecting on this decade or work, we have come to value the language of accompaniment to describe the qualities of this kind of scholarly social praxis. As Paul Farmer states, "[t]rue accompaniment does not privilege technical expertise above solidarity or compassion or a willingness to tackle what may seem to be insuperable challenges. It requires cooperation, openness, teamwork and humility."(2011) Relations based on accompaniment need not be prefigured by professional or even political expectations. Accompaniment does not assert the primacy of scientific objectives, nor does it presuppose solutions or success. Moreover, accompaniment implies a willingness to solidarity with people who may not share the same ideologies or visions. Rather accompaniment is a human relationship characterized by finding our way to a shared vision through shared work. As Daniel Renfrew (2018) writes, accompaniment can lead to "the deceptively simple act of forging empathetic understandings of the complexity of local social worlds" (p. 167). Scholars such as Reese and White have pressed us to ask: How might the food justice activist-scholar stand shoulder to shoulder with individuals, organizations and communities? How might we partake in their struggles, joy and grief? How do we provide support, encouragement and resources when necessary, help identify, uplift and elevate grassroots leaders, and gather intimate knowledge by walking side by side with people? How can we develop relations of trust that are deep enough and meaningful enough to constructively critique, challenge or question the people we are working with? How do we remain open to critique ourselves? How do we engage with those who do not want to be on board, those who might go even further in an attempt to sabotage the work? In sum, through time, how do we walk with people as we all become protagonists of the food justice movement?

Tina: there is no alternative

Tina's 2017 call to FJL provides a helpful example of the role accompaniment research can play in cultivating food justice activism. When she first reached out we had no immediate answers to Tina's question, but promised to accompany her as she began to develop a local coalition to address the grocery store closure affecting her community. We walked alongside Tina as she hosted a *Nourishing Networks* workshop in Calhoun County and recruited 25 other participants, primarily women, with a stake in the future of the county's rapidly evolving food system. Over the course of 7 h we collectively identified 140 food access barriers, 38 community assets and devised 11 healthy food access strategies that might be implemented. We identified resources and institutions that were already available to build upon and then accompanied Tina in establishing a small team to advance the projects they voted to move forward. Tina not only led these initiatives with passion, she inspired us to prioritize the rapid development of the train-the-trainers curriculum we developed with our community partners.

In September 2019, FJL hosted a *Nourishing Networks* facilitator training conference. Over 40 people attended the two-day event from a cross-section of professional and institutional backgrounds. Nutrition educators, social workers, farmers, market managers, food pantry directors and community food system practitioners were there to learn how to effectively facilitate conversations about food justice in their communities and build grassroots support for food policy change by integrating the work of the *Food for All coalition*, whose various members helped to co-facilitate the workshop. Standing up to urge her fellow participants to take up direct advocacy Tina testified: "I never realized the need to get involved in food policy to address food issues in my community. But now I'm organizing with others to get involved." In the time elapsed since that initial call in 2017, Tina has come to identify herself as "in the infancy stage of food justice activism." She submitted public comments to the USDA on recent SNAP cuts which she had never done before. She joined the Voices of Hunger WV circle of leaders to advocate for a constitutional amendment for the Right to Food. She is showing up to the state legislature and inviting her delegates to support other parts of the *Food for All* policy platform. She is organizing *Nourishing Networks* meetings, gaining confidence to lead a local coalition demanding food policy change from the ground up. She is emerging as a powerful voice and leader in her community and across the state. This year, she introduced a resolution for the right to food to the county commission in Calhoun.

Tina is one of many protagonists that we encountered in FJL on a journey that began in 2013 with a group of women serving vulnerable households in Monongalia County. Despite our many frustrations and failures in the process of learning how to accompany well, to build trust with people and partner organizations and to accomplish this work within the fraught demands of contemporary institutions of

higher education, FJL is cultivating food justice activism and research within a state and region often overlooked. Yet looking back, Tina's deepening engagement in food justice action was also an effect of mutual accompaniment. Our ability to collaborate together was an outcome of our encounter in a cooperative experiment to understand dominant conceptualizations of food access failure in West Virginia, democratize knowledge about the food system, build a community of practice and common language that could facilitate cooperative responses to the contemporary food crisis in Central Appalachia. That community of practice is now growing. There are many Tinas with us today. Now we must continue to accompany her, love her well through our research and activism even when we do not understand where those steps may be leading, nor where we continue walking together. Indeed, there is no alternative.

Data availability statement

The original contributions presented in the study are included in the article/supplementary materials, further inquiries can be directed to the corresponding author.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Self-organization for community resilience in an invisible agricultural community

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This study investigates how self-organizing efforts by residents of informal settlements, primarily migrant and informal farmworkers, shape community resilience in Majes, a water-scarce irrigation district in the Atacama Desert of Peru. We collected 45 semi-structured interviews with residents and authorities in Majes and analyzed findings through a framework of self-organizing. Analyses revealed that self-organizing by residents of informal settlements incorporated the three components of White's theory of Community Agency and Community Resilience, which contends that marginalized communities increase resilience by fostering a *commons praxis*, practicing a *prefigurative politics*, and developing opportunities for *economic autonomy*. We also found that residents self-organized into associations to increase access to resources, resulting in increased resilience. However, certain fees, corruption, and undemocratic decision-making processes can be detrimental to self-organizing. Results expand existing theories of self-organization and community resilience by highlighting how residents of informal settlements in agricultural spaces collectively organize to increase their resilience. Findings also begin to reframe narratives that describe migrants and farmworkers as powerless in the face of water scarcity, climate change, and other social-ecological risks.

KEYWORDS

agricultural labor, praxis, informal settlements, farmworker, social-ecological change, Peru, migration, irrigation project

1. Introduction

Scholars from across the social and ecological sciences have long argued that self-organizing entities can display more resilience in the face of a change or disturbance (Berkes and Ross, 2013). Self-organization can be particularly important for communities that face multiple obstacles to gaining support from public institutions. One such demographic is residents of informal settlements (Satterthwaite et al., 2020). For instance, approximately 1 billion people across the globe live in informal settlements, defined as areas, largely outside of municipal boundaries, where people settle and live in often poor-quality homes (Satterthwaite et al., 2020; United Nations, 2022). People that live in informal settlements often live without land titles and thus lack resources such as water, electricity, and sewer (UN-Habitat, 2018; Satterthwaite et al., 2020). Research on informal settlements, especially from a social-ecological change perspective, is still forming. More recently, however, scholars have taken notice and made calls to increase investigation on vulnerabilities and risks caused by climate and other social-ecological changes and adaptations to address those vulnerabilities and risks in informal settlements (Melore and Nel, 2020; Satterthwaite et al., 2020; Carrilho and Trindade, 2022). Even with this recent interest,

there is still an overall lack of research looking at how residents of informal settlements address ongoing social-ecological risks and changes. Even less has focused on informal settlements outside of large urban settings.

This is an important gap because informal settlements do not just develop in urban settings. In Peru, for example, informal settlements emerge as a result of the government's implementation of numerous large-scale water transfer projects (LWTP) that carry water from the eastern part of the country to the coastal desert regions in the west (Stensrud, 2016; Mills-Novoa and Hermoza, 2017; Damonte, 2019; Mills-Novoa, 2019; Erwin et al., 2022). Many of these projects aim to stimulate agricultural development by providing farmers and agricultural companies access to water in a desert region. One example is the Majes-Siguas Irrigation Project, which delivers water from the highlands to the Majes district (from here on, Majes) in the Arequipa department of Peru. In Majes, the irrigation project supports farmers and agricultural companies that sell on domestic and international markets (Stensrud, 2019). Over time, many farms hired migrants to conduct day-to-day farm work and irrigation activities. These employment opportunities prompted many people to continue to migrate, away from smallholder agricultural communities in the mountains, to live in undeveloped, informal settlements and to work on farms (Erwin et al., 2021, 2022). With this influx of migrant farmworkers, scholars estimate Majes's current population to be approximately 120,000 people, even though Majes was only designed to provide land titles and associated water to approximately 40,000 people, including owners of commercial farms, farmworkers who work on these commercial farms, and those who work and live in the town center (Stensrud, 2016, 2018). Consequently, despite the economic success of the irrigation project, Majes regularly experiences water insecurity (Erwin et al., 2021, 2022) and faces ongoing social-ecological risks due to such water insecurity. In particular, the Majes-Siguas canal is Majes' only source of water, and its infrastructure has started to crumble over the years (Stensrud, 2016; Erwin et al., 2022). Furthermore, the region of Arequipa, where Majes is located, is already experiencing shifts in water supply and quality, temperatures and growing seasons, and other related climatic and social-ecological changes (Postigo, 2014; Erwin et al., 2021, 2022; Popovici et al., 2021b; De Moraes et al., 2022).

As is the case with many other places around the world, informal settlements often develop outside of municipal boundaries. Many people arrive and settle in Majes, only to live in informal settlements on the outskirts of farms, without water, electricity, sewer, or legal access to land. This situation tends to result in public institutions in places like Majes neglecting the needs and priorities of the residents of these informal settlements (Nassar and Elsayed, 2018; Satterthwaite et al., 2020; Erwin et al., 2021, 2022). This negligence often renders residents of informal settlements invisible (Shatkin, 2004; Dovey and King, 2011). The lack of consideration for the needs and priorities of informal settlement residents in dominant cultural narratives and discourses, policy and planning documents that shape urban spaces, and social and political entities that create and implement laws tends to further marginalize these residents (Dovey and King, 2011; Erwin et al., 2022). It is also worth noting that in Peru and beyond many new residents to informal settlements are domestic or international migrants (Chambers, 2005; UN-Habitat, 2018; Baye et al., 2020; Tagliacozzo et al., 2021; Erwin et al., 2022), many of whom are employed as farmworkers (Arcury and Quandt, 2020; Tagliacozzo et al., 2021). Research on farmworkers, particularly in the Global North, shows that farmworkers are often rendered invisible by social, political, cultural, and economic factors and processes (Guthman, 2004; Gray, 2013; Minkoff-Zern, 2014; Erwin, 2022b). As such, individuals with the dual identity of farmworkers and new migrants may experience further invisibility, due to their profession and their residence in informal settlements. Even with this invisibility, research across the globe has shown how farmworkers and/or residents of informal settlements gain access to resources through self-organizing and partnering with NGOs (Arguello, 2010; Minkoff-Zern, 2014; Rivera and Kapucu, 2015; Amoako, 2018; Mares, 2019; Braier, 2020; Thompson, 2021; Erwin, 2022a,b). However, there is still limited understanding of how self-organizing can support resilience of those who are both residents of informal settlements and farmworkers in places like Majes.

This case study begins to address these gaps by asking: how do residents of informal settlements built around the Majes-Siguas Irrigation Project, mainly people who work for farmers and conduct in-home agricultural activities, organize to increase their power over and access to water? We address this question by analyzing 45 semi-structured interviews conducted with residents and leaders of informal settlements, as well as public water employees, in Majes. We analyzed the interview data through a framework of self-organization described as a bottom-up process of individuals, households, and communities exercising agency to come together to articulate and address issues of their concern (Berkes and Ross, 2013; Edelenbos et al., 2018). Our analyses revealed connections between self-organizing and community resilience. In particular, our results show that self-organizing in Majes incorporated three integral components of White's (2019) theory of Community Agency and Community Resilience (CACR). This theory contends that communities increase resilience by fostering a *commons praxis* where communities work collectively to access natural resources, encouraging *prefigurative politics* by constructing alternative, democratic decision-making spaces, and developing opportunities for *economic autonomy* through pooling funds to support community-scale development projects. Our results demonstrate that even though there are limits to self-organization, it can be key to increasing the resilience of an invisiblized community, like the farmworkers who are residents of informal settlements around the Majes-Siguas Irrigation Project. Increased attention to how these communities self-organize could contribute to reframing dominant narratives that focus on the powerlessness instead of the agency of these communities in the face of social-ecological change.

2. Literature review: self-organization and community resilience in informal settlements in agricultural regions

Scholars utilize self-organization to understand processes such as collective action, community engagement, and participatory policymaking that urban communities use to make change and work toward more sustainable outcomes (Horelli et al., 2015; Rivera and Kapucu, 2015; Edelenbos et al., 2018; Hasanov and Zuidema, 2018). To date, research on self-organization has often focused on how community-led processes support efforts toward urban sustainability in places like the Netherlands, Sweden, the United States, and the

United Kingdom (Horelli et al., 2015; Edelenbos et al., 2018; Hasanov and Zuidema, 2018). Previous research has illuminated numerous community-driven initiatives while also articulating the limits to self-organization; this research also highlights when support from and collaboration with local government is necessary for moving forward toward community objectives (Edelenbos et al., 2018). Previous research has also made headway into understanding how emergent community processes respond to change; however, much of this work takes place in urban spaces in the Global North. Because of this focus, scholars have called for additional studies into how self-organization unfolds in other contexts and its relationship to community resilience in those contexts (Rivera and Kapucu, 2015).

Scholars and policymakers are also pushing for increased attention to the ways that marginalized communities address their priorities, especially in the face of social-ecological risk and change (Erwin et al., 2021). For instance, the growth of informal settlements, their interconnectedness to urban areas, and the vulnerabilities that these informal settlements produce for residents in these settlements and surrounding areas, has caught the attention of scholars and the United Nations (Nassar and Elsayed, 2018; UN-Habitat, 2018; Satterthwaite et al., 2020; Carrilho and Trindade, 2022). Informal settlements often develop in environmentally fragile areas, such as steep hills, floodplains, coastal shores, garbage dumps, and riverbanks, which expose residents to risks such as landslides, flooding, and toxic pollution (Dovey and King, 2011; UN-Habitat, 2018; Satterthwaite et al., 2020). Informality also leads to political negligence, which can prevent or delay health and sanitation infrastructure projects that address public and environmental health risks (Nassar and Elsayed, 2018; UN-Habitat, 2018). This negligence, in turn, increases communities' vulnerabilities to various infectious diseases, environmental threats, and other risks (Nassar and Elsayed, 2018). Together, this literature demonstrates ongoing challenges that residents of informal settlements experience, as well as a need for research on how these challenges emerge in informal settlements outside of urban areas such as rural mountain communities or agricultural regions (Melore and Nel, 2020; Tagliacozzo et al., 2021).

Increased attention to informal settlements in agricultural regions is important for multiple reasons. Unlike residents of urban informal settlements who often work in industry, residents of informal settlements in agricultural regions often work or have worked as farmworkers, a group that is often rendered invisible by existing social, political, and economic institutions (Guthman, 2004; Gray, 2013; Erwin, 2022b). Scholars argue that this intentional or unintentional invisibilization, along with many farmworkers' undocumented status, limits their social, political, and economic power and their overall capacity to make change (Gray, 2013; Erwin, 2022b). In the United States, farmworkers are also made spatially invisible by living in housing hidden behind farmers' residences or in rural neighborhoods around agricultural areas (Summers et al., 2015). Tagliacozzo et al. (2021) is one of the few studies to focus on informal settlements in agricultural regions. In this study, the authors investigated the ways that the COVID-19 pandemic impacted the livelihoods of migrant farmworkers, largely people from the Middle East and Africa, in the agricultural area of Capinata, Italy. Their results show how informal settlements provided refuge for some undocumented farmworkers; at the same time, their rural, isolated locations increased their vulnerabilities, including COVID-19 infection and death rates (Tagliacozzo et al., 2021). Overall, they argued that informality increased structural and systemic vulnerabilities, rather than decreasing them.

So far, most research on farmworkers has focused on the ways that invisibility and informality produce farmworker vulnerabilities and thwart efforts toward social change. However, recent scholarship has illuminated how Black farmers in the American South increased their community's resilience to ongoing social, economic, and racial oppressions by organizing into agricultural cooperatives (White, 2017, 2019). In this work, White (2019) introduces the theory of CACR, which contends that marginalized communities can increase their resilience by fostering a commons praxis, encouraging prefigurative politics, and developing opportunities for economic autonomy. White's research laid the theoretical foundation for studies that endeavor to illuminate the ways in which marginalized agricultural communities self-organize in the face of numerous vulnerabilities and injustices. Her work also demonstrates the importance of documenting and analyzing how community resilience is important, not only in the face of disasters, but also as communities face ongoing racial, political, and economic oppressions and social-ecological change (White, 2017, 2019).

Even with White's groundbreaking research, there is overall little understanding as to what mechanisms increase the efficacy of self-organizing leading to community resilience, especially as it relates to decreasing vulnerabilities of marginalized agricultural communities. Scholars argue that "there is a need for a careful investigation into the internal and external aspects of different ways of organizing" (Hasanov and Zuidema, 2018, p. 91). In this paper, we begin to address these needs by investigating how farmworkers living in informal settlements in Majes, Peru self-organize and how such process relates to community resilience. Specifically, we investigated how people self-organized into associations to increase their access to basic resources and advocate for laws to both decrease inequality and increase Majes' resilience in the face of social-ecological change. In what follows, we first describe the case background and research site, with a particular emphasis on why and how people experienced water and land insecurity in Majes. We then document how residents of informal settlements actively engaged in activities where they collectively responded to change, with neighbors, in associations, and with landowning-farmers and examine if these associations made space for a prefigurative politics, commons praxis, and economic autonomy.

3. Research design and methods

3.1. Case background: informal settlements around the Majes-Siguas Irrigation Project

This case takes place in the Majes district of Peru, located in the Atacama Desert of in the department of Arequipa, an area that before the 1980s, was largely desert. In the mid-1980s, however, the Peruvian government built the 101-kilometer Majes-Siguas canal (see Stensrud, 2016, 2018, 2019, 2021; Mills-Novoa and Hermoza, 2017; Damonte and Boelens, 2019; Mills-Novoa, 2019; Erwin et al., 2022). The Majes-Siguas Irrigation Project, initially costing 18,000,000 Peruvian soles or 5,000,000 USD, changed the landscape from a desert, unpopulated area, to an agricultural export zone. The canal was initially designed to supply non-potable water to farm lots that were distributed to willing farmers through a lottery process. Approximately 2,600

farmers and their families gained access to land through lottery and a few other means (Stensrud, 2016). With this land, they received land titles and generally used their five-acre plots to grow crops like quinoa, avocado, and cactus using a mix of drip and sprinkler irrigation systems. Some farmers also raised livestock to sell on domestic and international markets.

The canal is the district's only source of water. It supplies water to hydroelectric dams which in turn generates electricity for the district. The canal also supplies potable water to the district including a small commercial center and irrigation water to all the landowning farmers in the area (Stensrud, 2021; Erwin et al., 2022). At the same time, the population has grown significantly over the last forty years, from a population of zero to estimates of up to 120,000 people (Stensrud, 2016, 2018). The district and the canal now support numerous agricultural businesses beyond the initial 2,600 farms, including one of the largest dairy productions in Peru with an estimated output of 600,000 liters of milk a day (Stensrud, 2019).

All water allocated through the canal originates from the Colca Valley, an area threatened by climate and other social-ecological changes (Erwin et al., 2021, 2022; Popovici et al., 2021a,b; De Moraes et al., 2022). The canal, the sole engineered water diversion system in Majes, has also started to degrade due to extensive use and earthquakes (Stensrud, 2021; Erwin et al., 2022). In addition, Majes, along with a neighboring irrigation district, La Joya, have adopted lax irrigation rules that allow farmers to irrigate without limits, increasing the likelihood of landslides (Lacroix et al., 2020; Flamme et al., 2022). Over the last few years, many water cuts have been imposed to conduct maintenance on the crumbling canal (Stensrud, 2016; Erwin et al., 2022). Sometimes these cuts last for up to 10 days. During this time, water is rationed and people who have access to reservoirs rely on stored water, while others without access to such stored water, many of whom are farmers and migrant farmworkers, have to find other ways to secure water.

The construction and continued operation of the canal has been met with resistance since its inception. In the 1990s, the district of Cabanaconde bombed the canal to gain more access to water from the canal (Vera and Vincent, 2013; Stensrud, 2016). There are also plans to build a second canal, named Majes-Siguas 2, which would share the original infrastructure of the Majes-Siguas Irrigation Project to carry water from the district of Caylloma to a neighboring area. While construction of Majes-Siguas 2 has started, it is consistently halted because of political conflicts over water allocation and concerns over social-ecological risks associated with the water transfer (Paerregaard, 2013; Stensrud, 2016).

With the passing of time, many people from across Peru, especially the district of Caylloma and the departments of Cusco and Puno, migrated to Majes to work on the farms that are irrigated by the canal and in various businesses in Pedregal, the urban center of the Majes district (Stensrud, 2018; Erwin et al., 2021, 2022). Many of these migrants are hired as irrigators and live on the farms to manage all irrigation activities. Others are farmworkers that meet with thousands of others every morning in a town square in search for day labor and other forms of temporary work on those irrigated farms. Some people, especially women, also own or work in small stores while caring for animals and children in their homes (Stensrud, 2018; Erwin et al., 2021). The majority of these farmworkers and other migrants live in informal settlements on the outskirts of the irrigated farming areas.

For decades, only farmers, businesses, and *some* residents living within the municipal boundaries had access to any water. In contrast, many residents of informal settlements lived without formal land titles and therefore without access to potable water for domestic use and non-potable water for irrigating household vegetable gardens or watering household livestock. Over time, as we detail in the following sections, people have gained access to water and other resources by organizing independently and into associations. This trend of forming associations follows a longstanding history of migrants from the highlands moving to the coastal, desert regions and cities to escape political violence and poverty and to secure a better future for their families (Jongkind, 1974; Chambers, 2005; Stensrud, 2018). One local leader estimated that there are currently around 100 associations in Majes with approximately 15,000 residents as members.

3.2. Data collection and analysis

This case study builds on existing fieldwork in Majes that investigated water governance, adaptation to social-ecological change, and community resilience (See Erwin et al., 2021, 2022; Popovici et al., 2021a). Our current research focuses on investigating how migrant farmworkers living in informal settlements in Majes self-organize to address water scarcity and other basic needs. The first and second authors traveled to Majes in November 2021 to interview people who live in informal settlements and authorities who work with water distribution across the district. Before conducting all fieldwork, the three coauthors designed an interview protocol in Spanish and obtained approval from the Institutional Review Board (IRB) at Purdue University.

We used a combination of purposive and snowball sampling to interview a variety of actors who lived in informal settlements and association members, largely current of former farmworkers, but also people who work with agriculture in their homes and store owners (Neuman, 2009; Creswell and Clark, 2018). We also interviewed association presidents and authorities that worked with the local and regional Peruvian water administration, JASS (*Juntas Administradores de Servicios de Saneamiento*). Specifically, we used purposive sampling to recruit interviewees with diverse backgrounds (in terms of gender, age, occupation, places they moved from, etc.) and from various associations with and without access to potable water, non-potable water, sewer systems, and electricity. Some associations had succeeded in obtaining access to all basic resources, while others were still under development, sometimes with weekly deliveries of potable or non-potable water. As seen in Figure 1, we also strategically visited associations that had differential access to the canal and its water. In addition to purposive sampling, we used snowball sampling to connect with association members and leaders within the social networks of the interviewees. We stopped data collection after reaching data saturation when an additional interview no longer added new understanding of the situation (Bailey, 2007). At the end, 45 semi-structured interviews were conducted, totaling 1,080 min of audio recording.

We conducted interviews in numerous places including within informal settlements, in the restaurants and shops of people who lived or owned their business in informal settlements, at the local

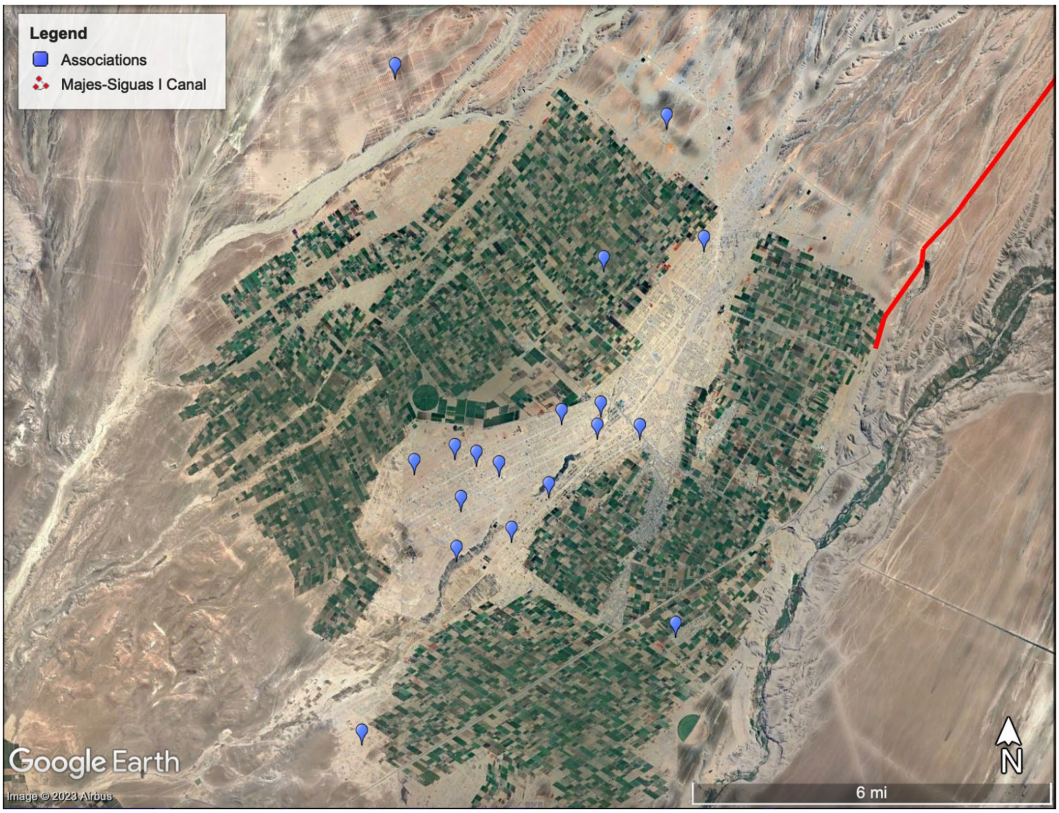

FIGURE 1
Map represent approximate locations of associations where 21 interviewees lived (3 associations had two interviewees each) and location of the canal.

TABLE 1 Summary of interviewees.

Total number of interviews		45
Total number of interviewees		60
Types of interviewees	Number of interviewees who were association presidents	4
	Number of interviewees who were JASS authorities	5
	Number of interviewees who people who were association members that lived in informal settlements and/or who lived in in temporary housing in Ciudad Majes.	51

meat market, on farms, and in an area where farmworkers waited for work in the mornings. In total we conducted 40 interviews with residents of informal settlements, people who have land in informal settlements through possession but live elsewhere, presidents of associations, and migrant farmworkers who lived in in temporary housing in Ciudad Majes, which is a formal part of the city of Pedregal. We also conducted an additional five interviews with representatives of local and regional water authorities (Table 1). The interviews with residents of informal settlements span across 20 different associations in Majes (Figure 1).

Upon completion of interviews, audio recordings were transcribed. The lead author created a draft codebook (See Appendix 1) using an abductive approach, which combines concepts, processes, and ideas from the literature review and our research questions with those that emerged organically from the transcripts beyond the existing literature. The draft codebook was then discussed with the second and third authors and subsequently revised. The first and second authors worked together to complete the intercoder agreement process. Specifically, the first author made edits to the draft codebook based on discussions with the second and third authors. The first and second authors then coded 10% of the 45 transcripts with the updated codebook, and repeated the process of discussion, codebook editing, and recoding until they reached an agreement about a coding structure (Campbell et al., 2013).

Next, the first author used thematic and content analysis and the computer assisted qualitative data analysis software, MAXQDA, to analyze the 45 coded transcripts (Joffe and Yardley, 2003; Hsieh and Shannon, 2005). The coded transcripts were summarized, categorized, and compared and contrasted to identify why people self-organized, how they self-organized, and the results of that self-organization. These emerging themes were further organized and analyzed to identify the relationship between how residents of informal settlements in Majes self-organized. It also pinpointed changes in their community's access to resources such as water, electricity, and sewer services. Analysis concluded by identifying quotes that exemplified why and how people self-organized.

4. Results: why and how people self-organized in Majes

In what follows, we document how and why the residents of informal settlements in Majes self-organized. We also present results on various self-organizing strategies used by the residents of informal settlements to successfully gain access to resources and increase their power. We conclude by presenting the drawbacks of certain associations and the limits to only self-organizing at the community scale, as brought up by our interviewees.

4.1. Mechanisms of self-organizing

4.1.1. The formation of associations

Interviewees informed us that before 2004, Majes mainly consisted of farmers and residents in a small city center and that associations started forming around 2004. These associations have between 100 and 500 members. In general, we found that association members were quite diverse. For instance, one interviewee told us that their association was named after a specific region in Peru. However, when we asked her if most people in the association were from that region, as the name indicated, she said: "*We are a mix, really, of people from Espinar, Puno, Chumbivilcas, Arequipa*." One association even had residents from Chile and Argentina.

Interviewees described numerous ways of forming associations. One association president told us that he and some friends traveled from Arequipa to Majes in a caravan to settle. Over time, they formed an association so that they could gain access to water and other resources. In another case, the association was formed by a family or people who arrived together from the same region. Interviewees also told us that some associations were formed by one individual, who later became the president of the association. This individual is often an earlier migrant who bought land and then sold land to newer migrants who moved to Majes and were looking for land. These newer migrants were then recruited and also became members of the association. Two association presidents also told us that many members were single mothers who had moved to Majes to escape domestic violence and find a way to support their families independently. One president described this as: "*More than half of the members are single mothers… I know a lot of women who are single mothers who come here from another place*." Another interviewee told us: "*There are many mothers here, single mothers and abandoned mothers*."

The majority of interviewees told us that their association formed an executive committee, with a democratically elected president, vice president, treasurer, and secretary. The executive committee conversed with the local municipality, communicated association priorities to the municipality and other authorities, and became knowledgeable in local, regional, state, and national laws. The majority of association members were also required to pay a monthly fee to the association, funds that were often used to fund community projects.

4.1.2. How associations made change

Forming an association often increased interviewees' capacity to organize among themselves and make change by working with the municipality, external to the association. In particular, having an association with an executive committee gave interviewees credibility with the municipality and thus, increased their capacity to gain provisional land rights and water access. One association president told us that upon creating an executive committee, "*we notified the municipality so that it would recognize us as an association*" which *"allowed us to gain provisional land rights*." Another president told us that creating an association stopped the municipality from kicking them off the land. He said: *"Well, we had already occupied the land three times, and each time, they kicked us out. Then, we created an association, and it stopped them from kicking us off the land. The municipality came three or four times. On the fifth time, we stayed. No one moved us anymore*."

Another group of women said they formed an association to demonstrate that they had settled the land, which resulted in them gaining access to more resources. They said: *"Before the municipality did not bring us water because not too many people lived here. So, we created an association, and now, the municipality leaves water, here, in a container*." Others described the relationship with the municipality as an ongoing process. For instance, while some communities had successfully gained access to water from the municipality, others were in different stages of gaining access. One interviewee informed us that some people in their association already obtained access to water, but they were still working with their association to ask for more water because: "*Not everyone has it*." Another interviewee who was a member of an association told us that the municipality was bringing them water in cisterns, but they were now "*asking them [the municipality] for drinking water*" through indoor plumbing.

In some cases, the municipality did not support or comply with associations' needs, even if they had formed and made formal requests. In these associations, interviewees told us that having an association gave residents the capacity to collectively organize funds to implement projects, with or without support of the municipality. They often organized projects in community meetings where members discussed topics such as ongoing challenges with water access, crime, land rights, and landslide risk mitigation strategies if they resided in a risk zone. Four interviewees informed us that many of the meetings had been paused during the COVID-19 pandemic, but it was common to "*investigate issues and ideas during community meetings*." Independent projects varied and depended on the association and their needs. For instance, two interviewees informed us that the executive committee would organize community projects to "*work and clean the street*." Two other interviewees told us that "*the association had organized and installed pipes*" to pump non-potable water from the canal to their lots. An executive committee member told us that her association had pooled resources from association members and installed a soccer pitch and a clubhouse. They had also recently worked independently from the municipality and the electricity provider to install electricity within their association. She told us: "*we self-finance to improve our quality of life, every one of us, for the betterment of everyone*."

4.2. Motivations and functions of associations

This section describes the roles associations played in supporting residents of informal settlements in Majes, specifically how self-organizing secured some residents access to water and other basic resources. It also describes how associations worked to advocate for landslide mitigation and risk reduction.

4.2.1. Self-organizing to increase access to water

We found that the most prominent motivation for creating an association was to gain or improve access to water. The majority of interviewees, including association members and presidents, told us that they worked with associations to improve access to water, which includes gaining access to non-potable water, buying and installing pipes for potable water, and soliciting the municipality to bring potable and non-potable water in each week. One interviewee described how in the past, people had to walk far to obtain water, but they worked with their association to improve access. He told us: "*There has always been water, but the water distribution point was up there… We had to carry it, and since it was really far, we asked our [association] president. He put another pick-up point here, a little closer.*" Another interviewee told us that they had worked with their association to gain access to non-potable water from the canal. She described this as: "*The association was organized, and we bring in water from the canal through pipes… It is an investment that has been made. Every lot has it.*"

4.2.2. Self-organizing for electricity

In addition to gaining access to water, about a quarter of interviewees who were residents of informal settlements told us that they had gained access to electricity through working with their associations to solicit service from the local electricity company. One young business owner described this as follows: "*Without electricity, there was nothing. So, recently, we worked together to gain access to electricity. We just paid our first bill!*" Another interviewee told us that they started by having one meter for the whole association (referred to as a "*collective meter*") and later transitioned to individual meters. The majority of interviewees who had a collective meter aimed to eventually have individual meters, as one interviewee explained: "*Before we had a large meter that was paid by the entire association… Now, we have meters in each little house.*"

4.2.3. Self-organizing for provisional land rights

Because residents lived in informal settlements, they did not have formal land titles. Formal land titles protect people from being evicted and give people automatic access to water. However, formal land titles are difficult to obtain. Therefore, the majority of interviewees, including association members and presidents, told us that one of their key priorities was to gain provisional land titles, which were temporary land titles protected by Peruvian law. As one association president described, provisional land titles provide some protection from eviction: "*You cannot evict them because they have a provisional title... The Possession Law protects them.*" While the Possession Law did not give residents with provisional land titles automatic access to water, provisional land titles did make it "*easier to request water*," as one president commented. Similarly, another interviewee described this as: "*we have to do it little by little. We have land and water, but it is provisional.*"

4.2.4. Self-organizing to advocate for landslide mitigation and risk reduction

Interviewees, including two association members, an association president, and the president of the association of associations (an organization that represented numerous associations) all informed us that the municipality had classified their area as a landslide zone. One president described this as: "*According to the municipality and the authorities, this is a risk area... There's a study where they classify you as high risk. Those that are high risk are on the borders of ravines.*" Because of their location in a risk zone, some associations were forced to advocate for themselves to the municipality. Mainly, they disagreed with the risk classification or wanted the authority to help them mitigate the risk. In a few cases, the authorities wanted to make people relocate out of the risk zone but the association members did not want to move. One interviewee told us: "*Right now, we are asking the municipality to reduce the risk in an eroded area… We are waiting for mitigation.*"

4.3. Organizing beyond single associations

In what follows, we describe how interviewees worked across associations to gain rights to land, water, and electricity. We also document how some associations collaborated with other organizations, like the Water Users Association (WUA; a community organization for formal residents with water rights), to address water risks that Majes continually faces.

4.3.1. Collaboration across associations

We found residents of informal settlements would often work with the association of associations when multiple associations were experiencing the same issue, like with land titles or landslide risks. The association of associations had a president, its own executive committee, and "*approximately 10,000 members...from 24 associations.*" Through it, member associations continually worked together to address emergencies in the community as the president explained to us: "*We are a well-established group. If there is a problem, we all provide support, we work together to solve it. Right now, we are trying to get meters. We worked together, traveled to Arequipa, and had our issues heard.*" At the time of the study, the association of associations had proposed a law to formalize all provisional land titles and had recently traveled to Lima to advocate for the law. This president explained this to us as follows:

> "*If, God willing, the congressmen say: 'Let's approve it,' it would be a win for all the association members here. With that authorization, the mayor can formalize all of us. And you can request your water. We have already knocked on doors to the largest players so that they can do the water and sewage project for us, which is a huge investment… Being united makes us stronger and able to improve our associations.*"

As aforementioned, multiple association members and presidents identified landslides as an issue. Because this was a cross-cutting issue, the association of associations advocated for the municipality to adopt mitigation measures to reduce landslide risks in informal settlements. At the time of the study, they were working together to conduct a survey of landslides across the associations, as one interviewee described: "*Between the presidents of all the associations, all the documentation has to be presented to do all this, to carry out the survey.*" The association of the associations planned to present the survey results to the municipality as way to demonstrate need for mitigation measures.

4.3.2. Working with external organizations to address issues with canal infrastructure

Interviewees from across associations also told us that they were worried that the Majes-Siguas canal would collapse and that they would be forced to leave Majes for good. A water authority representative described the issue as follows: *"It [poor canal infrastructure] is difficult not only for the general population, but also for farmers. If the canal collapses, not only will the population be harmed, but it will also damage farmers."* To address this concern, the president of the association of associations told us that they were working with the WUA and other community groups to advocate for a reservoir to protect them in times of emergency. The president told us that their association and member associations representing the residents of informal settlements had joined with the WUA to ask policymakers to make a reservoir above the district to provide water during water cuts and protect them in the case of an emergency, like canal collapse. The president expanded on this by explaining how the associations were working with other organizations in Majes to address the problem. In particular, the president said:

> *"We already talked to the mayor and the president of the Water Users Association. We are collecting signatures because they have requested more than ten thousand signatures to make the intermediate dam and reservoirs… It's not a solution, but it's a workaround, an emergency plan… The Water Users Association is driving this project, but it has to go hand in hand with the general population and the authorities… Without water there is no life. That's why we have met with the mayor, with the president of the Water Users Association, who explained to us how serious it is right now and requested that we support them in collecting signatures for a petition from all the association presidents."*

4.4. Accessing resources independently when the association did not meet peoples' needs

While many interviewees expressed that their association supported them in pursuing common goals, others were frustrated with their association. One interviewee commented that the monthly fee of being an association member was exorbitant. Two association presidents also told us that many members bought pieces of land, albeit informally or through provisional land rights, in the association as an investment or vacation home, but they lived in the local city of Pedregal or in places elsewhere like Arequipa. Specifically, one president commented that because some members lived elsewhere, overall participation in community meetings and events was limited.

Several interviewees also told us that they had actively participated in their association's community meetings, but that their ideas would often be rejected by other members. While most associations had their own rules for executive term limits and for how one gains an executive position, one interviewee told us that his association did not have term limits. Another interviewee shared an extreme case with a president he called a "*dictator*." The interviewee expanded by telling us: "*when you become president, you do not want to leave… We call it a mafia. He tries to stay, stay, and stay, and well, he stays.*" He expanded by explaining to us that the president of his association would "*traffic [land] lots,*" which means that when "*a neighbor does not live on the lot, the president would sell it to someone else… Why can he do this? Because the owner does not have a title. It's a bit more informal, only possession.*"

Provisional land titles posed additional challenges to the functioning of the associations. First, although residents of informal settlements *could* gain access to water or electricity with provisional land titles, access was not guaranteed, and at best, in flux. One interviewee told us that their association had worked for years to gain access to resources, but projects would discontinue when there was a change of authority. He described this as: "*We have already been conducting studies, but sometimes the authorities are also the ones that fail and discontinue projects that the previous authority left behind… There is often no follow-up when there is a change of authorities.*" Second, several interviewees further expanded on the challenge associated with provisional land titles by saying that authorities are not required to recognize provisional land titles held by their association or respond to the requests made by those holding provisional land titles, even when the association follows outlined procedures to prepare for water and electricity access. One interviewee described this as: *"To get electricity, we have done all of the technical surveys, soil studies, everything… There has been no response."* Third, as demonstrated in section 4.1.2, a key difference between having formal land titles and provisional land titles in informal settlements is that people with provisional land titles often had to self-finance their infrastructure. One interviewee told us: "*Unlike with private property, the municipality hardly intervenes, nobody helps you. We have to self-finance everything.*" At the time of our interviews, the majority of residents in informal settlements had not yet gained formal land titles through working with their associations.

Because of these issues, some interviewees told us that they preferred to live and organize themselves independently of associations. For example, two interviewees told us that they had to open a soup kitchen independently of the association because: "*We talked about it in a community meeting, and the president told us if we want to open a soup kitchen, then we have to organize ourselves. So, we organized ourselves and decided to open the soup kitchen.*" One interviewee had decided to access resources independently without having to pay a fee to an association. This interviewee told us: "*I am an individual. I have nothing to do with the association, because the association asks you for money every month… At each meeting, quota here, quota there. So, I decided to do it individually.*"

5. Discussion: the role of self-organizing in shaping the resilience of farmworker communities in informal settlements

Our results illustrate that while self-organization has its limits, it can support community resilience for agricultural communities living in informal settlements, like farmworkers. First, although it has been recognized that informal settlements pose numerous social-ecological risks, research on these risks, as well as the ways informal resident communities adapt to these risks is still forming; to date, much of this research has focused on settlements that form on the outskirts of urban areas (Shatkin, 2004; Dovey and King, 2011; Mehta et al., 2014; Amoako, 2018; Nassar and Elsayed, 2018; Baye et al., 2020; Satterthwaite et al., 2020; Carrilho and Trindade, 2022).

Notwithstanding these limitations, previous studies have documented that the residents of informal settlements experience challenges to accessing basic needs like water and electricity, often live in areas at risk of landslides or other natural disasters, and rarely hold formal landownership of their lots (Hoffman and High-Pippert, 2010; Dovey and King, 2011; UN-Habitat, 2018; Satterthwaite et al., 2020). Moreover, residents of informal settlements in water-scarce, urban areas "usually face more water constraints and are more vulnerable to increases in food and water prices" (Satterthwaite et al., 2020, p. 147). Our results show that residents of informal settlements in Majes face similar, ongoing social-ecological risks as people who live in informal settlements in urban areas, especially, risks of landslides, challenges accessing water, land, and electricity, and spatial marginalization from town centers. However, while our interviewees did not specifically discuss the relationship between irrigation practices and landslides, ongoing research in the area shows that decades of irrigating Majes's sandy soil has instigated landslides, and ultimately, will destroy villages and agricultural lands (Lacroix et al., 2020; Flamme et al., 2022). Utilizing drip irrigation in future irrigated agricultural projects in the desert, like Majes-Siguas 2, could decrease the distinct social-ecological risks that these communities face (Flamme et al., 2022).

Importantly, our results highlight that political marginalization motivated residents of informal settlements to self-organize into associations. In particular, they self-organized to counter the neglect by the municipality. They also self-organized to gain access to different resources, including water, electricity, and land rights. Literature suggests that communities self-organize in response to discontent and to work together to meet a goal, especially environmental sustainability goals (Edelenbos et al., 2018; Hasanov and Zuidema, 2018). However, in general, research on self-organization has focused more on the results of self-organization, the way self-organization shapes public institutions, and the transformative power of self-organization, but less on why communities self-organize (Edelenbos et al., 2018; Hasanov and Zuidema, 2018). Our research broadens this literature by showing why people self-organized into associations and how they pooled their own resources through association membership fees to develop and legitimize their communities. In addition, there is a history in Peru of migrants from the highlands moving to the coastal desert regions and cities to escape political violence and poverty and to secure a better future for their families (Jongkind, 1974; Chambers, 2005). However, there is limited research investigating how these migrants collectively achieve social, economic, political, and environmental goals (see Stensrud, 2018). As such, our study also contributes to the longstanding research on internal migration in Peru, particularly in the context of Peru's numerous LWTPs.

Our research also contributes to building linkages between community self-organization and community resilience. Our results highlight how self-organizing was integral to the resilience of interviewees who were members of various associations, especially as it relates to CACR's interrelated dimensions of *prefigurative politics*, *commons praxis*, and *economic autonomy* (White, 2017, 2019). White (2017, 2019) describes *prefigurative politics* as the creation of alternative, democratic spaces outside of public institutions where people come together to make decisions and self-reflect. We found that some associations in our study had characteristics that foreground *prefigurative politics*. In particular, many associations had instituted democratic decision-making processes for electing leaders and making collective decisions. Our interviewees who belonged to associations without democratically elected leaders described their associations as ineffective, and some even called their presidents "*dictators*." These results uphold the theory of CACR by showing that *prefigurative politics* with democratic institutions appeared to be recognized as supporting community goals and resilience, while institutions that did not provide such democratic spaces were viewed as ineffective.

Our results also show how self-organizing into associations created a *commons praxis*, whereby communities make decisions "around shared spaces and resources such as access to land, water, and seeds" (White, 2017, p. 19). This was evident in what our interviewees shared with us, particularly that many associations, as well as the association of associations, held meetings where they discussed issues such as access to water and electricity and made action plans together. Creating such a *commons praxis* through self-organizing also supported some associations' efforts toward *economic autonomy*, defined as "an alternative system of resource exchange within the community" (White, 2019, p. 10), by giving people a space to connect plans to resources. As one interviewee told us, her association had to be resourceful and "*self-finance everything*" because the municipality did not address their needs and priorities. Indeed, her association had successfully self-financed multiple community development projects including a soccer pitch, a clubhouse, and even installed electricity in their association. It is worth noting that in our research, while associations were created to provide support for the residents of informal settlements to address their resource needs and basic rights, none of our interviewees discussed their associations creating space for self-reflection, a critical component to *prefigurative politics* for community resilience (White, 2017, 2019). Additional empirical data into how self-reflection works within community groups like these associations and how self-organizing can support self-reflection could help identify relevant strategies to further strengthen community resilience.

As aforementioned, our research and many other studies have illuminated how self-organization can help marginalized communities work toward shared goals (Horelli et al., 2015; Rivera and Kapucu, 2015; Hasanov and Zuidema, 2018; Suhartini and Jones, 2020). However, few studies discuss the limits to self-organization. Our research begins to shed light on these limits by describing how and why individuals avoid self-organizing and prefer to work independently. In particular, some interviewees were unable to reach their goals within their associations, experienced inconsistent or unequal access to communal resources obtained through the work of the association, or expressed a sense of frustration or disappointment in the lack of support from association members for community development projects. Consequently, these interviewees responded to these challenges by joining other associations, collaborating with landowning farmers, or pursuing their goals independent of an association. These results seem to follow other trends within the literature where scholars have argued, "embracing processes of self-organization in decision-making calls for appreciating the different pathways in which local collective action could lead to active and inclusive partnerships between citizens, policy-makers, academics, businesses, and the society as a whole" (Hasanov and Zuidema, 2018, p. 91). Our research thus sheds light on the ways that across-scale collaborations can increase the capacity of informal settlement residents to increase their access to resources and resilience in the face of risks like a failing canal infrastructure.

Finally, addressing structural inequalities is integral to decreasing vulnerabilities for both a specific group and the broader community or

site (Adger, 2000). However, neglecting existing community strengths and focusing solely on vulnerabilities can decrease our capacity to learn from and support existing grassroots efforts that mobilize and organize marginalized communities (White, 2017, 2019). Our research documented and analyzed an example of how farmworkers living in informal settlements in an irrigation district in the Global South, a group that had been rendered invisible to a large extent (Guthman, 2004; Shatkin, 2004; Gray, 2013; Minkoff-Zern, 2014; Erwin, 2022b), worked to obtain access to resources, demand rights, and increase resilience through self-organization. As such, our research joins with other scholars who provide nuanced, counter arguments to apocalyptic narratives that frame climate refugees in the Global South as largely powerless in the face of change (Farbotko and Lazrus, 2012; Bettini, 2013). Our research also complements food justice scholars who focus their research on farmworker agency in the Global North, especially the United States (Minkoff-Zern, 2014; Mares, 2019), by highlighting farmworker agency in a different context. In particular, our research shows how individuals who migrate to informal settlements face various social, political, economic, and environmental challenges; however, some successfully used collective agency to increase their resilience, even in the face of these challenges.

6. Conclusion

This research highlights how an often invisiblized population–farmworkers living in informal settlements in agricultural regions–self-organize to increase their resilience through forming associations, collaborating with other community groups, and working in conjunction with landowning farmers. This research speaks to the importance of *prefigurative politics*, *commons praxis*, and *economic autonomy* in strengthening community self-organization and consequently, community resilience (White, 2017, 2019). Our research also identifies some limits to self-organization, including internal corruption, undemocratic decision-making, a lack of community participation, inefficient communal resource sharing, and frustration with monthly fees. Our findings contribute to reframing dominant narratives that describe migrants and other farmworker populations in the Global South and Global North as powerless in the face of multiple social-ecological changes and challenges. Conversely, our findings show that many migrant and informal farmworkers strategically cultivate collective agency, which has increased their access to land and water. Moving forward, increased scholarship on documenting and analyzing vulnerabilities of invisibilized communities and more importantly, how invisibilized communities address their vulnerabilities by cultivating community resilience, could continue to shift how society as a whole supports these communities.

Data availability statement

The datasets presented in this article are not readily available because it is interview data with some sensitive information, including home addresses and other identifiable information. This was required for analyzes but cannot be shared because of IRB requirements. Requests to access the datasets should be directed to anna.erwin@utrgv.edu.

Ethics statement

Data collection procedures for this study were approved by Purdue University Institutional Review Board (IRB). The IRB waived the requirement of written informed consent for participation from the participants because many of the participants could not read or write. We did obtain verbal consent from all participants to collect and record interviews. All participants were also given the option to withdraw from the study and refuse participation or recording at any time.

Author contributions

AE led the conception of the article, and led the acquisition, analysis, and interpretation of the data. CS participated in the conception of the article, and participated in the acquisition, analysis, and interpretation of data. ZM led in the acquisition of data, and participated in the conception, analysis, and interpretation of data. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2023.1160109/full#supplementary-material

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Sustainable agriculture and food sovereignty in Haiti: sharing knowledge and shaping understanding of food systems at the University of Fondwa

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The Association of Peasants of Fondwa (APF), a grassroots organization led by a visionary Haitian Spiritan priest, established the private nonprofit University of Fondwa (UNIF) in Haiti in 2004. The University aims to fill a gap in educational opportunities for rural youth and to develop community leaders able to steward food security, sustainable farm animal husbandry, and small business development. Since the institution's foundation, University faculty members have explored low-input sustainable agriculture techniques, which were inspired by strategies shared earlier by Cuban agronomists and adapted to the Fondwa region's mountainous terrain. While the University has faced and continues to confront many challenges related to its sustainability as an institution, this article describes the processes by which its faculty and students have conducted diagnoses of soils and crop choices, the innovations they have developed and introduced to improve harvest productivity in rural Haiti and, especially, the ways and means by which they have sought to share such (re)thinking of traditional practices with local farmers. We argue that the University of Fondwa faculty's close collaboration with local farmers and the agricultural techniques they have refined thereby have not only improved food security for the families involved but have also contributed to the creation of social capital in the countryside and enabled participating Haitian farmers to imagine a path toward food sovereignty. In addition, by educating farmers and providing them tools to improve their food production, the University has worked to close the deep inequality gap that exists between urban and rural Haiti.

KEYWORDS

Haiti, food security, food sovereignty, subsistence farming, university-citizen knowledge generation and transfer, reimagining food systems

1. Introduction

This article explores the contributions of the University of Fondwa, a nongovernmental rural higher education institution founded by a Spiritan priest in conjunction with the *Asosyasyon Peyizan Fondwa* (APF) a local peasant organization, to address the problem of food insecurity and inequality in Haiti through community engagement, creation of social capital, research, and dissemination of know-how concerning sustainable agriculture. We distinguish between food

security and food sovereignty in this analysis (Steckley et al., 2023). While food security focuses on the availability and sufficiency of nutritious food, food sovereignty is concerned with the complex relations of inequality and power (local and global) embedded in food systems. That vision, "promotes [a] democratic rights-based model that not only advocates the right to healthy and nutritious food, but also the right to determine the structure of the food system, including how food is produced, as well as the social and ecological relations that intersect food production (La Via Campensina, 2007 in Steckley et al., 2023, p.3). While "food security" is compatible with neoliberal thinking and intensive and unsustainable agriculture and labor exploitation, the concept of food sovereignty, developed in 1996 by the global peasant movement "La Via Campesina," is not. Instead, it focuses on reducing the influence of global capitalism in food production and advocates for "diverse, sustainable and democratic food provision systems across the globe (Wittman, 2015, p. 179).

Haiti adopted a Policy for Food Security, Sovereignty, and Nutrition in 2018 [Pierre, 2010; Politique et Stratégie Nationales de Souveraineté et Sécurité Alimentaires et de Nutrition en Haiti (PSNSSANH), 2018]. That statute formally embraced food sovereignty as the way forward for the country. Nevertheless, the government of Haiti has traditionally had little presence in the countryside, and the assassination of President Jovenel Moise in 2021 made the nation's security and economic situation still more fragile. We contend that, notwithstanding the many challenges the country faces in ensuring food security for its population and beginning well before the nation's 2018 policy statement, the University of Fondwa has worked to promote not only improved food security by introducing more sustainable forms of food production, but also to foster food sovereignty by providing assistance to small farmers, involving community leaders in locally appropriate agricultural innovations, and educating young rural leaders.

2. A changing agricultural firmament

Haiti occupies a land area of 28,000 square kilometers and is divided into 10 departments. Mountains comprise about 70 percent of the country's territory and roughly the same percentage of its nearly 10 million residents live in its 570 rural communal sections while 30 percent of its people reside in the nation's urban centers. As suggested above, historically, the Haitian countryside has been quite disconnected from its urban areas, and the government's 18 Ministries and State Secretariat are unable to provide even basic public services to citizens living in rural locations (Philippe, 2012). The word "peasant" appears on the birth certificates of people born in communal areas and those living there have long been stereotyped as poor and stupid. Haiti remains the poorest country in the Latin America and Caribbean (LAC) region and among the poorest countries in the world. In 2021, Haiti had a GNI *per capita* of US$1,420, placing it significantly below the lowest in the LAC region, which averaged US$15,092. On the UN's Human Development Index, Haiti ranked 163 out of 191 countries in 2021. In 2021, 65 percent of households experienced a deterioration in their incomes compared to the years before the pandemic, indicating that an already high poverty rate has most likely risen. In line with these results, World Bank estimates suggest that in 2021 poverty likely increased to 87.6 percent ($6.85/day), 58.7 ($3.65/day) and 30.32 percent when using the most extreme definition of poverty ($2.15/day). Haiti is also among the countries with the greatest inequality in the region. This is largely due to two thirds of the poor living in rural areas and the generally adverse conditions for agricultural production there, creating a welfare gap between urban and non-urban areas (World Bank, 2023).

While Haiti evidences a pedoclimatic (a microclimate with soils that integrate the combined effects of temperature, water content, and aeration) soil diversity that could permit cultivation of a wide range of crops throughout the year, in the period from March to June 2022 nearly 45% of the Haitian population, or 4.5 million people, nonetheless needed urgent food assistance (Coordination Nationale de la Sécurité Alimentaire, 2022). The food crisis in Haiti is linked to a marked decline in the degree of food sovereignty the country enjoyed until the1990s. Prior to that decade, the nation had produced about 80% of the food necessary to sustain its population. The overall lack of infrastructure and heavy reliance on rain-fed agriculture in Haiti also affects the nation's food production. Additionally, farmers' limited access to credit means that most agriculture is practiced at the subsistence level.

As a result of the neoliberal Structural Adjustment Policies imposed in the late 1980s and retained into the 1990s, the overall tariffs levied on agricultural product imports from the United States (U.S.) dropped from 40–50 to 4.5% during that period [Ministère de l'Agriculture des Ressources Naturelles et du Développement Rural (MARNDR), 2010a; Theodat, 2017]. More specifically, rice tariffs dropped from 50 to 3%; maize from 50 to 15%; bananas, wheat, and chicken import duties from 40 to 5%; and egg and milk import fees from 40% to 0 (Pierre, 2010; Steckley et al., 2023, p.8). These measures undercut the competitiveness of locally produced food vis-á-vis items from the U.S. and increased the vulnerability and food insecurity of Haitian farmers.

The so-called Washington Consensus, underpinned by neoliberal ideology concerning how best to promote economic and social development, has driven the perspectives of the United States government as well as those of many other Western nations since at least the first term of the Reagan administration (1981–1985). That perspective redefined "food security" and distinguished it from "food autonomy." Today, food security, is linked to the purchasing power of consumers, rather than to a country's agricultural production [United States Agency for International Development (USAID), 2000]. In this view, in a closely connected world, crops should be produced where they can be grown most efficiently and traded in the international market on the same basis. Neoliberalism calls for maximizing the role of markets in society as arbiters and mechanisms of social choices while minimizing the role of democratic decision-making. Indeed, U.S. President Ronald Reagan declared in his first inaugural address that government was the central problem confronting Americans and, by extension, other societies. Prime Minister Margaret Thatcher echoed that claim in the United Kingdom and that assertion and assumption were soon ensconced in the policies of major bi-lateral and international aid institutions and exported around the world. That ideology also emphasized the efficiencies that would purportedly arise from governments contracting with nongovernmental and for-profit entities to deliver their services whenever possible. As Harvey (2007) has succinctly characterized this political rationale:

> Neoliberalism is in the first instance a theory of political economic practices that proposes that human well-being can best

> be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong property rights, free markets and free trade. The role of the state is to create and to preserve an institutional framework appropriate to such practices. … State interventions in markets (once created) must be kept to a bare minimum because, according to the theory, the state cannot possibly possess enough information to second-guess market signals (prices) and because powerful interest groups will inevitably distort and bias state interventions (particularly in democracies) for their own benefit (2007, p. 2).

The adoption of this trade liberalization policy made it impossible for poor unsubsidized Haitian farmers, with limited access to technology and fertilizers, to compete with heavily supported growers in the United States and elsewhere and made the country increasingly dependent on the availability of cash, and foreign currency in particular, for the acquisition of the food necessary to feed its population. In addition, the continuous depreciation of the Haitian Gourde in recent years has reduced the purchasing power of households, which, as a result, have become increasingly food insecure [Banque de la République d'Haïti (BRH), 2021; United States Department of Agriculture (USDA), 2021].

Currently, only 50% of the food consumed in the country is produced domestically. That is, Haiti is highly dependent on food imports, valued at almost $1 billion USD per year (Ford and Dorodnykh, 2016). A quarter of this amount is for rice, which represents approximately 11% of the total food expenditure of urban, and 6% of rural, households. In fact, as explained above, the once flourishing Haitian rice industry has now largely been displaced by imports of that staple from the United States.

The presence of international nongovernmental organizations (INGOs), and of their donated food and seeds has also contributed to Haiti's declining capacity to attain food sovereignty. For generations, prior to the advent of neoliberal trade policies and a global emphasis on major crop production, Haitian farmers in rural communities had grown native corn, peas, and sorghum. These locally sourced plants were high in nutrients and well adapted to the country's often steep terrain and to its climatic conditions. However, beginning in the 1990s, INGOs began to provide farmers with free, genetically engineered seeds on the view, nominally, of helping them improve their crop yields. As a result, many growers largely abandoned native varietals. The new cultivars, however, were not well adapted to Haiti's soils and weather. In addition, as genetically engineered crop yields have decreased over time, farmers have had to buy seeds each season after INGOs stopped providing them free. This has made Haitian growers, the largest share of whom, as we have noted, operate on a subsistence or near-subsistence basis, even more dependent on the availability of currency and forced them to use a significant portion of their scarce (and declining) available cash for that purpose. That fact, in turn, has resulted in a rise in malnutrition and related health problems in the nation's rural population especially.

Haitian food dependency is not limited to crops, but also extends to livestock and fish. Goats and cattle are the most commonly raised animals in the country; goat herds were last estimated at 2,500,000 and cattle at 1,500,000 in 2020 (FAO, 2020). According to the same source, in 2020, there were 1,500,000 pigs, and 10,500,000 chickens. However, despite this level of livestock production across the country, Haiti's meat imports have grown to more than $161 million USD per year, with poultry alone representing more than 50% of that total [Banque de la République d'Haïti (BRH), 2021].

With this background in place, we next outline briefly the history and orientation of the University of Fondwa. Thereafter, we explore how UNIF faculty members, and their students are addressing specific crop vulnerability issues by partnering with local farmers to explore fresh possibilities. Finally, we address the evolving outcomes of those efforts. We conclude by arguing that notwithstanding the many challenges the University of Fondwa has faced and continues to confront, its faculty and students have opened up possibilities for improving agricultural sustainability and food sovereignty in rural Haiti, as well as for reducing the gap in terms of social capital and access to resources between the countryside and urban areas. While the University today relies on the financial support of external donors to operate, its roots in, and strong ties with, Haiti's rural communities and farmers and the fact that it is managed and run by local leaders with deep knowledge of the nation's agricultural heritage is contributing to efforts to develop the conditions necessary for food sovereignty in Haiti's rural communities.

3. Higher education in Haiti and the origins of UNIF

Gaventa and Cornwall (2008) have argued that knowledge, power, and freedom are inextricably intertwined. Human insecurity results from existing structures of power determining who enjoys what modicum of security. Such structures can be identified at the local, state, and global levels. The solution to deep inequalities requires much more than providing individuals with economic resources; it also demands ensuring access to basic human rights and equipping individuals with knowledge that enables them to make life choices. As Gaventa and Barrett have observed, as citizens may not see themselves with the power to act, focusing on participation alone is insufficient to encourage exercise of their agency. So understood, an increase in social knowledge is also needed to broaden people's engagement to secure that result (Gaventa and Barrett, 2012, p. 2402).

Following the fall of the Duvaliers in 1986, Haiti entered a period of democratic transition, characterized by a multidimensional liberalization of life in the country. While primary and secondary education have since become relatively more accessible to a greater percentage of the population, Haiti remains far from attaining the United Nations sustainable development goals developed for that domain. According to studies of the Haitian educational system conducted by the World Bank (2018) and UNICEF (2018), the net enrollment rate for primary school in Haiti was 55% in 2018, while that for secondary schools was 17%. These percentages vary significantly by region within the nation with enrollment figures generally higher in the country's urban centers.

Traditionally, government and international funders have emphasized support for the country's primary schools. Nevertheless, in the aftermath of the 2010 earthquake, former president René Preval also proposed expanding enrollment and funding for higher education. Preval's successor, Michel Martelly, also indicated that he viewed post-secondary education as a priority, symbolized by his decision to name the nation's first undersecretary for higher education (Downie, 2012, p. A8). Nevertheless, higher education institutions in

Haiti do not possess sufficient capacity to meet potential demand. According to data from the UNESCO Institute for Statistics (2021), only about 1% of the population of Haiti aged 25–64 had completed a higher education degree. For the academic year 2020–2021, the nation's K-12 education system produced about 70,000 graduates [Ministry of Education and professional training of Haiti: Bureau national des examen d'état (National Office for official Exams) (BUNEXE), 2021], while the State University of Haiti (UEH) and the network of public university locations in the provinces, had an enrollment of approximately 24,000 students. UEH's inability to address the demand for higher education in the country, both in terms of capacity and in curricular offerings, has spurred the creation of private universities. Private (for-profit and nongovernmental) higher education institutions in Haiti today play a significant role in higher education, enrolling perhaps 60% of all tertiary students in the country. Financing remains a major constraint for both public and private higher education institutions in Haiti, with many struggling to secure sufficient resources to provide quality education to their students.

As we have noted, farmers from Fondwa, led by a Spiritan priest born and raised in that community, Joseph Phillippe, created a grassroots organization called *Asosyasyon Peyizan Fondwa* to respond to these challenges in 1988. The group included in its aspirations the creation of a nongovernmental university whose mission was to help to create the conditions necessary for grassroots local organizations in Haiti to create wealth in their communities using locally available resources. Since its inception, APF has also provided essential public services to Fondwa, including road construction, reforestation initiatives, a health center, an orphanage, primary and secondary schools, a radio station, and a credit union. In 2001, to celebrate the 200th year anniversary of Haiti's independence, APF organized several public gatherings, which included peasant farmers as well as professors from the University of Havana, Cuba, and educators from the United States, to address the broad question of how best to serve its community's rural population. Paulo Freire, the legendary Brazilian thinker and pedagogue, inspired and informed those conversations (Freire, 1970/2000), which generated the founding ideas and ideals for what became the University of Fondwa. Participants suggested UNIF should be underpinned by a "popular education" methodology and structure; one through which peasants and international collaborators would be engaged as professors and students. The participants in these meetings identified three principal objectives for UNIF and argued that its curriculum should:

1) ensure that marginalized groups become aware of their situation (what Freire called "conscientization"),
2) encourage individual and collective efforts to build a more just society, and
3) press for needed social change (Philippe, 2013, unpublished remarks).

Guided by this vision, the University of Fondwa opened in 2004. Since its creation, UNIF has sought to work with the country's peasants, and especially those in its region (disproportionately subsistence or near-subsistence farmers), to organize and address their needs collectively. The University's leaders have embraced the view that educational opportunities ultimately must be made available throughout rural Haiti if the nation is to nurture and retain intellectual capital in those regions and develop a workforce able to participate in, and stimulate, local development. Put differently, University faculty and leaders have viewed the engagement of the peasantry in all of Haiti's 570 communal sections through participatory processes as a principal engine for long-term national economic and social development (Philippe, 2013, unpublished remarks).

In a personal interview with two of the authors in 2012, the University's founder suggested that to create wealth in a community it is necessary to work at different levels to encourage and retain social capital within it (Philippe, 2012, unpublished personal interview). Philippe saw APF's creation of the University of Fondwa as well as of a K-12 school located nearby as part of a strategy to secure development in his home village and, as an exemplar initiative for rural Haiti more broadly. In pursuit of this aspiration, UNIF has sought to strengthen agricultural production, enhance conditions for food sovereignty, and create social capital by educating rural students and conducting research in three domains: veterinary medicine, agriculture, and business management. The University's founders hoped the institution would help Haiti's peasant population to become active and responsible citizens; ensure social and economic progress in rural areas; and become a leading entity in efforts to ameliorate poverty and inequality by creating know how and social capital.

In particular, the 2012 UNIF strategic plan, whose central elements remain in place today, embraced a mission centered on peasant culture and sustainability to break a cycle of dependence on external support:

> The university will be based on a *solid ethical foundation* that respects the Haitian peasants' cultural identity, their set of values. For instance, the university will be founded on the *principle of solidarity*. The university will be based on the *principle of popular education*. That means it takes as its starting point the peasants' life experiences. … The philosophy of the university and all the subjects taught should also be based on the *principle of sustainability*. The students must be prepared in such a way that they learn to minimize their dependence on external factors and instead maximize the self-management and development of their communities. In other words, they become promoters of independence rather than dependency (University of Fondwa business plan, 2012, unpublished, emphasis in the original).

UNIF's leaders and faculty members see students not only as apprentices, but as agents of development, charged with a moral responsibility to contribute to their communal sections of origin. Father Philippe's original vision called on communities to recommend students for the University, through APF-created Local Development Committees (LDCs), grass roots self-government institutions, which would include local public professionals and organizations heads. As envisioned, each LDC would select three students in its communal section and support their education. In turn, the students would put their expertise at the service of their communities. During their education, students would be engaged in internships in the completion of which they would be expected to identify available resources and fashion possible initiatives for wealth creation (Stephenson and Zanotti, 2020).

While this mechanism has never worked as initially envisaged, due to the financial challenges confronting Haiti's rural communities, at the time of this writing (September 2023) six LCDs have been able

to fund UNIF students since the university's founding. In the 2021–2022 academic year, more than 70% of students in UNIF's School of Agriculture completed internships in institutions previously created by university graduates, while 72% of those graduates now have stable jobs or are successful entrepreneurs.

In the two most recent classifications of Haitian universities, UNIF was ranked among the first 20 of the more than 200 higher educational institutions in the country (Lafleur, 2022; UniRank, 2023). However, the University of Fondwa continues to face constraints that threaten its survival as an institution. More than 50% of the university's operating budget is comprised of external donations. That fact, and its fluctuations across time, has prevented the institution from increasing its full-time faculty and improving its research capacities. Moreover, to secure its economic survival, UNIF has increasingly accepted students without grants, which limits its leverage to address its rural development mission, as students without support do not necessarily have strong ties with specific communities in the countryside.

In 2016, UNIF was able to secure the continuing support of a few main donors through the auspices of its U.S. fundraising arm. Having achieved a degree of financial security and stability since, the University's leaders and relevant faculty have sought deliberately to address several challenges related to Haitian food sovereignty. In the roughly two decades since its foundation and notwithstanding the challenges it continues to face, given the macro-scale difficulties in the country, UNIF's small faculty has developed a solid knowledge of mountain agriculture, a know-how essential to cooperating with, and assisting, more than 80% of the country's farmers. The research and outreach activities we describe next suggest that through its practices and vision in this domain, University faculty are assisting their targeted population through a combination of modern and traditional practices. Fondwa faculty have sought to devise experiments to test possible innovations in agricultural methods in constant collaboration with local farmers. That approach seeks to ensure that area growers are vested in, contribute to, and are knowledgeable of, the potential benefits and costs of possible changes in their crop selection and planting, maintenance, and harvesting practices to the maximum extent feasible. To date, the University has developed and tested several practices in this way that have not only increased soil productivity, but also reduced the vulnerability of those who adopted them and created social capital by simultaneously ensuring that a cohort of youth with strong ties with Haiti's rural communities—UNIF's students—are aware of those innovations and farmer experiences with each.

4. A word on methods and our analytic stance

The authors of this article have been working in partnership for approximately 12 years as faculty members of our respective universities. We have visited one another's institutions, shared resources and experiences via frequent conversations, and learned deeply from one another in so doing. As such, this article is the product of sustained interinstitutional as well as individual collaboration. We report on University of Fondwa efforts based on the research and experience of faculty who have played major roles in those efforts. We likewise examine Haiti and Haitian food security and sovereignty more generally, through the lens not only of interested outside observers, but also from the perspective of those living in one of that nation's poorest regions working to develop a more sustainable future for its citizens. Given these realities, we cannot and do not claim "neutrality," but instead hope very much that we are cooperatively engaged in sharing the knowledges we each bring to our collaboration for the betterment of the Haitian population and especially its most poor and vulnerable.

It must also be noted that the realities of institutional capacity and the state of the social, political and economic context in present-day Haiti generally and in Fondwa more particularly, have mediated the availability of systematic data for this study. For instance, differently from state sponsored studies on soil fertility conducted in India (Reddy et al., 2022), Haitian scholars cannot rely on soil fertility maps or a national soil fertility management strategy since neither exist in the nation. As documented below, international NGOs, such as the Red Cross or Objectif Tiers Monde, as well as universities located elsewhere including the University of Louisiana, have supported a share of UNIF's local projects, which, when successful, can be replicated in other rural regions. However, these initiatives cannot yield the results and/or vast comparative data sets that large projects backed by considerable government funding may be expected to produce. Moreover, the overall lack of a coordinated state strategy for agricultural development constitutes a considerable challenge for UNIF and for the Haitian agricultural sector more broadly. The UNIF faculty work collaboratively with farmers not only to identify salient production concerns, but also to ameliorate or overcome ongoing crop related issues as they arise. While they collected some data, for example, on yield differences with alternate planting techniques (which we cite where available), time and resources have not yet permitted that group to develop a systematic quantitative measures approach to the multiple valences of the implications of those interventions. While at least to date the UNIF faculty have not enjoyed sufficient capacity or resources to measure systematically the diffusion patterns of the innovations that they have collaboratively developed, the evidence they possess is not trivial, and the Fondwa faculty have sought to share it via informal farmer networks. We are persuaded that the long-standing engagement of the authors of this article with UNIF together with the original data collected by UNIF faculty and students provides a solid basis for our judgments of that institution's relative impact on Haitian rural communities' steps in the direction of food sovereignty.

5. Challenges to Haiti's food production system

In addition to being threatened by the neoliberal trade conditions and policies we have described above, food production in Haiti continues to face challenges that have arisen from its history as a post-colonial state, its geographic location and geomorphology. The landownership regime inherited from the French, which has resulted in extreme fractionation of land and land ownership, the widespread deforestation arising from colonial exploitation of the land to produce sugar cane and cotton, as well as from current practices of charcoal production, the mountainous terrain, the fact that Haitian agriculture is mostly rain fed, and the nation's location in an area prone to extreme

weather events, are all factors that continue to pose obstacles to the country's farmers.

5.1. The Haitian land ownership system

The legacy of French colonization has shaped the Haitian land ownership system. Even after achieving independence, Haiti followed French land law, which prescribed the equal subdivision of agricultural plots among heirs. Thus, with the increase in the country's population, the size of inherited plots has decreased considerably, even though this phenomenon has been somewhat mitigated across time by emigration and urbanization (Barthélemy, 1989; Smucker et al., 2000). The majority of farmers in Haiti own very small plots, with more than half (53.71%) holding less than 0.387 hectares. Only 21.14% have access to more than 1.29 hectares. Approximately 7.43% of the 8, 000 farmers in the Fondwa area would be considered by existing definitions not to be working on "small farms." Indeed, plots of less than 0.387 hectares might more accurately be referred to as "micro-farms" (Scruggs et al., 2021). Figure 1 provides an overview of land ownership in the Fondwa region, which evidences this pattern.

The colonial exploitation of Haiti's arable agricultural land also played a critical role in creating the nation's current widespread deforestation, as wooded areas were cleared to make way for plantations of sugar cane, cotton, and indigo (McClintock, 2004). Meanwhile, charcoal, which provides 85–90% of Haiti's domestic and industrial energy production, is presently the nation's major cause of continuing deforestation (Bargout and Raizada, 2013).

Since the mid-1980s, the country has witnessed an unprecedented rural–urban migration, which has reduced the countryside population and agricultural workforce. Overall population growth has in the meantime raised the demand for food, with a consequent increase of intensely cultivated land and an overall drop in soil fertility [World Bank, 2019; FAO, 2020; United Nations Development Programme (UNDP), 2021]. The upshot of these trends is that ultimately, Haitian farmers have been challenged to produce more food on less arable land.

5.2. The climate

Haiti enjoys a mild climate suitable for growing a variety of crops, with the annual temperature range varying from 20 to 35°C and average rainfall exceeding 3,000 mm [United States Agency for International Development (USAID), 2018]. However, 60% of the nation's territory has a 20% slope or greater (Hylkema, 2011), which makes it particularly vulnerable to erosion and renders large areas unsuitable for mechanized farming. Meanwhile, the Caribbean basin is at the crossroads of major climatic depressions in the western hemisphere. Haiti's losses to natural disasters during the period from 1995 to 2013, for example, have been estimated to total $8.5 billion [United Nations Office for Disaster Risk Reduction (UNDRR), 2015]. The United Nations Office for Disaster Risk Reduction has calculated the material damage caused by cyclone Matthew in 2016 alone to be $1.9 billion in the departments of Grande-Anse, South, and Nippes [United Nations Office for Disaster Risk Reduction (UNDRR), 2015]. The United Nations Food and Agriculture Organization has estimated that agricultural losses from that single storm were $580 million, or 29.47% of the total value of Haiti's overall costs arising from that event (United Nations. UN News: Global Perspective/Human Stories, 2016). Disasters such as Hurricane Matthew affect food production for several years following their occurrence and thereby threaten the overall food security of the Haitian people while simultaneously dramatically increasing the vulnerabilities of the country's farmers.

5.3. Food production and consumption in Haiti

As mentioned above, Haitian growers raise a diverse array of crops including cereals (rice, maize, sorghum), legumes (beans, groundnuts) and root vegetables and fruits (yams, cassava, potatoes, bananas). Together, these constitute the basis of the Haitian diet (Pressoir et al., 2016). Notwithstanding this diversity, these foodstuffs are by and large genetically degraded today in Haiti and are providing decreasing yields. Access to quality seeds, including heirloom varietals, and

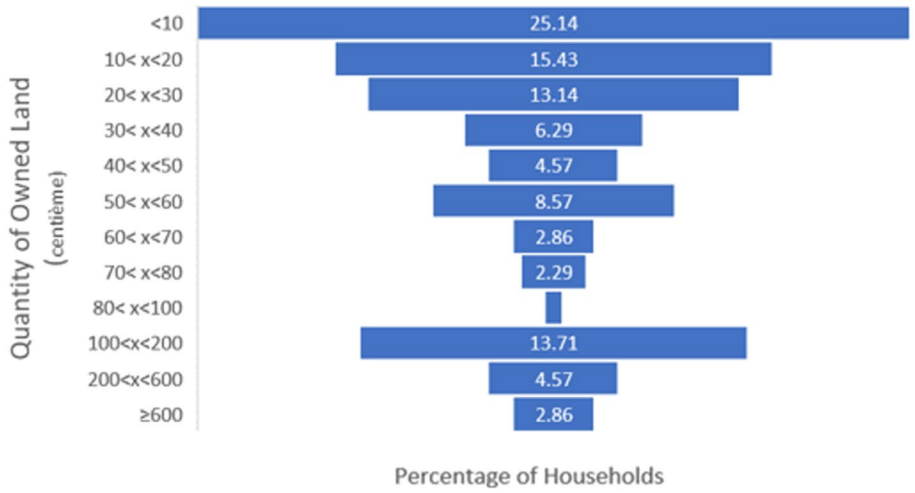

FIGURE 1
Land ownership in Fondwa. Source: Scruggs et al. (2021).

fertilizers remains very limited, particularly in remote rural areas, where road infrastructure is often poor or non-existent.

Approximately 85% of food crops grown in Haiti are consumed domestically (Pressoir et al., 2016). However, that production is insufficient to address the nutritional needs of the major share of the nation's families, who, as noted above, purchase most of the food they consume (Daméus and François, 2017). For example, a survey conducted by the University of Fondwa (Scruggs et al., 2021) found that 41.4% of Fondwa's population is living with some degree of food insecurity. That finding is in line with the national average for Haiti.

The storage and distribution of agricultural products also presents marked challenges. Many areas with relatively high production or production-potential are not connected to markets by main roads and remain virtually inaccessible during the rainy season. Thus, close to 50% of produce, especially fruits and vegetables, perishes before reaching markets. Storage and refrigeration infrastructure are also limited, forcing farmers to sell their products immediately after harvest. The overall fragility of the storage and distribution chain contributes to high seasonal price variations and to an often-poor quality of available fruits and vegetables [Ministère de l'Agriculture des Ressources Naturelles et du Développement Rural (MARNDR), 2010b; Theodat, 2017].

The lack of a storage and distribution infrastructure deeply affects the Haitian population's food security and sovereignty. On the one hand, the inability of farmers to sell agricultural products contributes to reduced food production and encourages rural exodus. On the other hand, the price of the limited amount of locally grown agricultural commodities reaching consumers in good condition often makes them non-competitive with imported goods.

6. The University of Fondwa's contribution to Haiti's food sovereignty

The faculty of the University of Fondwa have addressed the issues highlighted here through a combination of community (peasant farmer) engagement and technical initiatives designed to improve agricultural yields, increase the nutritional value of crops, and maintain and replenish arable land. That is, University of Fondwa teaching and research are deeply community-based. Initiatives are identified by local actors, such as farmers and representatives of grassroots or partner institutions, along with students and professors. The faculty seek to address grower concerns through recursive experimentation, starting with pilot projects, and involving progressively larger numbers of farmers.

We here highlight University initiatives regarding soil fertility management, crop rotation, and high yield and nutritional value crops. Perhaps more importantly, we also profile the community engagement approach UNIF faculty has employed to develop these efforts. The University's agricultural programs have been tested and introduced in close partnership with farmers positioned and willing to risk innovation. Those growers, who are generally better educated than many in their region and have larger plots, are playing an important pioneering role in bringing about changes in food production practices in their communities. The relatively impoverished population of Haiti's rural regions (including that in which Fondwa is located) has traditionally proven risk averse and reluctant to experiment with changed production processes or new crops or varietals due to the potentially catastrophic—indeed in too many cases, life threatening—costs implicit in doing so. We contend that, while facing many challenges, the model UNIF has employed in which local farmers are not only the recipients of knowledge, but active partners in its co-production, is improving the potential for food sovereignty in the area the institution serves.

The University's experience suggests that when tightly connected to rural communities and willing to co-produce relevant knowledge that reflects not only expert understanding, but also the lived experience of farmers, higher education organizations can play an important role in changing established agricultural practices and in improving the food security of subsistence farmers. UNIF's engagement with local growers has emphasized five areas, which we briefly describe below: Improved management of water and soil fertility through crop rotation and association, introduction of short cycle varieties of cultivars, increased focus on sustainable and high yield edible roots and tubers, soil enrichment through the development of organic fertilizers; and improved fallowing practices. In addition, as we also document in this study, UNIF has contributed to closing the rural–urban gap by creating a cohort of educated local leaders. In this way, agricultural practices have increased Fondwa's rural communities' overall social capital.

6.1. Effective management of water and soil fertility

Due to its location in a rural mountainous area, where agricultural production is rainfed due to farmers' lack of capacity to invest in irrigation systems, University of Fondwa faculty members have specialized in high-altitude and organic production strategies. As such, UNIF's faculty share the view that no remediation effort in the Haitian food sector is possible without special efforts to protect the country's soils. To counteract systemic soil degradation, Fondwa faculty have engaged in preventive conservation efforts in concert with farmers to devise and test practices to limit erosion. Advocating for conservation agriculture, UNIF faculty have popularized the value of organic waste, including animal waste, in improving soil fertility. Indeed, research conducted by the University's faculty and students has demonstrated that it is possible to quadruple the yield of cultivated plant species with the use of organic fertilizers. Bossejour (2020), François (2021), and Laguerre (2021), for example, have demonstrated that the yield of bell peppers increased by 110%, the yield of eggplants increased by 150%, and the yield of beets increased by 180% by using chicken manure, horse manure, and guano as fertilizing agents, respectively. These studies were conducted in close collaboration with a sample of farmers from Fondwa. Once the efficacy of this effort had been demonstrated, 80% of local farmers adopted these methods in the next growing cycle. This soil conservation management approach consists of an integrated program, spanning from soil preparation to harvesting. During planting preparation, organic waste, which would otherwise be burned in conventional Haitian agriculture, is buried instead, to increase the clay-soil humic complex, which is essential for the vitality of the micro-organisms necessary to create organic matter. To support this soil-organic matter management system,

UNIF faculty have advised farmers with whom they are working at the beginning of every season to put earth retention structures in place to reduce erosion and limit displacement.

In addition to the use of organic waste, UNIF faculty have promoted crop association. Lack of rotation and the abuse of a monoculture planting system generally forces peasant farmers to overuse synthetic fertilizers to compensate for the soil nutrient deficiencies that arise from intensive use. Such fertilizers are expensive, not readily available in Haiti, and make farmers dependent on imports. This combination of factors increases growers' vulnerability to weather events and their general insecurity. To address this scenario, UNIF faculty have worked with local farmers to promote crop rotation and association as ways to reduce soil depletion and fertility loss. University researchers have documented the fixation of natural nitrogen by beans and groundnuts, and the significant effect of intercropping on the yield of maize and beans that results from capitalizing on that fact in planting and production design (Benjamin, 2021; François, 2021; Spaddy, 2021). An example is the association of maize (*zea mays*) and beans (*Phaseolus vulgaris*) planted in a common furrow. Beans, being a legume, fix nitrogen from the air and store it in their roots. At the time of their senescence, which precedes that of maize, beans release huge amounts of nitrogen into the soil, which fertilize the maize, contributing to a considerable increase in corn yield averages. This spatio-temporal approach to soil management also conserves water, thereby reducing the risk of flooding downstream. UNIF faculty members have tested this rotation and association approach repeatedly and it has now been adopted by many peasant farmers in the Fondwa area.

6.2. Short cycle varieties

UNIF faculty are currently experimenting with an innovative plant variety selection project, aimed at identifying high-performance substitutes for the pigeon pea (*Cajanus cajan*) and sorghum (*Sorghum bicolor*) varietals grown throughout Haiti. While the pigeon pea and sorghum forms selected as possible replacements by UNIF faculty have been in use in Haiti in various locations for more than 5 years, many farmers are not yet aware of these alternatives. Fondwa faculty and students have worked in partnership with an international NGO (Objectif Tiers Monde) and with 100 local Haitian farmers to test the adaptability of two such sorghum varieties in the communes of Carrefour and Léogâne in the West department of Haiti near the University. The project has sought to introduce varieties with a life cycle of about 3 months to obtain better agronomic performance than can be attained with traditional crop choices. The results suggest that short-cycle sorghum is highly appreciated by Haitian farmers. In adaptation tests of two sorghum varieties conducted in 2021 for about 1 year with 120 farmers, UNIF faculty found that short-cycle sorghum offered a yield of 1,400 kg/ha, which surpassed the yield of the traditional variety of sorghum (500 kg/ha) by 110%. Following conversations with focus groups conducted with the primary beneficiaries of this sorghum extension program, UNIF researchers estimated that the number of adopters of these varieties in the test area would likely double each year thereafter until fully substituting for the traditional varieties across the country (Joseph et al., 2021, unpublished report).

6.3. Edible roots and tubers

As highlighted above, Haitian farmers and the country's general population are dependent on imported food commodities, especially rice. UNIF's agriculture faculty and leaders believe that, in order to obtain food sovereignty and reduce food insecurity, Haiti must promote plant production that fosters farmers' autonomy—via seed supplies—that exhibit vigorous adaptive capacity in most agrosystems of the country and that also evidence drought and disease resistance/tolerance and produce higher yields than existing forms. A few species of edible roots and tubers (*Ipomea batatas, Discorea* sp., *Manihot esculenta*) meet all of these criteria and University faculty are now working with Fondwa area growers to develop ways to produce these varieties on existing farms. In addition, researchers have conducted multiple field experiments to identify factors that can improve yield and/or control pests and disease in the existing varieties of these crops (Innocent, 2020). This is to say that faculty recognize that not all local growers will be ready or able to take risks to adopt the suggested changes in their existing practices.

Fondwa faculty researchers were among the first to demonstrate that yams can be produced with one third of the seed volume generally used by Haitian farmers. UNIF faculty have also obtained especially promising results with the sweet potato, a very popular food item in the Haitian diet, whose varietal biodiversity facilitates its planting and production throughout the year. To date, University researchers have worked with Fondwa's farmers to introduce four fortified varieties of sweet potato: Tibêta, *Lespwapeyizan*, *Tiokap*, and *Beauregard*. *Beauregard*, a variety rich in nutrients, has so far been found in testing by local (Fondwa area) farmers to be the most productive of these crops. According to two recent studies conducted in the Fondwa region, the *Beauregard* variety yielded around 20 t/ha, which represents a 400% increase above the national average yield [Ministère de l'Agriculture des Ressources Naturelles et du Développement Rural (MARNDR), 2019; Innocent, 2020]. Despite its high productivity, however, the adoption rate of this variety has not yet surpassed 20% due to its starchy texture when cooked, which is not favored in Haitian cuisine. UNIF is now working with its students and in partnership with a team of researchers from the University of Louisiana (United States) to ensure that farmers throughout the nation become aware of the productivity advantages of the *Beauregard* sweet potato.

6.4. *Terra preta*, medicine for degraded lands

As noted above, the pressure exerted on the soil by intensive cultivation has led to its degradation in many of Haiti's agrosystems. One response to this challenge adopted by UNIF faculty and their local partners is the nurturance of better soil. *Terra preta* loam is characterized by a dark brown to black color and varies in thickness from 50 cm up to 2 meters (Baize and Girard, 2008; Kern et al., 2009). These soils are native to the Amazon Basin in Brazil, to Ecuador and Peru, as well as to West Africa (Benin and Liberia) and the savannah of South Africa. *Terra preta* fertility is much higher than other soils because of its organic matter and nutrients, including nitrogen, phosphorus, potassium, calcium, magnesium, and manganese (Glaser et al., 2001). Researchers around the world have focused on recreating

the conditions for formation of these loams. Based on promising results of multiple experiments, some scientists have argued that *human-made Terra preta* could serve as a model for the development of agricultural practices in the tropics that could result in more sustainable yields (Glaser et al., 2001).

Accordingly, UNIF's researchers have carried out several experiments on human-made *Terra preta* and found that it is possible to triple or even quintuple the yields of several varieties of vegetables compared to surrounding soils. Milien (2020) found that *Terra preta* increased the yield of sweet peppers (5.95 ± 2.85 t/ha) threefold when compared to the average yield obtained in the surrounding area (1.89 ± 0.35 t/ha). Lindor (2021) demonstrated that the yield of *Pissum sativum* doubled when cultivated in *Terra preta* soil compared to surrounding soils (8.12 vs. 3.13 t/ha). Moreover, Sejour (2020) demonstrated that the yield of tomatoes and cabbages increased 30 and 40% respectively, when cultivated in *Terra preta*.

In partnership with the Swiss and Haitian Red Cross, UNIF faculty members have shared these findings with peasant farmers in the mountainous region of Léogâne near Fondwa, particularly in those areas most sensitive to erosion with highly degraded soils. Faculty have also worked with a small group of growers in that area to test the replicability of these results. One of the most relevant characteristics of this intervention as collaboratively designed, is that it relies on reuse of organic matter from farm residue and waste. This soil enrichment strategy has allowed engaged growers to introduce new cash crops and to obtain higher yields with fewer inputs, in line with sustainability and respect for the environment. This experiment is ongoing.

6.5. An improved fallow

Traditionally, Haitian farmers have used fallow periods to manage their fields. This involves not cultivating specific parcels for limited interludes, to manage and preserve soil fertility. However, this practice may also lead to further soil degradation. For instance, in steep mountainous areas where vegetative cover is sparse, such as in Fondwa, the soil is very vulnerable to erosion. In 2018, University of Fondwa faculty members therefore tested a project based on the introduction of legume species other than beans, as well as market gardening species, as fallow cover crops. With the introduction of cabbage as fallow cover, farmers not only found a way to utilize land after sweet potato harvesting, but they also obtained a cash crop that has yielded strong profit margins. In this way, growers participating in the partnership to date, which include nearly all the farmers working in the Fondwa region, have helped to maintain soil fertility, reduce erosion risk, improve their family's diets, and increase household income.

This innovation has permitted growers to realize an additional vegetable crop in the summer, while also protecting, enriching, and harvesting from what would otherwise have been fallow plots. That is, in addition to reducing soil erosion, this technique has increased the food security of Fondwa's households. UNIF faculty are currently working on a plan with local farmers to adapt these practices and to share them with other growers across the region and country. Even though crop rotation has been practiced for centuries in Haiti, the logic of sequential interrelated benefits among specifically selected crops has been poorly understood by the nation's farmers. With the efforts of the University of Fondwa through joint experiments between researchers and farmers, and by means of continuous dissemination of findings, 70% of farmers in the Fondwa area are today practicing this form of science-based crop rotation.

7. Experimenting alongside farmers

As the above examples have suggested, the UNIF agriculture faculty design and develop their research projects in close partnership with local farmers. Haitian peasants (subsistence farmers especially) are particularly reluctant to take the risk of planting new crops because they are not confident of yields, or how well those plants will sell in the market even if they adapt well to the soil and weather conditions of the area. In addition, in some cases, new practices require additional labor and very poor households do not have the capability to hire workers. In order to reduce risk, many farmers only gradually adopt new crop varieties, or they test new possibilities in tandem with traditional ones. For instance, UNIF has worked with the region's growers to plant beans and maize at the rate of one seed per pocket spaced 10 cm apart, contrary to the traditional planting method of 5 to 6 seeds per pocket at varying distances. Area farmers not already engaged in this experiment soon learned nonetheless that this practice required fewer seeds and resulted in improved yields. Nevertheless, most Fondwa area growers adopted an intermediate planting pattern. Instead of employing the technique of one seed per pocket, they planted at the rate of 2 to 3 seeds per pocket at a regular distance. In consequence, UNIF faculty conducted research to determine whether that strategy resulted in different yields from that initially proposed and learned that it did not. While this outcome was fortuitous, this episode highlights the high degree of risk aversion among the area's subsistence farmers even when arguments for changed practices appear to be well founded. It also suggests that the diffusion of change is likely to be a non-linear process mediated by a host of factors, even when those highlighting possible innovations are known and trusted by those whom they seek to influence.

As a general proposition, many universities are interested in helping growers conduct their research and experiments on lands their institutions own and manage. That fact implies that any innovations developed are likely to be shared only late in such processes, when investigators have determined that their results can be extended more broadly. However, undertaking these initiatives in this way can be time consuming and, more importantly, may be disconnected from the perspectives and perceived priorities of local farmers and their communities. As such they run a high risk of non-adoption, a risk exacerbated in Fondwa's case by the poverty of area growers. To address these concerns, UNIF faculty work to ensure that the interested (the "willing") potential beneficiaries of any possible innovation are involved from the outset in any research that may affect them. They can thereby help to steer and adapt those investigations in ways that address their needs and situations. In any case, since UNIF does not itself own arable land, it must rely on carefully selected groups of local farmers to help its researchers investigate possible production or soil care strategies. Faculty recruit grower /partners from among community members who are aware of UNIF and its efforts to assist farmers. University faculty have found that those growers most receptive to experimentation and adoption of new techniques are those who are literate and possess sufficient land

and capital to be able to bear some modicum of risk. Generally, after initially conducting preliminary experiments addressing a new practice, university researchers invite a group of selected local farmers to partner in the testing, refinement, and dissemination of those practices. During meetings with its grower partners, UNIF faculty members routinely present possible projects to garner their views, experience, and suggestions. These interactions are not always without conflict, but they do tend to prompt thorough consideration of the strategies/changes contemplated. Nevertheless, UNIF's strategy of partnering with literate farmers suggests that education increases local growers' inclination to innovate, thus triggering a virtuous cycle. Put differently, when employed, such demonstration plots represent an important tool to challenge the dominant imaginary of the Haitian farmers with whom UNIF faculty work as somehow lacking and doltish.

The current UNIF agricultural faculty's approach to encouraging experimentation and possible adoption of change among the farmers they serve echoes the findings of a similar case study in Malawi addressing the impact of agricultural extension on efforts to improve crop productivity (Masambuka-Kanchewa et al., 2020). In that instance, agricultural communication (AGCOM) agents were promoting farming innovations. However, AGCOM agents were disconnected from the farmers and the communities they served, they did not allow for reciprocal learning, and were not focused on specific, locally based, success stories. As a result, the solutions proposed in extension campaigns in that area of Malawi did not address the problems confronting local farmers and those growers did not trust the strategies recommended.

The UNIF faculty has been mindful of these concerns and has worked to address them in their approach to agricultural extension and communication. In another recent related study, in this case addressing the adoption of integrated pest management practices, Diaz et al. (2020) demonstrated that even in Florida, United States, farmers' negative experiences result in adverse impacts on the willingness to consider and the pace of adoption of innovations. On the other hand, when farmers have been included in the design and implementation of extension practices, they are more likely to embrace the suggested agricultural practices. In a study concerning the adoption of novel agricultural practices in Nepal, Ghimire et al. (2022) reached similar conclusions. An analysis of relationships developed via Farmer-to-Farmer (F2F) Extension System efforts (Silvert et al. (2022) also concluded that famers were likely to be more willing to consider changes in practices when involved in developing and testing them. In the meantime, Agole et al. (2022), in a study of factors affecting productivity among smallholder farmers in Uganda, concluded that community culture should be considered when working with growers to introduce possible changes in planting, cultivation, or harvesting practices. In line with these findings, Calixte et al. (2020) have emphasized the importance of local agricultural technicians in Haiti and of the dissemination of agricultural innovation through strong partnerships with farmers. These studies support the UNIF faculty's strategy of developing and testing possible changes with growers as a way both of maximizing the understanding among farmers of what is being considered and why and, as a corollary, of minimizing the potential for failure. Figure 2 offers a graphic depiction of the approach Fondwa faculty are now employing to develop and implement possible changes with area growers.

The Figure underscores the fact that farmers are involved at every stage of the process of consideration of possible changes in agricultural processes/strategies in which UNIF faculty and students are engaged. The result in principle is multiple opportunities for farmers and university representatives to bring their special knowledges to bear in ways that both inform and test the plausibility of potential changes, even before those are subjected to limited field trials. This emphasis on coproduction and cooperation can encourage trust and deepen mutual understanding among these actors even as it opens up possibilities that one or both parties might not otherwise have considered. It also results in a continuing social space in which those engaged can interact concerning the unfolding of relevant events and factors, including the vagaries, of weather, pests and markets and how those might be affecting planned efforts. Working at its best, this process will address farmer concerns, in ways they their knowledge and experience informs and alongside scientific expertise.

8. UNIF at the crossroads of conventional and organic farming

Reddy et al. (2022) have compared the outputs of traditional and organic agriculture in India. That study suggested that when organic agriculture practices were employed in rainfed hilly areas, farmers profited from the change. Those scholars found that organic strategies increased production and profits for farmers growing two different crops: paddy rice and soybeans. While that study also found a decrease in productivity when organic methods were introduced as compared to traditional agriculture in irrigated areas, overall, Reddy et al.'s findings support the UNIF faculty's generally positive assessment of the impact of organic agriculture for the rural communities they serve in Haiti, whose farms are mostly rainfed.

However, the applicability of the Reddy analysis to the very different context of Haiti should be qualified. The topographic conditions of the Haitian territory, the land tenure situation in the country, combined with a dearth of investment in the agricultural sector by the Haitian government and the lack of cash available to most farmers severely limit, as we have emphasized, the availability of chemical fertilizers. As a result, most Haitian subsistence growers practice a mix of organic and conventional agriculture, and the two cultivation systems cannot be considered separately, as in India (Reddy, 2019). For instance, a Haitian farmer who typically does not use chemical fertilizers may occasionally employ a chemical pesticide when funds are available to do so. As a result, while Haitian agricultural productivity varies according to pedoclimatic region, its overall productivity is, on average, much lower than the average global yield for comparable crops. For instance, the average global yield of corn is more than 5 times higher than the average yield for that staple in Haiti (FAOSTAT, 2021). Joseph (2013) has compared the traditional rice cultivation system (SRT) and the intensive rice cultivation system (SRI) in the Artibonite Valley in Haiti and estimated the profits for each, respectively, at 296 USD/ha (SRT) and 1,500 USD/ha (SRI). Even lower yields and incomes routinely occur in the mountain agroecosystems of the country. Moreover, and importantly, the collection of data regarding agricultural productivity and profitability in Haiti is haphazard. Haitian farmers do not routinely keep records of their farms' productivity. They also do not typically calculate or

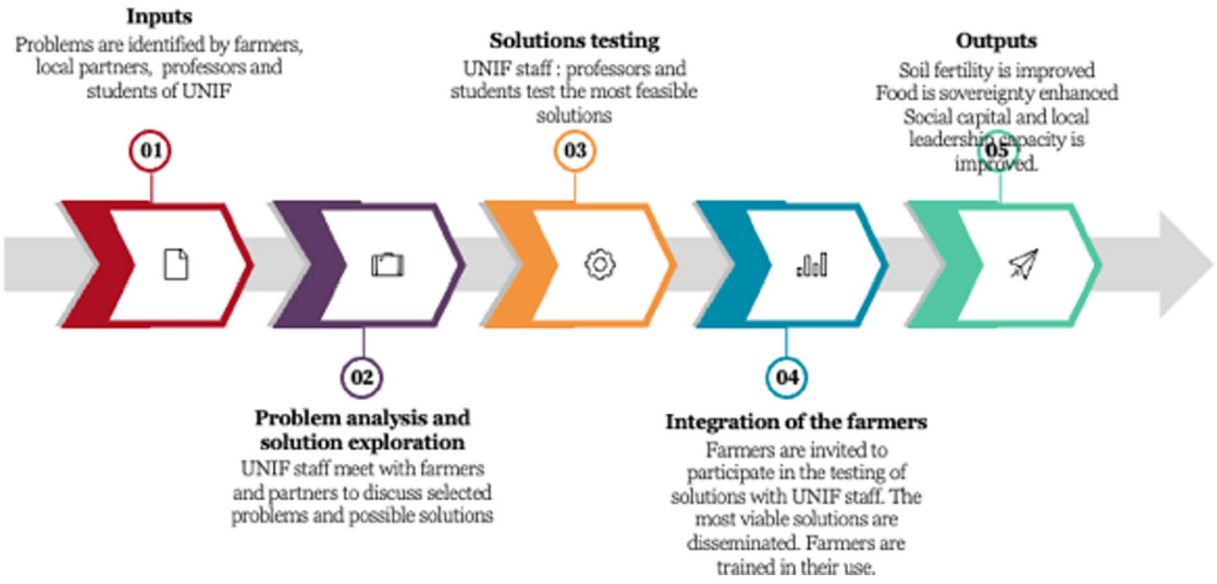

FIGURE 2
UNIF conception of agricultural change. Source: Scruggs et al. (2021).

consider the value/cost of their or family members' labor when evaluating their profit margins. As might be surmised, this situation often results in an inaccurate assessment of profitability. In any case, profit margins vary considerably among plots, as a result of the heterogeneous soils found on Haitian farmlands.

UNIF faculty are now exploring efforts to test the proposition that conventional agriculture is best practiced in the nation's plains, assuming the appropriate production factors and infrastructure can be attained, while respecting agronomic principles of water and soil fertility conservation. Meanwhile they are also examining whether agroforestry systems should be prioritized in the country's mountainous regions, within a conservation and sustainability framework. It should also be said that, as a higher education institution, UNIF is not focused exclusively on increasing food production or farm(er) profitability. Instead, its faculty are working also to develop paths toward food sovereignty. In this regard, UNIF's research activities should not be measured exclusively in terms of profitability and production. The University's contribution to farmers' vocational literacy and its promotion of cooperative practices, has also paved a path toward food sovereignty and increased social capital while also contributing to the creation of a generation of local leaders.

9. Conclusion and major lessons learned

UNIF faculty members' cooperative knowledge-generating and sharing activities have deepened farmers' agricultural literacy and provided opportunities for innovation. It is important to emphasize that, differently from international actors who tend to import new seeds and techniques with little consideration for grower preferences, UNIF is strongly connected with local farmers and its faculty routinely work in partnership with those whom they seek to serve.

The University of Fondwa's students are also a key asset for the mission of the University. They act as agents of development in their home communities, as they adopt and adapt in different regions of Haiti the innovations they learned at university. A study conducted by UNIF of its alumni in 2019 (unpublished UNIF report, 2019), found that not only do Fondwa alumni help the growers in which they reside to improve agricultural strategies, but they also often become members of grass roots organizations and cooperatives working for their development. Some become involved in local politics and are elected as CASECs, Chief of the Assembly of the Communal Section, the grassroots political subdivision within Haiti. In assuming these roles, alumni become active advocates for social change.

One of the major challenges UNIF now faces is to diversify its donor base further to ensure its financial stability. This support is necessary for an institution that cannot rely on state support, tuition, or donations from wealthy alumni. In any case, as two of the authors of this article have argued elsewhere, academic capitalism, when embraced in fragile higher education institutions, has been detrimental to the accomplishment of educational goals (Stephenson and Zanotti, 2017). Moreover, international NGO financial support is often not sufficient to bring about durable positive effects in the life of the populations the University serves. Indeed, as two of the authors of this article have argued, it may even shift local actors' foci to NGO donor priorities instead of the best interests of service recipients. This suggests the importance of NGOs being deeply rooted in the local communities they serve and accountable first and foremost to their populations (Zanotti, 2010; Stephenson and Zanotti, 2012). The population UNIF serves is among the most vulnerable in a country characterized by very high vulnerability and many of its service area subsistence farmers are enmeshed in a cycle of poverty transmitted across generations. By working persistently to develop knowledge and to share those findings in cooperatively informed ways, the University is furthering its mission to serve the farmers of its region and beyond. The local roots of the University of Fondwa's leaders and UNIF's

ongoing partnerships with growers, from the recruiting of students to its continual generation and testing of specific cropping and harvesting strategies with those farmers, has not only contributed to increasing Fondwa's farmer's resilience and improved food security, but, at the margin, it has also helped to close the social capital gap between the countryside and urban areas. Notwithstanding Haitian farmers' high level of illiteracy and relatively resistance to innovation due to the threat that failure poses to their survival, the case of the University of Fondwa suggests that offering these growers new knowledge in cooperative and collaborative ways can work catalytically to reduce inequality, not only by providing access to resources, but also, and perhaps more importantly, by creating a generation of rural community leaders cognitively equipped and open to lead needed change. In this sense, UNIF is contributing to the social change necessary for Haiti to secure food sovereignty as a nation.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Virginia Tech Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

LJ: conceptualization and writing. MS and LZ: conceptualization, writing, and editing. SR: conceptualization. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Urban agroecology enhances agrobiodiversity and resilient, biocultural food systems. The case of the semi-dryland and medium-sized Querétaro City, Mexico

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Small-scale agroecological practices in the urban areas of Querétaro, México, as in other mid-sized cities, could maintain agrobiodiversity pools and sufficient productivity for a food sovereignty baseline. The application of agroecological principles fosters agrobiodiversity and socio-ecological resilience in urban food production. Emerging urban gardens result from an immediate necessity for food that does not appear in local statistics, nor is there any account of them in any cadastral source or land register of Querétaro City. Based on studies of 28 urban gardens, we survey and analyze farming practices using socio-ecological resilience methodologies and the Diagnostic Survey of Agroecological Practices. We find that the agroecological management of urban gardens results in significantly more species richness than in conventionally managed plots, likely due to the multifunctional purposes associated with biocultural memory. The number of social actors participating in agroecological management is increasing. It represents an urban strategy of resilience that contributes to enhancing the microclimate and nutrient cycling, as well as to improving water management and biodiversity. Results also indicate that gardens of approximately 200 m^2 harbor the highest levels of agrobiodiversity. This area size for home vegetable production appears optimal for user-friendly management practices in urban settings and could represent the minimum benchmark for a family and a goal for urban planning and policy recommendations. Urban gardens contribute to the adaptive capacities of city dwellers to enhance their food security and sovereignty. Therefore, given that 70% of the national population face some level of food insecurity, we argue that, along with the protection of land-use rights, the promotion of a diverse urban landscape could improve long-term socio-ecological and food supply resilience. Additionally, urban gardens promote neighborhood social inclusion and affordable access to food. The empirical results and insights from this study in Querétaro can inform land-use policies for urban agriculture more broadly, especially in Latin American metropolitan areas.

KEYWORDS

urban agroecological practices, urban agrobiodiversity, urban socio-ecological resilience, urban food policy, small-scale food systems, biocultural memory, urban farming, adaptative governance

1 Introduction

1.1 Background of the study

City dwellers, scholars, policymakers, and non-governmental organizations increasingly recognize urban agriculture as an essential contributor to food security, the sustainable use of resources, and biodiversity in urban landscapes (Smit, 1996; Barthel et al., 2013; Clausen, 2015). Community gardens, rooftop gardens, school gardens, guerilla gardens, and other unique forms of urban production enable people to cultivate food and community while conserving agrobiodiversity (Whitney et al., 2017), soil, and water (Colding, 2011; Golden, 2013; Classens, 2014; Tornaghi, 2016). Agrobiodiversity results from interactions between the genetic resources of plant, animal, fungi, and microorganism species (both domesticated and their wild relatives), the environment, and the management systems and practices used by culturally diverse peoples at the intersection of biological and cultural diversity. It includes diversity at the ecosystem, species, and gene levels (FAO, 2004; Jackson et al., 2007 and Casas and Vallejo, 2019) and comprises various foods, fibers, and medicines of natural origin as well as the ways in which they are produced. The collection and cultivation of various species for food and other purposes requires the use of land and water resources. The variety and variability of species are necessary for sustaining key functions of agroecosystems, including both their structure as well as various processes for and in support of food production (FAO, 2004). Indeed, agrobiodiversity is a vital sub-set of overall biodiversity. Many people's food and livelihood security depend on the sustained management of various biological resources that are important for food and agriculture (Schneider and McMichael, 2010). Yet at least 70% of crop genetic diversity has been lost due to climate change, the industrialization of agriculture, and the associated shifts in the socio-economic and cultural dynamics of food and agriculture (FAO, 2020; Njeru et al., 2022).

Parallel to the decline of crop diversity in agricultural landscapes, the current diet of most people is dominated by only three crops – wheat, rice, and corn – which provide over half of the calories consumed globally (Pollan, 2002; UNCSN, 2020). This fact raises concerns about human health as well as the resilience of the global food system, as agrobiodiversity is key to both healthy nutrition and climate change adaptation. This structural lack of diversity in the food system poses immense risks to food security and human well-being, especially for poor and vulnerable populations, for instance in the case of crop failure. These risks are exacerbated by the impacts of financial speculation on food crops ().

The loss of agrobiodiversity[1] also incurs substantial costs. For example, the role of pest control by natural predators is estimated to be worth 100 billion USD, the role of soil biota in increasing soil fertility at least 25 billion, and the value of crops whose production depends on insect pollinators 15 billion (Constanza et al., 2014). According to the more radical views of activists, grassroots movements, and many peasant and indigenous communities, this extraordinary, abundant diversity is sacred, sustaining all forms of life (not least our own), and should not be subject to pricing and offsets in market-driven speculation that causes inflation for those that most need access to affordable food (Hawkes, 2006; FoEI, 2021). In Mexico, as in many other countries where the Green Revolution was institutionalized, agricultural modernization has led not only to the reduction of crop species diversity but to the replacement and erosion of indigenous crop varieties. These varieties are adapted to particular environments and tolerant to adverse climatic conditions and their loss has driven both the reduction of food resilience and a rise in health problems over recent decades. The push of corporate globalized food systems and free trade agreements to replace diverse and rich traditional diets to highly processed, energy-dense, and micronutrient-poor foods and beverages has led to the proliferation of obesity, diabetes, heart disease, and other diet-related chronic (Popkin et al., 2012). For example, most drinks and snacks consumed in Mexico contain high-fructose corn syrup, which has been linked to the epidemic of obesity and Type 2 diabetes (Bello-Chavolla et al., 2017).

The COVID-19 pandemic also had dramatic effects on people's diets. Besides food prices peaking around the world (GRFC, 2020), demand for fresh produce diminished as many people worried about potential supply chain disruptions and shifted towards greater consumption of heavily processed items with longer shelf lives. This trend links to the incidence and severity of diabetes and other diet-related diseases which have been identified as risk factors for COVID-19 mortality (IPES-FOOD, 2020; UNCSN, 2020). Marginalized city dwellers with underlying health conditions such as diabetes, high blood pressure, obesity, and heart disease – mostly belonging to lower-income groups, communities of color, and indigenous groups – are at particular risk of severe illnesses, including hospitalization and death (Popovich et al., 2020). The crisis of the COVID-19 pandemic must provide the impetus to transition from industrial agriculture towards regenerative, diversified, and resilient agroecology-based food systems (Altieri and Nicholls, 2020).

In terms of urban resilience, medium cities have been identified as both the main hosts of urban growth today and the weakest urban-area types in terms of infrastructure, water service, and food provisioning for the future (World Bank, International Monetary Fund, 2013). Medium cities are those with a population between 100 thousand and 1 million inhabitants (Covarrubias, 1985; Padilla, 1998). Urban areas in Latin America are often defined by a population concentration above 1,000 persons per km^2 or more than 10 inhabitants per ha with basic services, such as water, electricity, transportation, and communications. Peri-urban areas, on the other hand, are located within the area of influence of city systems and adjoin neighboring "non-urban" systems (MacGregor-Fors and Ortega-Álvarez, 2013). Landscape stewards in urban and peri-urban areas employ diverse socio-ecological practices. Harnessing the power of these practices can cultivate resilience within urban food systems, enabling them to reorganize to meet human needs in times of crisis (Altieri and Nicholls, 2000; Elmqvist et al., 2003; Folke, 2003; Folke et al., 2011; Colding and Barthel, 2013; Blay-Palmer et al., 2015). Urban resilience has become ever more important in this age of climate change, urbanization, rampant environmental degradation, pandemics, and intensifying social disparities in the food system.

1 Related to agrobiodiversity, the flexibility and variety of production and management technologies and practices of small urban farmers is encompassed by the term agrodiversity, used by Pinedo-Vasquez (2008). Pertaining only to primary production, high agrodiversity is central to any strategy aimed at developing sustainable food-production systems that are resilient to stresses driven by climate change (Brookfield and Stocking, 1999; Njeru et al., 2022). In this article, we use the term agrobiodiversity in order to conform to the definitions of the FAO (2004) and the Mexican Commission for the Knowledge and Use of Biodiversity that operates the National Biodiversity Information System (SNIB, CONABIO, 2023).

Research demonstrates that agroecological perspectives and practices can contribute to food-system adaptation and resilience and, relatedly, to the success and productivity of urban agriculture (Gliessman, 2013; Altieri and Nicholls, 2018). On the field and farm level, this approach aims to foster the optimal recycling of nutrients, organic turnover of soil fertility, closed energy flows, water and soil conservation, and pest regulation. At the same time, management practices that improve crop diversity also significantly contribute to an increase in the supply of critical vitamins and nutrients beyond the production site, particularly when that diversity includes green leafy vegetables (Rajendran et al., 2017). Therefore, agroecology presents a holistic grassroots tool to both improve the ecological impact and the productivity of urban agriculture and benefit surrounding human communities.

Despite the emerging recognition of its advantages, the potential of urban agriculture is scarcely considered in estimates of food production, nor in projections of research priorities. In Mexico, urban farming is not included in agricultural statistics, urban land-use mapping,[2] or accounts of local and national-level food security.[3] The contributions of urban agriculture, in other words, are under-theorized, under-estimated, and under-recognized in both scholarly research and practical policymaking. Given the rapid pace and future trajectory of urbanization around the world – combined with growing concerns over food security, struggles over the resources needed to ensure adequate food access and nutrition, and the ecological implications of industrial food production and long-distance food trade (Schnell, 2013; SEDESOL, 2014) – a strong focus on urban agriculture in scholarship and policy is more urgent than ever.

Our study of urban gardens in the Metropolitan Area of Querétaro, Mexico contributes to the nascent literature on urban agriculture. It provides agrobiodiversity data to inform policy-making processes about the urban circular metabolism and to stimulate political interest in reusing resources in urban ecosystems as much as possible (Bolton and Hildreth, 2013; Mostafavi et al., 2014; Angulo et al., 2015; Lucertini and Musco, 2020; QroCircular, 2023).[4] The study was conducted over a 2-year period and included site visits (28 urban and peri-urban gardens in the Querétaro municipality), personal communication and interviews, species identification, and soil sampling. We posed four questions: (1) What are the main components of agrobiodiversity in urban gardens in Querétaro? (2) Do garden management practices differ across the range of urban garden types? (3) Is agrobiodiversity different between Querétaro's urban and peri-urban landscapes, and if so, how? (4) How does agrobiodiversity in urban agriculture contribute to socio-ecological resilience? The remainder of this introduction situates key contexts and concepts for the study of urban agriculture and resilience and provides the rationale for this case study in Querétaro to inform urban planners, scholars, and food providers elsewhere to consider a similar process.

1.2 Urban farming, biocultural food systems, and resilience

Urban agriculture (UA) includes the production, distribution, and consumption of food within the limits of a metropolitan area (Companioni et al., 1997; Altieri, 1999; Smit et al., 2001; Cole et al., 2008). While the boundary between cities and the countryside is ambiguous and shifting, for urban agriculture, the "metropolitan area" typically includes both urban and peri-urban spaces.[5] In this study, we examine urban and peri-urban gardens which, following Esteva (2013), we refer to as *urbicultura*.[6]

Urbicultura comprises strategies and mutual-support networks for growing food in the city. It has experienced a significant boom in Mexico in recent decades (Esteva, 2013). Such "alternative" food networks have the potential both to increase resilience in the face of ongoing food insecurity due to political strife, economic recession, and climate change and to minimize risks for farmers (Blay-Palmer et al., 2015). An agroecological base in the production system may reduce the dependence on external inputs, promote the consumption of local and healthy food in the population, and generate various alternatives for food access and distribution within the metropolitan area. It also can allow urban dwellers, who are socially isolated from farmers and their policy issues, to connect with each other in ways that can both build and heal communities (Simmel, 1903; Nabhan, 2001; Altieri and Nicholls, 2009; Ostrom, 2009; De Zeeuw et al., 2010; Peretto and Valente, 2015). As such, agroecological *urban farming* can be an important component of efforts toward food sovereignty,

2 Cadastral municipal land descriptions of legal ownership, land-use, and location within the Querétaro's Municipal Registration.

3 The National Census, which is conducted every 10years, does not include urban agriculture metrics, nor does the most recent biennial Household Intercensus Survey (ENIGH, 2022). The SAGARPA-Mexico without Hunger National Program only collects information on small-scale farmers and producers in rural areas (SIAP, 2017). Urban agriculture is also not included in the biannual multidimensional poverty evaluation in Mexico (CONEVAL, 2019). As a result, there is no estimate of the number or contributions of urban farming operations in Mexico.

4 Querétaro City is widely used as a representation of a prosperous expansive urban model by mainstream institutions, such as (UN-Habitat, 2017), but in reality, its rapid expansion is repeating the complexity of structural problems of many other mid-sized Latin American cities, like Caracas and Lima and Santiago de Chile. In February 2021, Standard & Poor's awarded Querétaro a national credit rating of MxAA+. This rating came after the state had been recognized as the second most competitive in the country by the Mexican Institute of Competitiveness (IMCO). However, the growing real estate speculation of 56% accounted for only an 18.9% increase in investment in public transportation and 4.4% in water distribution according to the Builders National Survey (ENEC, 2023). Prior to the COVID pandemic, Querétaro registered a growth of 1.4 million dwellers and after it, became one of the most popular cities for remote workers. In 2022, a total of 118 individuals were reported to daily inmigrate into the City of Querétaro (González, 2022).

5 In their study of urban agriculture and food security in the Global North, Opitz et al. (2016) argue that urban and peri-urban areas are categorically different from each other, and should be studied as such. For our purposes, and in the context of Querétaro, we approach urban and peri-urban agriculture as spatially overlapping categories.

6 We used the term Urbicultura in italics and Spanish (with potential translation) since it represents the cultural appropriation of an emerging practice in Mexico. We use this language in an explicit attempt to decolonize research, to preempt viable criticism, and provoke thought about the coloniality of knowledge production.

defined in the Nyéléni (2007) Declaration as, "the right of peoples to healthy culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems." Achieving food sovereignty entails gaining bottom-up control over agrifood production, processing, and consumption. It will necessitate strengthening the socio-ecological resilience of food and farming systems within and between rural and urban areas, which includes protections for biodiversity and land rights. It also will require the adoption of knowledge-intensive farming practices linked to the biocultural memory of ingredients, processes, and uses of different varieties of crops. Biocultural memory can be defined as the knowledge, practices, and the basis of identity and beliefs transmitted from generation to generation of peoples (FAO, 2020). The term "biocultural food systems" thus refers to the diversity of food crops and the associated knowledge.

Emerging research indicates that urban farming and its practitioners, often referred to as *urbicultores* in Spanish (which translates as *urbicultivators* in English), have the potential to enhance food security, climate adaptation, and community-level resilience in cities (Colding and Barthel, 2013). Resilience is the capacity of a system to withstand disturbance and to reorganize to retain its function, structure, identity, and feedback (Holling, 1973; Gunderson and Holling, 2002; Walker et al., 2004; FAO, 2010/6; MacGregor-Fors, 2011). For example, *urbicultura*, whether considered as identity-based knowledge of food, culturally-appropriated ingredients, products, and processes or as a biocultural food system (Esteva, 2013), can reduce negative impacts within households during periods of food scarcity. This role is especially relevant when food prices experience substantial spikes, as witnessed during the 2007/2008 global food-price crisis and more recently, amid the COVID-19 pandemic and the war in Ukraine. This is particularly important for poor and marginalized people who are most affected by food price spikes and for whom gardens can be a buffer in the short term. Rather than representing momentary shocks to otherwise well-functioning systems, *disturbances* reveal deeper structural problems in the food system. Indeed, recent food price hikes have pushed the number of hungry in the world to its highest level in human history. At the same time, leading transnational agribusiness corporations recorded record profits during the crisis and the productivist approaches to food security that they champion have gained more traction in policy and business circles (McMichael and Schneider, 2011; Bloomberg, 2021). In the longer term, the food crisis disturbance demonstrates that rather than a lack of food availability, it is social exclusion and economic disparity that systemically limit people's access to food (De Schutter, 2014; Piketty, 2014).

The high proportion of people on the planet who are hungry, food insecure, and/or deficient in micronutrients co-exists with a growing proportion of people who suffer diet-related diseases and maladies from "over-consumption." This trend is related to the replacement of more locally-based and whole foods with calorically dense but nutritionally empty industrial foodstuffs (Muñoz de Chávez et al., 2002; Drewnowski and Specter, 2004; Patel, 2008; Scrinis, 2008; Carolan, 2012; Tilg and Moschen, 2015; FAO, 2016).

FAO (2010/6) urges that the solution to the structural causes of food crises lies in establishing local markets, promoting urban gardens, improving natural-resource sustainability and land distribution, and supporting grassroots organizations. More than simply a matter of official, top-down policy, maintaining and enhancing urban food production for resilience also involves civil society. Walker et al. (2004) refer to collective action to empower agency in local food systems and manage resilience as governance *adaptability* (Walker et al., 2004). Urban gardens often serve as an important example of such community-based adaptability led by civil society. However, city dwellers also require a supportive policy environment to ensure land-use rights and safeguard against dislocations.

Urban farming is particularly powerful as a form of resilience when based on the agroecological model, the main objective of which is the prioritization and design of ecological-regulatory functions (Smit, 1996; Golden, 2013; Nicholls et al., 2015a,b). For instance, agroecological practices facilitate functional redundancy through high levels of crop diversity and peripheral plot complexity in urban farming practices (Whitney et al., 2017). Redundancy provides a broader adaptive capacity to respond to disturbances (Altieri, 1999). Agroecological urban farming promotes biological activity in the soil, conserves soil organic matter, and relies on interactions and positive synergies between agroecosystem components, further enhancing the system's resilience. Therefore, agrobiodiversity creates functional insurance and supports the reorganization and renewal efforts of disturbed systems (Elmqvist et al., 2003; Colding, 2007). While greater ecological complexity is essential for a city's resilience, the activation of cultural diversity through conducive governance practices and organization is key for the capacity of cultural practices and the landscape to co-evolve, i.e., for the development of land use and management (Rindos, 1980; Barthel et al., 2005; Colding and Barthel, 2013). As this empirical study shows, this activation depends more on diversification and the knowledge-intensive biocultural memory of its practitioners than on its capital intensity or the productivity of a single crop. Therefore, activating the biocultural memory of city dwellers becomes strategic. The food selection and preparation processes transmitted through history are key for alternative futures. Agroecology has the potential to restore the importance and recognition of agricultural practices that have been present in the territories for several generations and that are kept vital through biocultural memory (Zeeza and Tasciotti, 2008; FAO, 2020). Because of the relatively small scale of production, UA can be highly decentralized. As many crops in UA have been carried to metropolitan areas by migrants, these systems tend to be highly diverse in terms of crop mixtures and production practices. Urban gardens are less dependent on external inputs, such as fossil fuels and fossil fuel-based inputs. Instead, they rely on recycling soil and water and using plant and animal waste for fertility. As such, UA has the potential to close energy cycles in cities (Altieri and Nicholls, 2007). Finally, in addition to improving food access, UA projects are a form of financial saving and community development for urban farmers, and they provide learning opportunities, youth development, and community integration (Colding, 2011).

Urban farming does not inherently embody agroecological principles, nor does it solely rely on biocultural memory. Realizing the full potential of urban agriculture in enhancing resilience often requires an *agroecological transition*. This transition involves the comprehensive transformation of a production system, encompassing technical, productive, ecological, and socio-cultural aspects, in a multilinear process of change (FAO, 1996; Smit, 1996; Freire, 2000; Caporal and Costabeber, 2004; Rogé et al., 2014).

The transition of urban farming in this direction depends on the adaptive capacity of social and ecological conditions. Key social factors, including local governance, the presence of biocultural memory among practitioners, community organization, property rights, and institutional alliances, must be addressed. On the ecological front, it is imperative to enhance biodiversity through functional groups like organisms that perform vital roles such as pollination, seed dispersion, grazing, predation, nitrogen fixation, decomposition, soil fertility enhancement, and water flow modification. To ensure their livelihoods, urban farmers also must re-learn how to maintain ecological functions, such as nutrient cycling and organic matter optimization for soil fertility, system diversification, pest prevention (e.g., by stimulating the presence of natural enemies as a biodiversity management strategy), and sustainable water management over time (Altieri, 2002; Altieri and Toledo, 2011).

1.3 Urban farming: the case of urbanization in Querétaro City

Urban food insecurity and diet-related diseases and illnesses vary across social classes, resulting in corresponding disparities in access to food (Harvey, 2006; McClintock et al., 2016; FAO and OECD, 2020). As is the case in many Latin American metropolitan areas, the underlying root cause of the food-related problems in Querétaro, especially people's inability to access nutritious food, is the structural social crisis of exclusion and economic inequality (FAO, 2012; De Schutter, 2014). Although millions of tons and varieties of food and food products arrive in urban markets every day, they are unevenly distributed throughout the city. Shorter and more equitable food supply chains also exist, but the ongoing industrialization and capitalization of the world's agrifood systems marginalize players in these localized chains (Nabhan, 2001; Clapp and Fuchs, 2009; McMichael, 2009). The farmers (especially smallholders), who might otherwise operate and benefit from their production directly receive only 5 to 17% of their food's retail value (Nabhan, 2001; Baker, 2013; Schneider, 2014).

Historical increases in food prices have limited access to food in Mexico (FAO, 2001, 2009; ENSANUT, 2013; CONEVAL, 2014a,b), particularly following the surge in processed-food consumption associated with NAFTA (Grain Report, 2015). Between 1993 and 2001 the sale of processed food grew 10.5%. This trend, along with food financial speculation (Isakson, 2014), has intensified the country's dependence on food imports, which rose 300% from 5,000 million tons of imports of corn in year 2000 to 18 million tons in 2021 (Enciso, 2021). In Querétaro, as in Mexico more broadly, food access is limited by food availability and price increases. In 2015, almost 22% of the national population lacked access to sufficient amounts of food, and only 30% were considered food secure[7] (CONEVAL, 2015; GRAIN with ENSANUT). According to CONEVAL (2015), 17.5% of the population (>300,000 people) lack regular access to food in Querétaro alone, and 40% are considered food insecure. In October 2017, the minimum cost of a monthly basic food "basket" in Querétaro's urban areas was 2,924.94 Mexican pesos (146.98 USD), while it was 1,891.51 Mexican pesos (95.05 USD) in rural areas. In January 2023, the value of the "extreme income poverty line" defined with the price of the urban food basket went from 1,930.38 USD (January 2022) to 2,143.72 USD (January 2023), increasing by 11.1%. Similarly, the value of the rural food basket increased by 11% (from 1,481.10 USD in January 2022 to 1,644.23 USD in January 2023; CONEVAL, 2023).

On its multidimensional poverty measurement ENIGH (2016, 2018, 2020), CONEVAL (2020) reported an increase from 4.9% of the population (99,423 persons) in 2016 to 6.9% in 2020 (164,201 persons) experiencing severe food insecurity in Querétaro, and an increase from 48,798 in 2016 to 66,471 persons having limitations in food access and consumption during pandemic[8] (CONEVAL, 2020). The consumption limitation of households refers to when household members have a poor or borderline diet. This assessment takes into account the frequency of food consumption and dietary diversity of 12 food groups, the variety of foods across 12 food groups, serving as an approximation of nutrient adequacy. The situation in Querétaro illustrates the broader problem of urban food access, which is becoming a high-priority issue in Mexico and Latin American medium-sized cities (MDGs Goal 2: Zero Hunger Challenge of the United Nations, Envision 2030, Agenda 21, GEO, MDG, UN-Habitat, 2004).

Anemia, i.e., a deficiency in red blood cells or hemoglobin, is also widespread in the Mexican population. Data showed that 11.6% of non-pregnant and 17.9% of pregnant women had anemia in 2012. Since then, this figure has increased to over 20% of pregnant women. This deficiency affects infant growth within the first months of life. In Querétaro, anemia stands at 23.5% in data for pre-scholar toddlers, contrasting with 10.1% of those of school-going age (IC95% 17.9–30.0). Rural children present a smaller index of anemia (22.0%) than urban children (24.4%) (CONEVAL, 2020). This situation within the most critical ages of development creates a public health challenge. The largest portion of the Mexican population is 25–35 years old, meaning that in the coming years, this population will increase demand for public health services due to food-related illnesses.

In Querétaro, like elsewhere,[9] urbanization is accompanied by both deepening social inequalities and intensifying environmental problems (Jordán and Simioni, 1998; IPCC, 2007; Kunzmann, 2009). With the population having grown around 30% in the last 6 years (from 1,091,025 to 1,530,820 inhabitants in 2022; CONAPO, 2022), the population of Querétaro City[10] is booming. It makes up 64.4% of the entire state's population (INEGI, 2015; COESPO, 2021).

The city has seen state-promoted industrialization, rapid population growth, and national immigration due to the mechanical and aeronautic investment of private capital. This growth has attracted a middle class with resource-intensive lifestyles to Querétaro (Arvizu-García, 2006), even while urban poverty and food insecurity are on

7 42% were ranked as mildly food insecure, 18% as moderately food insecure, and 10% as severely food insecure.

8 Mexican Food Security Scale (EMSA), as well as the limitation of food consumption according to the World Food Program (WFP) of the United Nations.

9 Rural–urban food disparities are intensifying in the context of rampant global urbanization. Today almost half of the world's population lives in urban areas, and this level is expected to reach 70% by 2050 (FAO, 2016).

10 Querétaro City Metropolitan area that includes four municipalities: Querétaro, Corregidora, El Marqués and Huimilpan.

the rise. Simultaneously, there has been a notable trend in the real estate sector, characterized by the proliferation of vacant newly built homes (Bayona, 2016).

Furthermore, urban sprawl itself contributes to social inequality as it often encroaches upon agricultural land, including prime farming areas, to accommodate urban and suburban development.

What is more, urban sprawl itself contributes to social inequality: the physical growth of cities oftenprevents land from being used for farming (Olson and Lyson, 1998).

Querétaro City is sprawling on semi-arid lands previously occupied by agriculture, pasture, and native vegetation (INEGI, 2015). Located in the hydrologic region of Lerma -Santiago, Laja River Basin, and Apaseo River sub-basin, the city has a semi-dry temperate climate (BS1k) according to the Köppen classification. It has warm summers and an average annual precipitation of 550 mm. While El Marqués and Querétaro municipalities have mainly rain-fed agriculture, urban expansion has fragmented the remaining natural vegetation areas, especially those in highly vulnerable locations that serve as regeneration zones for aquifers, such as vegetation on steep cliffs, in the foothills, on stream banks, or sites into canyons (Bayona, 2016). For this reason, the urban and peri-urban areas of Querétaro have the highest risk levels for both flooding and drought in the state. Between 2001 and 2010, out of nearly 1.5 million inhabitants, more than 60,000 people (4% of the population) were affected by floods (Suzán-Azpiri et al., 2014). These disasters have the strongest impacts in neighborhoods characterized by the lack of employment options, housing, services, income, health security, education, and food provision (IPCC, 2014).

The city's water supply faces significant vulnerability. Scarce groundwater has been under pressure for decades (the deficit according to data from CNA is −105.9 Mm3), and the PNUMA GEO Querétaro 2008 reported that wells were sinking at a rate of 4–6 meters per year, heightening concerns about potential aquifer depletion. The city has virtually no surface water, and sewage is discharged directly into the Querétaro River. The river's treatment is partial and urban drainage infrastructure is insufficient. The Acueducto II Project for water distribution in the city intends to bring water from the Panuco Watershed as far as the Infiernillo spring, located in the Moctezuma River. As many civil protests and human rights violations have happened in 2023 to Cadereyta, Querétaro inhabitants, the current administration is looking to source water from Querétaro semidesert dam in Tzibanzá with a new megaproject for the "following 50 years" called Acueducto III.[11] Although the project should partially overcome the dependence on the local aquifer for the next 30 years (PNUMA GEO Ciudad de Querétaro, 2008; Kirkland, 2020; Granados-Muñoz, 2022), there is some skepticism about the medium-term viability of the project among some insiders in the State Water Commission (personal communication CEA Agency, 2022). Furthermore, the watershed course within the city and the presence of vertisols, which tend to limit the drainage velocity, increase flood vulnerability. The aquifer issue has recently been made public by civil organizations reporting on the critical problem of water availability in Querétaro City (Bajo Tierra Museo, 2022). Additionally, the Metropolitan Zone of Querétaro (MZQ) is decreasing its aquifer water infiltration area due to the conversion of agricultural lands and land of high ecological value into industrial, commercial, or new housing lands (Soria et al., 2020).

Land use and vegetation juxtaposed layers in Figure 1 show the remaining irrigated and rain-fed agriculture, demonstrating that sources of locally available food have been displaced by urban sprawl. Reduced wild biodiversity and agrobiodiversity around Querétaro make the city increasingly vulnerable to natural and human-induced changes. About 60% of natural forested areas (scrubland) in Querétaro have been removed,[12] including profound losses of mesquite wood (99% reduction), tropical deciduous forest (90% reduction), and oak forest, (85% reduction) (PNUMA GEO Ciudad de Querétaro, 2008). At the microclimate level in dryland urban gardens, the loss of soil organic matter by higher air temperatures caused by the urban heat-island effect can accelerate the decomposition of the remaining organic matter, increasing the salt and sodium contents, affecting soil fertility while suggesting that green vegetation and food production may also reduce urban heat island effects (Colunga et al., 2015). At the same time, longer growing seasons may allow insect pests to complete a greater number of generations per year and spread plant diseases, resulting in crop losses.

Increased cultural diversity is perhaps the bright side of urbanization. Urban farming can benefit from this silver living. Like many cities in Latin America, Querétaro attracts migrants from rural areas and other regions within the country. The immigration rate has grown by 2.6% [La Voz de Querétaro, 2017 with data from COESPO (2017)] and almost doubled during the COVID-19 pandemic (Expansión Obras, 2021). Migrants from rural areas often bring with them agricultural knowledge that can be useful for farming in the city. In referring to biocultural memory, scholars, such as Toledo and Barrera-Bassols (2009), suggest that it can be recovered in the public space of urban agriculture. As such, it can be harnessed to enhance the responsive capacity to, and resilience in the face of, multiple threats, such as those described above. The biocultural memories carried with migrants to Querétaro might be reflected and used in its urban food and farming system. This possibility becomes especially important as the social and environmental impacts of capitalist, industrial food and farming emerge.

In Querétaro, there is a growing recognition of the lack of fresh, safe, and local food. For example, a recent study found that 70% of people between the ages of 18 and 23 in Querétaro expressed concerns about the availability of nutritious food (Félix, 2017). With rising awareness of the harmful impacts of agrochemicals, desire, especially among young people, for non-industrial and "local" foods, and the biocultural memories and "traditional" knowledge carried by migrants, urban agriculture in Querétaro may have a role to play in transitioning towards more agroecologically and socially resilient food

11 The emblematic icon of Queretaro City is a patrimonial UNESCO World Heritage Site shows that from the beginning of the second half of the 17th century, the city has experienced water shortages and struggled to supply the valuable liquid. The aqueduct has been designated as an International Historic Civil Engineering Landmark by the American Society of Civil Engineers.

12 It should be noted that some vegetative regeneration has occurred with the abandonment of farming plots in peri-urban areas; however, this also makes those regenerative spaces vulnerable to interests of speculative capital to convert land into private urban developments.

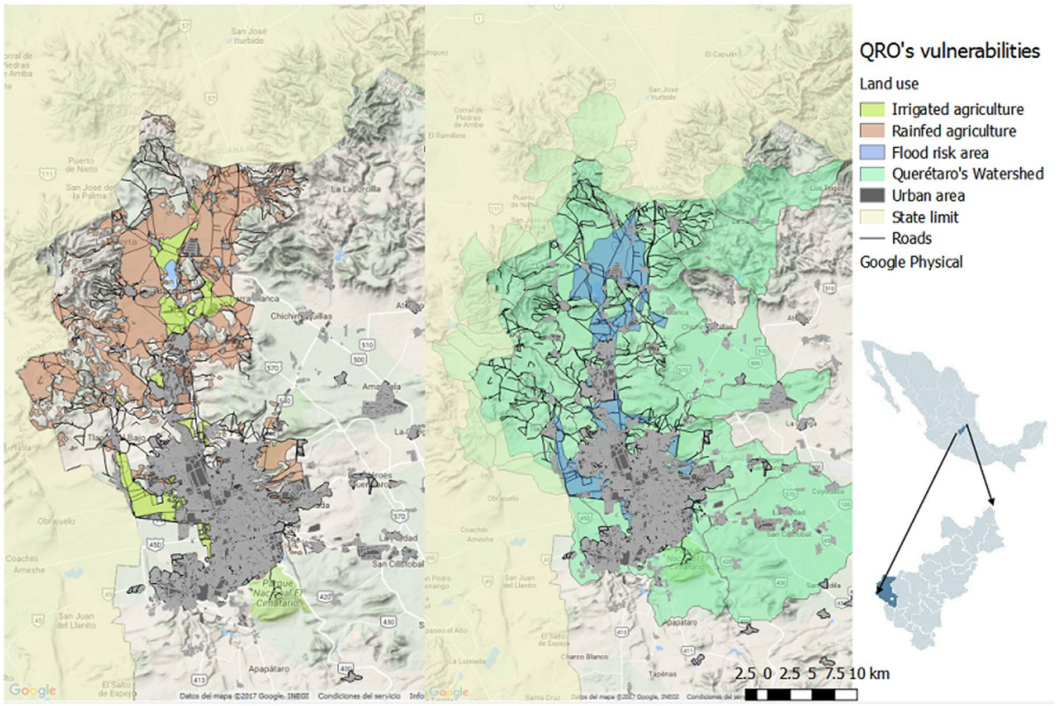

FIGURE 1
Vulnerable areas of city sprawl over rain-fed agriculture and flood risk across Apaseo River watershed, Querétaro City, Mexico.

and farming systems. To this end, this study aimed to identify the practices of urban farmers in Querétaro and analyze their impacts on agrobiodiversity and socio-ecological resilience in the city.

2 Methods

2.1 Sampling and data collection

The present study is an attempt to initiate primary data collection on urban farming in Querétaro City. As there are currently no data on the number or distribution of urban gardens in the city, we used a convenience sample using snowball sampling. Sampling started with five gardens from a list of friends and acquaintances of the authors, whom we visited and whose urban farmers were invited to participate in the study. In the initial phase, key informants provided further contacts, resulting in a contact list of 17 urban farmers which we started visiting. Those garden owners provided us with the names of other gardeners, and so on. We also contacted Facebook groups and online networks (Sembradores Urbanos-Colectivo Tlalli, NaYax, CIASPE), as well as emerging networks and independent horticultural enthusiasts involved in urban gardens (Zona Viva, Transición Querétaro). From these contacts, the sample snowballed to 31 gardens, from which 28 gardens were suitable for the study, due mainly to their food production, hosting availability, and consent to participate in the study. Garden sizes ranged from 12 m^2 to 0.6 ha, with 25 to 60 m^2 as the most common range. During the two-season study period from 2015 to 2017, each of the 28 gardens was visited at least three times in person to administer surveys, conduct interviews, and document agrobiodiversity and management practices. The location of each garden was recorded with GPS to plot data in Quantum GIS Version 2.18.2 with GRASS 7.0.5 and Google Earth Pro.

Using the principles of agroecological methodology (Altieri, 1995; Henao, 2014; Nicholls et al., 2017), we characterized agrobiodiversity in the 28 urban gardens by evaluating each garden's (1) horticultural composition, (2) agricultural productivity, and (3) water and soil management. The first round of data collection to identify garden management practices was based on Altieri et al.'s (2014) Diagnostic Survey of Agroecological Practices. It consisted of a 24-item questionnaire of agroecological indicators, including nine main indicators: nutrient cycles, nutrient loss prevention, soil water and humidity retention, diversification, soil quality, organizational support, land tenure aspects, and pest control practices. The lead author implemented the survey and interviewed every urban farmer or the person who spent the most time in the garden, assigning a score of 0 to 3 for each item in the questionnaire. To differentiate between "conventional" and "agroecological" gardens, management practices were rated on a scale of 24 points. Sites rated above 12 points were identified as agroecological due to their higher complexity (see Figure 2).

Additionally, a quantitative closed-question survey was administered to record the gardeners' demographic profile (age, occupation, formal education, and gender). The species richness (S), defined as the number of species within a plot, was obtained through sampling or via a census of individual frequencies and recorded (Moore, 2013). Once the agrobiodiversity of the urban gardens was plotted, we used an extrapolation tool to describe and report its evidence across the city. The Inverse Distance Weighting (IDW) algorithm was used to interpolate and report the highly variable data, assuming that the weight of distant inverses has a local influence that

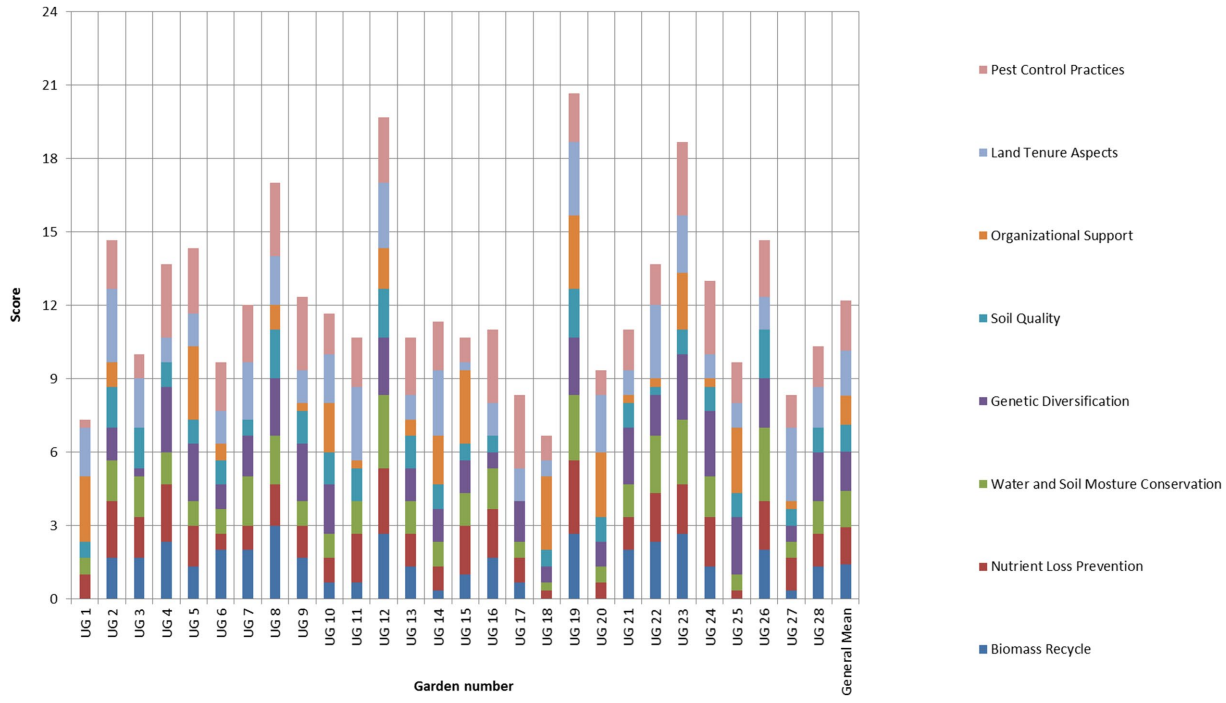

FIGURE 2
Cumulative agriculture management score for all 28 sites based on the diagnostic survey of agroecological practices. The threshold between the two management types was 12 points.

diminishes with distance (Childs, 2004). Weighting was assigned to sample points through the use of a weighting coefficient that controls how the weighting influence will drop off as the distance from the new point increases.

2.2 Data categorization and analysis

To gage locational variability in practices and agrobiodiversity, and to test the null hypothesis that no differences exist between management and location that affect species richness and productivity among urban gardens across the city, we differentiated peri-urban and urban gardens. There are many approaches to defining peri-urban spaces (see, for instance, Maestre et al., 2012; MacGregor-Fors and Ortega-Álvarez, 2013). For this study, sites with paved roads were the main attribute used to distinguish peri-urban and urban gardens. As a result, 20 gardens were located within the city of Querétaro (adjacent to an asphalt paved road) and eight were peri-urban (no paved road).

We categorized gardens as: (a) home-consumption gardens, for families sharing a private backyard, (b) community gardens, (c) didactic school gardens, and (d) commercial market gardens (Figure 3).

Botanical records for each garden were created through a combination of site visits and photography. Because gardeners typically do not keep a complete botanical record of their gardens, photographs were taken at each site, species were identified, and the resulting database was compared with botanical keys of plants of the World Online databases of Kew Royal Botanic Gardens (2017) and the Missouri Botanical Garden. Additionally, garden owners were asked to tour their site together and name every possible species by their common name to later contrast them with botanical keys and databases. In order to review the accepted name and its synonyms, The Plant List (2013) Version 1.1 was consulted to work down the taxonomic hierarchy. Key species in the gardens were determined using the highest Importance Value Index IVI as the measure of the spatial value of one particular species, which is the sum of the relative coverage by species (RC), relative density by species (RD), and the relative frequency by species (RF).

$$IVI = RC + RD + RF^{*} 100.$$

Relative coverage (RC) was registered by taking the average of two canopy diameters of every species. RD was calculated by accounting for its density across gardens, and RF was the global discrete frequency across gardens. Data was organized by management practices, location, productivity, species richness, and IVI-value for ecological importance. Data about the number and profile of people involved in the garden, land dimensions, and productivity were kept updated in the dataset as the research progressed over a period of three years. Statistical analysis of variance was carried out using R Studio. A two-factor ANOVA (Location * Management) was performed to analyze differences in species richness and productivity. Some analyses required logarithmic or square root transformations to meet assumptions. Significant differences between combinations of factors were subsequently determined by a *post hoc* Tukey's HSD test (Quinn and Keough, 2002). Across the study, horticultural varieties were used as species for richness calculation. Richness and management practices were both indicators of agrobiodiversity.

FIGURE 3
Urban and peri-urban gardens in Querétaro City, Mexico categorized by **(A)** family or private backyard gardens, **(B)** community gardens, **(C)** didactic school gardens and **(D)** commercial market gardens. Photos by *G. Villavicencio*.

3 Results

3.1 Agrobiodiversity results

3.1.1 Species richness and productivity

In terms of species richness, the most diverse gardens cultivated up to 86 plant varieties and achieved between 5 to 7.5 kg/m^2 of overall production (Figure 4).

Location and management were the most important factors in species richness, with urban gardens having higher and significant richness differences (W = 0.86377, value of $p = 0.007404$) than peri-urban gardens (W = 92,503, value of $p = 0.5094$). This was mostly due to the non-commercial focus of the urban garden and the cultural adaptations depending on their food preferences and origins. More specifically, urban sites managed with agroecological practices were shown to enhance the species richness (ANOVA value of p 1.71e-05*** *post-hoc* Tukey test HSD; Kruskall-Wallis of group differences chi-squared = 15.558, df = 3, $p = 0.001397$ and a Pairwise comparison using Dunn's test for multiple comparisons of independent samples value of p of 0.0009) as compared to conventional management (Figure 5). Overall, gardens with approximately 200 m^2 registered the highest biodiversity richness and rated considerably high in productivity.

Species richness was higher in the medium-sized gardens (200 m^2) of middle-class gardeners than in high-income or large commercial gardeners. Of special relevance is the fact that urban gardens with the highest productivity were not the most agrobiodiverse. Production showed a stronger relationship with location (higher productivity in peri-urban areas) than with management (Figure 6).

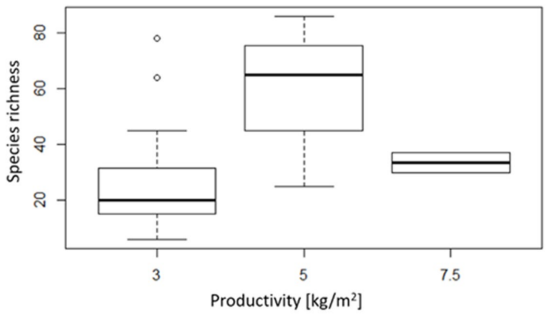

FIGURE 4
Species richness vs. productivity (3, 5, and 7.5 kg average per square meters) in Querétaro City, Mexico.

The total productivity of the urban gardens in the study, which covered a total of 6,984 m^2, was approximately 36,000 kg wet mass per season. We conservatively estimate that this is the equivalent nutritional intake of 6,050 kg of proteins (168.51 proteins per gram), 161,487.19 Kcal of energy (4,498 Kcal of Energy per gram), 34, 957.41 kg of carbohydrates (973.69 per gram), and 5,428.382 kg of fats (151.2 fats per gram).

FIGURE 5
Species richness per Location (left), Richness per Management (middle), and Richness vs. Location and Management (right) where P denotes Peri-urban; U, Urban; A, Agroecological; and C, Conventional.

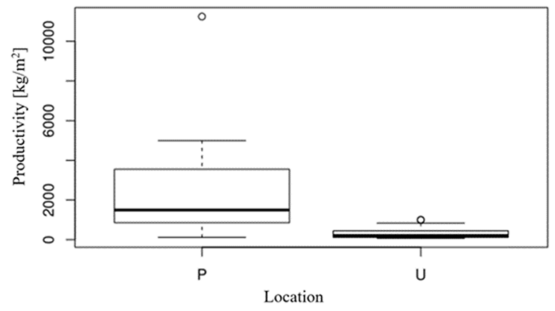

FIGURE 6
Productivity vs. Location (P, Peri-urban; U, Urban) and Management (A, Agroecological; C, Conventional) showing significant differences per location in Querétaro City, Mexico.

3.1.2 Agrobiodiversity composition

Using the Importance Value Index (IVI) described above, of the 142 horticultural varieties identified in the study, the key horticultural varieties were: *Capsicum annuum L.* (Chili 7.6/300%), *Aloe* sp. (*Aloe vera* 6.9/300%) and *Beta vulgaris* var. *cicla* (Chard 6.1/300%). The most common plant families where Solanaceae, Laminaceae, and Asteraceae, followed by Apiaceae, Rutaceae, and Rosaceae. We separated IVI values for trees, shrubs, and herbs. Even though the production of mushrooms was reported, they were not included in the list.

For herbs, vegetables, and annual crops, the most relevant IVI value indexes were *Aloe* sp. (*Aloe vera* 6.9/300%), *Beta vulgaris var. cicla* (Chard 6.1/300%), *Lactuca sativa L.* (Lettuce 24.1/300%), and *Coriandrum sativum* (Coriander 8/300%) (Figure 7).

The highest IVI value indexes for shrubs (Figure 8) were *Opuntia ficus-indica* (Prickly pear 43.1%/300), *Capsicum annuum L.* (Chilli pepper 30.4%/300), and *Rosmarinus officinalis* (Rosemary 21.2%/300).

The most relevant IVI value indexes for trees (Figure 9) were *Carica papaya* (Papaya 24.5/300%), *Persea Americana* (Avocado 23/300%), and *Prosopis laevigata* (Mesquite 18/300%).

Biocultural Food Systems, as reported in Nabhan (2020), restore the broad diversity of wild and cultivated plants once found in ancestral diets, such as prickly pear species that dominate the extensively managed *nopaleras* in Arid America, in the fluctuating border of Mesoamerica and Arid America. The present study shows that in the arid landscape of Querétaro City, *Salvia, Aloe,* and *Opuntia* and genra reported the highest IVI Values. The CAM succulents *Aloe* and *Opuntias*, which exhibited the highest IVI values, are drought-tolerant species that have evolved from ancestral diets. This suggests that these food plants could serve as a foundation for climate-resilient food security when cultivated in perennial-dominated polycultures. This approach can contribute to the restoration of land health, particularly in terms of enhancing the soil moisture retention capacity of *Prosopis laevigata* and drought-tolerant or polyphenolic shrubs. Additionally, it can reduce the overall water consumption of crops and provide stability in yields, even in the face of climatic uncertainties (Nabhan et al., 2020).

3.1.3 Agroecological management survey results

Using the Diagnostic Survey of Agroecological Practices (Table 1), we classified 83% of the gardens as agroecological, and 17% as conventional.

Figure 10 illustrates survey results by garden, using an example of three gardens for the agroecological group and three gardens for the conventional group. Nutrient-loss prevention and water and soil conservation were the most important variables differentiating the two groups (Figure 10).

Most agroecologically managed sites practiced composting for soil conservation. Some did contour planting (only in some peri-urban areas), increased vegetation, mulching, integration of flowers and borders to promote pollination and beneficial insects, intercropping, crop associations, and efficient use of water such as using Tlaloque water treatment systems[13] or collecting it from kitchen areas as gray watering. The use and availability of appropriate technologies for efficient recycling and collection of biomass and water were greater in commercial gardens. Limiting factors most often mentioned by urban gardens were the lack of compost, management skills, and seeds and local varieties, followed by lack of space, insecure land tenure, water costs, and pest presence.

In the community garden *El Huerto del Buen Comer* located in Menchaca III, the economically most disadvantaged garden in the present study, no water irrigation reached the area by the time of the study. The neighbors used to buy waterpipes on communal basis of

13 Tlaloque is an ingenious rainwater harvesting system developed by a non-profit that is helping the most marginalized communities in Mexico City and nearby cities to have access to clean water.

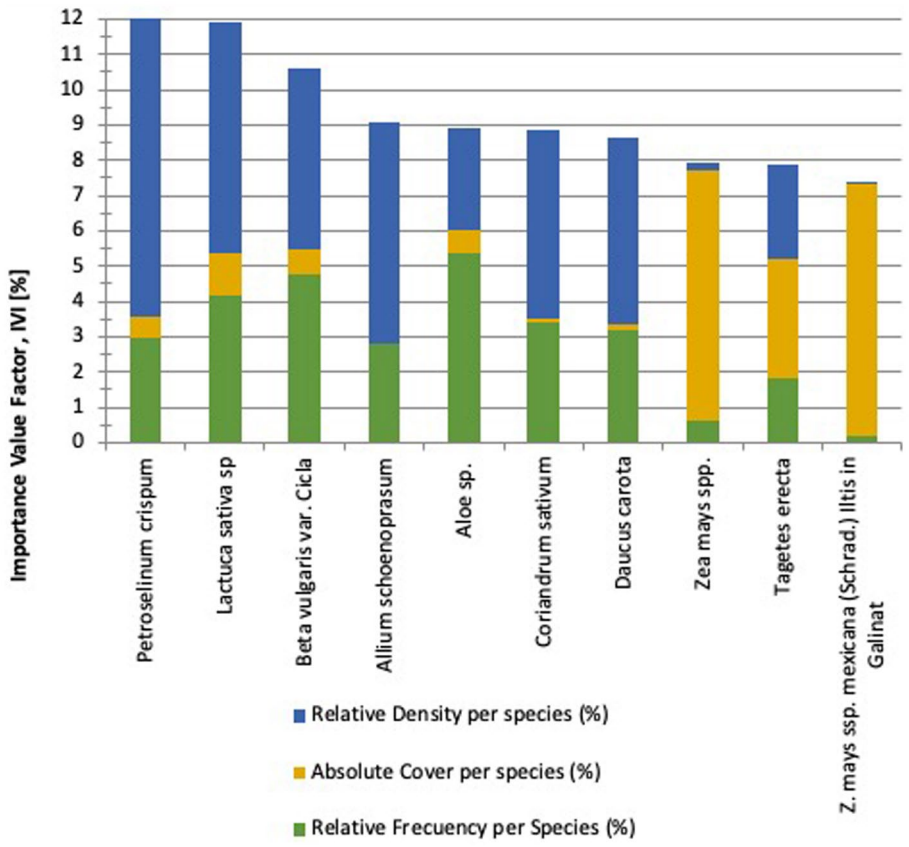

FIGURE 7
Highest IVI value indexes reported for the main variety of herbs, vegetables, and annual crops.

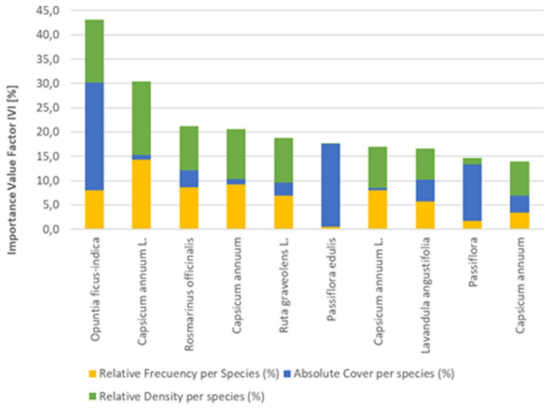

FIGURE 8
Highest IVI value indexes reported for the main varieties of shrubs.

cooperation. The water was stored using low-cost practices as much as possible, such as using PET bottles to cover sprouts to reduce water evapotranspiration and enhance soil moisture.

3.2 Demographics of urban farmers

In our study of 28 urban gardens, 18 urban farmers were women and 10 were men. The preliminary results were shared and validated on 8 March 2017 over a dinner organized and called *De urbicultor a urbicultor* (from urban farmer to urban farmer). Of the 34 attending gardeners, 29 were asked to bring something they harvested from their garden. We collected the harvested vegetables on a previous afternoon and they were cooked by a local chef interested in ancestral cuisine. The dinner took place in the home garden of a local wheat-producing peri-urban farmer and social leader. The age of respondents ranged from 20 to 69, with a mean of 45 for women and 35 for men. Urban farmers were more educated than the state's schooling average of 10.5 years, which is equivalent to a little more than the first year of high school (INEGI, 2020) with 67% of the female respondents and 60% of the male respondents having a bachelor's degree. The idea of food access was particularly relevant for Menchaca's garden, which was the only one under a community-based organization and which has been replaced by a police station. Of the women sampled, 20% held a graduate degree, which is a high-level degree in terms of formal education. Furthermore, 90% of the male gardeners were employed outside the home. For women, an equal number (39%) were employed outside the home, and inside the home, with jobs ranging from flexible, independent jobs and projects to informal jobs done while parenting. Overall, nearly 61% of *urban growers* were women between the ages of 40 and 49, with more than 15 years of formal education. Despite high levels of formal education, only nine gardeners indicated that they felt comfortable with, and knowledgeable about, horticulture.

3.3 Socioeconomic characterization of urban gardens

The main difficulty during sampling was to develop trust with the garden owners for them to allow us to enter their houses. In Mexico there are few front yards, so we needed to cross the whole house to have access to the plots. We visited mostly owned or leased backyards, with the exception of Menchaca's community garden in a vacant lot that has since been taken over by the municipality in order to build a Police Control Station, to reduce the neighborhood insecurity, on top of rich soil.

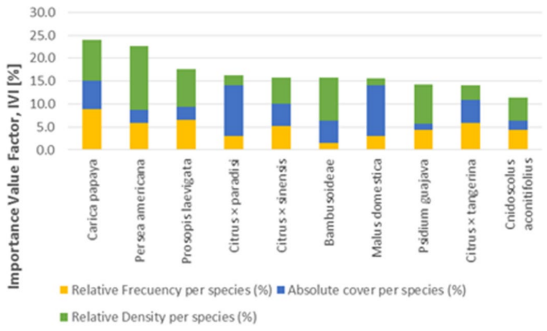

FIGURE 9
Highest IVI value indexes reported for the main varieties of trees.

For descriptive purposes, we categorized the 28 urban and peri-urban gardens (UPA) based on Orsini's adaptation Orsini et al. (2013) of Moustier and Danso's (2006) socio-economic typology. In total, 18 gardens were categorized as *small-scale agriculture*. They were urban, less than 100 m^2, and operated with self-consumption as the main objective. Of these, 90% were operated by women. Two gardens were categorized as small-*scale commercial agriculture*, located in urban and peri-urban areas on less than 1,000 m^2, and operated by both men and women for small-scale income generation. Four sites, operated by men in peri-urban areas on more than 2,000 m^2 for income generation, were classified as *agriculture businesses*. Four peri-urban gardens of more than 5,000 m^2 were categorized as *non-specialized agriculture* (Table 1).

The 28 urban and peri-urban gardens analyzed in our study were highly complex and heterogeneous systems. Food production practices consisted of raised beds, biointensive beds, double digging beds, vertical gardens, planting directly in soil, in pots, on green roofs, in backyard gardens, on street sidewalks, in vacant lots, and in municipal parks. Half of the urban gardens (14 of 28) were primarily

TABLE 1 General typology of socio-economic profiles of urban and peri-urban gardens of Querétaro City.

Socioeconomic profiles of urban farmers, based on Orsini et al. (2013)				
	Small-scalle agriculture	Small-scale commercial agriculture	Agriculture business	Non-specialized agriculture
Number of identified gardens	18	2	4	4
Location	Urban	Urban and peri-urban	Peri-urban	Peri-urban
Product's destiny	Self-consumption	Urban markets	Urban and export markets	Self-consumption and urban markets
Main objective	Self-consumption	Small-income generation	Main income or part-time	Self-consumption and small-income generation.
Classification by objective	Family gardens, communitarian, commercial and school gardens.	Commercial and communitarian gardens	Commercial urban gardens	Family gardens
Adaptations by allocations	Directly on the ground, biointensive double digging, raised beds, vertical, green roofs, public roads, vacant lots, municipal parks, pots and reused containers.	Municipal vacant lots, roads, city parks, biointensive double digging, shaded plots.	Raised beds, on the ground growing, greenhouses.	Directly on the ground.
Size	<100 m^2	<1,000 m^2	>2,000 m^2	>5,000 m^2
Products	Vegetables, flowers, fruits and chickens.	Vegetables, prickly pear, flowers, chickens, rabbits, sheep and milk.	Vegetables and flowers, chickens, turkeys, pigs, sheep, horses and aquaculture.	Corn, beans, fruits, flowers, legumes, tubers, pumpkins and prickly pears.
Technology appropriation level	Low	Low to middle	Middle to high	Very low
Gender	Women	Both	Men	Both
Limiting factors	Lack of compost and seeds, pest control (aphids, molluscs, gastrophods and grubs) land size and access.	Land size, land access, insumes, lack of agroecological intensive knowledge, local market prices, fluctuations.	Technological knowledge, market prices fluctuations.	Lack of agroecological intensive knowledge and strategies for water and soil regeneration.

Categorized based on Orsini's adaptation Orsini et al. (2013) of Moustier and Danso (2006).

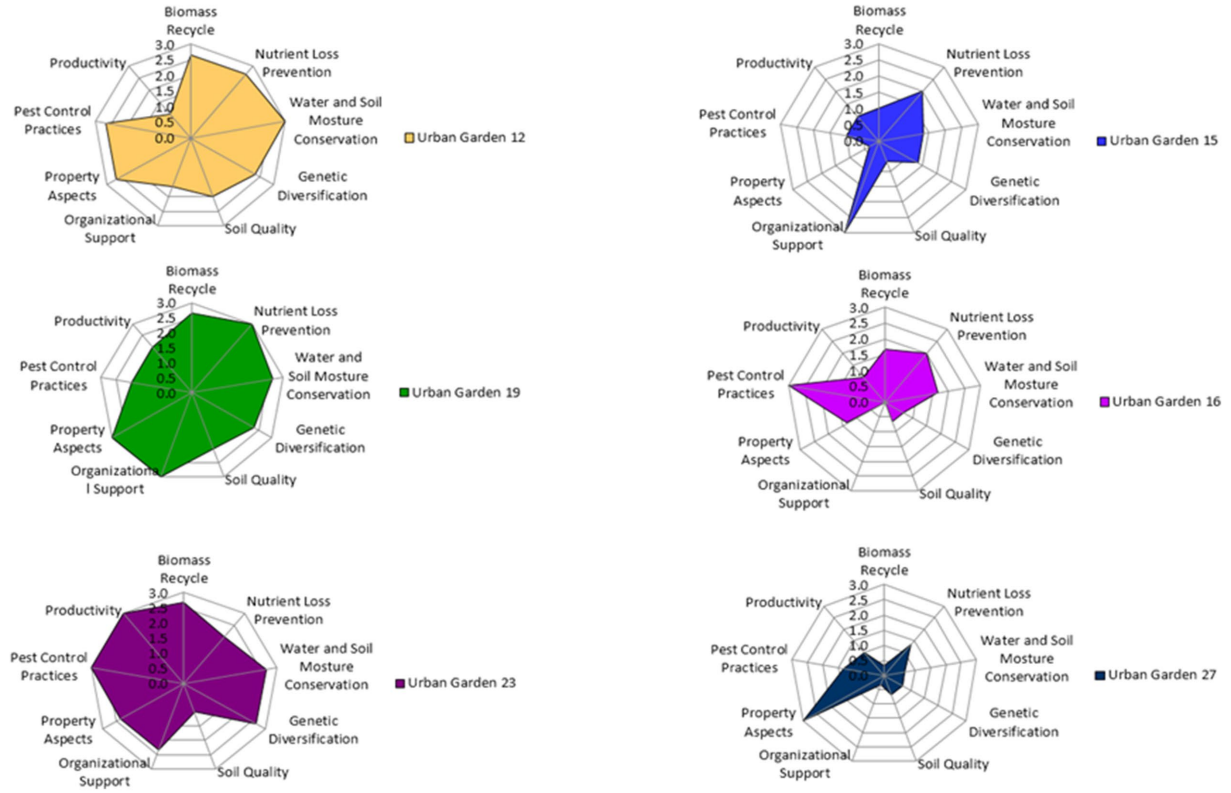

FIGURE 10
Management survey results by example gardens, where cumulative >12/24 points was considered agroecological management (Left group) and < =12/24 points conventional management (Right group).

used for self-consumption or household-level food self-sufficiency. Other uses were commercial (7), didactic/learning (4), and recreational (3) (Figure 11).

While most of the self-consumption plots were founded in high-income areas, Menchaca's "*Huerto del Buen Comer*" was located in a low-income, high-risk, and marginal area (Metropoli, 2013). Commercial gardens were generally located in peri-urban areas except for "*Bioleta Café*," located in an urban residential area. All commercial gardens were able to pay employees. It is important to note that, even though most urban farmers were women, most urban farmers with the "economically active population" status were men. This is due to the preponderance of commercial sites in peri-urban locations that were managed by men. Nearly 86% of the gardens in the study were community-based, meaning that they were financed and operated by their members with no additional state programs or funding provided. Only four of the 28 cases, or 14%, depended on civil-association funds or governmental support. One result of this is that secure land access and tenure were a major concern for respondents, as community-based gardens were informal and at risk of displacement or dispossession due to urban development. In addition to insecure land tenure, urban gardeners mentioned other limiting factors, including the lack of compost, management skills, seeds, and local varieties, followed by a lack of space, high costs for water, and the presence of pests.

Our GPS investigation indicated that rainfed fields appear to be atrophying or disappearing due to the recent urban sprawl and water scarcity. Our findings also show that hotspots of agrobiodiversity (Figure 12) coincided with high socioeconomic development (levels B and C+) and describe a hierarchical structure in the capacity to access certain goods and lifestyles (AMAI, 2008).

Considering that most of the urban gardens in this study are not located in low-income areas, it is important to highlight the key distinctions of gardens located in low-income areas. These distinctions encompass factors like land tenure and the vulnerability of leases, both in gentrified areas and in cases of State expropriation, as exemplified by the case of *El Huerto del Buen Comer*. Ensuring food security is not a main objective of most of the cases represented in this study due to the fact that the participants are more likely to already have diverse diets through purchasing food and being more socio-ecologically resilient due to their ownership of larger green spaces and potentially higher literacy profiles. Nevertheless, these *urbicultoras* are more engaged in cultural processes of biocultural recognition, native farming or renewed domestication, foraging cacti revival, learning to process local food options, and improving the diversity of their dooryard gardens to value the cultural use of foods and beverages.

4 Discussion

4.1 Urban agroecological practices provide agrobiodiversity

Agricultural management significantly impacts the ecological composition of agrobiodiversity across urban locations. In our study,

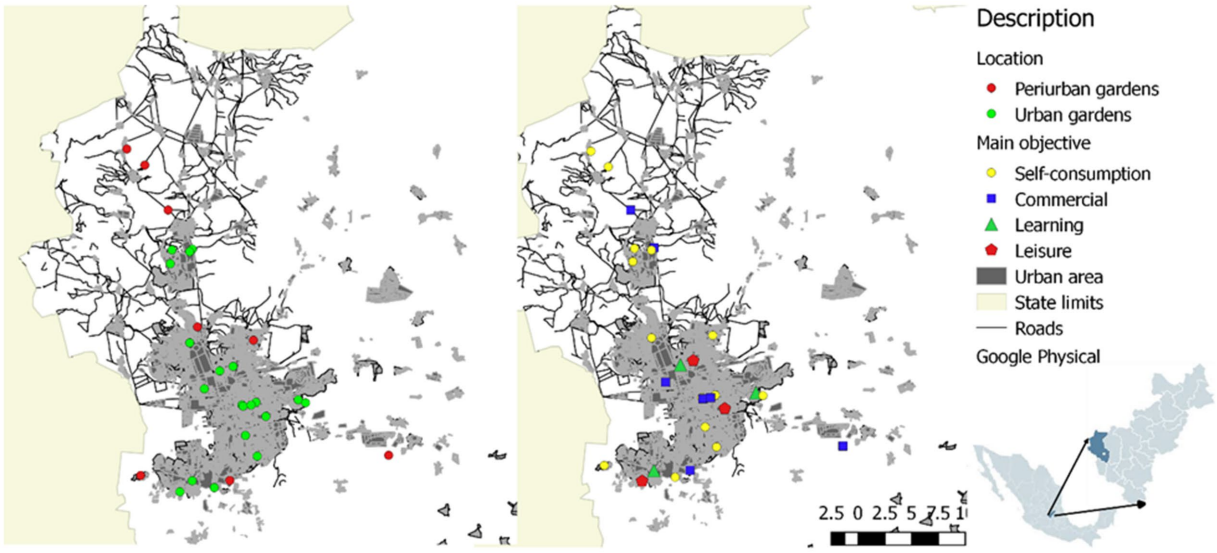

FIGURE 11
Distribution of gardens per location (urban = red circle or peri-urban types = green circle; Left side) and main purpose (self-consumption = yellow circle, commercial = blue square, learning = green triangle, and leisure = red pentagon; Right side) in Querétaro City, Mexico.

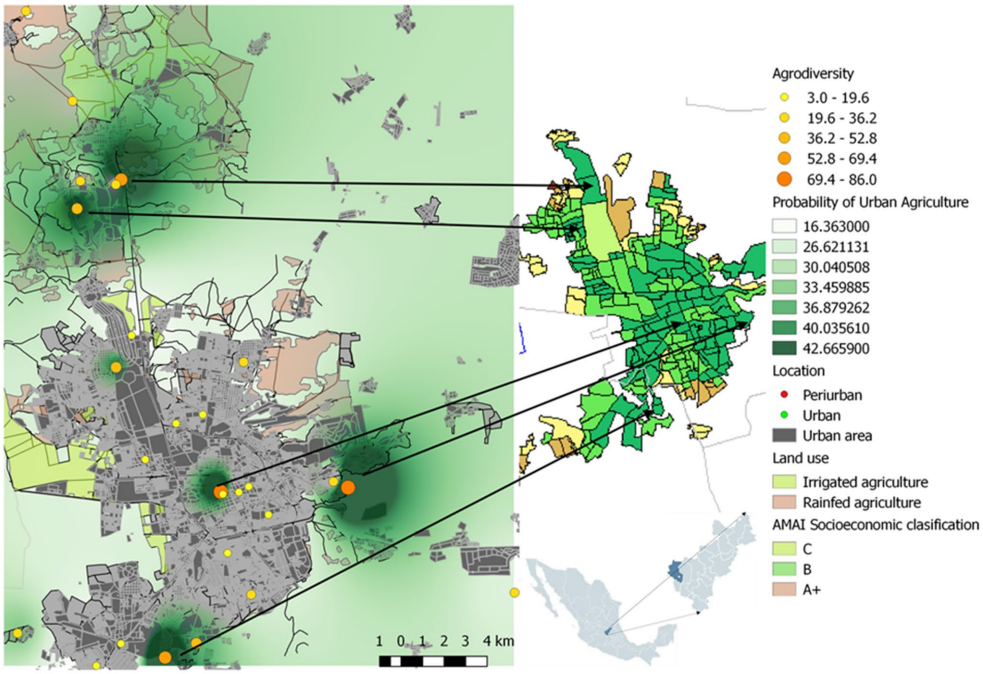

FIGURE 12
Agrobiodiversity (hotspots) interpolation of species richness within the 28 urban gardens per socioeconomic units in the Metropolitan (A+ High-income class, C Middle class and D+ Low middle class and D Low class and E Lowest class) Area of Querétaro City, Mexico. AMAI Data source per AGEB, INEGI (2022).

urban sites managed with agroecological practices demonstrated enhanced species richness, which is essential for building resilience in food and farming systems. Productivity, however, was significantly higher in peri-urban locations, where species richness was lower. In Querétaro, average production in urban gardens ranged between 5 and 7.5 kg/m^2. In Cuba, in contrast, the range is 10–20 kg/m^2 (Companioni et al., 2001; Ortiz et al., 2001; Hernández et al., 2005; Vázquez-Moreno, 2007). This difference might be related to both precipitation (Querétaro is a dryland area, while Cuba is not), and to the *organopónico* agroecological management of the Cuban case. *Organopónico* refers to community-led low-input systems in which producers plant in beds, plots, or covered areas. Most often this takes place in vacant lots or spaces where there are no urban buildings, patios, or gardens, and is usually of small scale up to 100 m^2 (Nicholls

et al., 2002). The main difference is that *organopónico* systems were the result of a historical process led by the Cuban state's political will and policies and its *Campesino a campesino* methodology to guarantee food production in the cities (Ortiz et al., 2001; Machín, 2010).

The present study provides explorative data on urban farming and agrobiodiversity in Querétaro, undertaken in part to inform further research and policymaking on urban agriculture and socio-ecological resilience. Based on surveys and interviews with urban farmers, the study also reveals some of the vulnerabilities of urban and peri-urban farming. Several respondents mentioned land tenure as a major concern for the permanence of garden sites. Indeed, the rising cost of land leases and land speculation are often neglected aspects of urban agriculture even though they can fuel gentrification and marginalize the space for food production, especially for lower-income people (Mougeot, 2000; Schupp and Sharp, 2012; McClintock et al., 2016).

In our study, gardens of 200 m^2 registered the highest species richness and rated considerably high for productivity. These traits contribute both to providing diversified diets and promoting complexity and redundancy (the latter being among the principles of agroecological resilience) in the urban ecosystem. Moreover, the urban gardens rated higher in richness than peri-urban gardens, mostly due to their non-commercial focus which enabled the *urban farmers* to plant a variety of crops. Often these were more associated with crops related to their subjective life stories or to biocultural memory than with yield or market-led productivity. Current leasing costs in Querétaro might limit the further spread and scaling-up of agroecology to only middle- and upper-class citizens within the city. The two exceptions in our study of urban agriculture in downtown Querétaro were only possible because the leasers could still afford a low, almost-frozen rent for large properties with enough space to cultivate. Other marginalized gardens in Menchaca III, the most insecure zone in the city (due to gangs according to interviewed cab-drivers; El Universal de Querétaro, 2013, 2017), did not experience the same luck. This was the case of "El Huerto del Buen Comer," the only community garden found in the study that was initiated by a centralized municipality of Querétaro, and progressively self-governed using an organizational culture inspired by Liberation Theology Pedagogy in the 1970s. Not long before the publishing of this study, the municipality dismantled this community garden, which had been creating and co-evolving the biocultural memory in a variety of food collective-cooking activities and restoring the social fabric. The municipality did so with the aim of gaining more control and security of the neighborhood by building a Police Station on top of long-managed fertile soil and a safe public oasis for sociocultural restoration. These kinds of displacements – whether by private or state forces – disempower the idea that people may actively and cooperatively protect their local ecosystems and strengthen the fragile communities as the base of their livelihoods (DeLind, 2001; Martínez Alier and Roca, 2013).

The urban garden represents a heterotopian place that delineates social space where the potential for "something different" exists (Harvey, 1979, 2013; Lefebvre, 2014). In the context of urban farming, this "something different" signifies that through food production, consumption, preserving and practicing biocultural traditions, and ensuring municipal support, the transition to community-based food systems can be promoted, concurrently fostering socio-ecological resilience. Because of its highly complex and heterogeneous nature, urban agriculture can help to improve food access, enhance agrobiodiversity, conserve energy in the rural–urban relationship, create purposeful jobs, and contribute to overall urban community health and wellness. To bring about a transition to agroecological *urbicultural* systems, it is necessary to identify agroecological principles that allow for biodiverse, resilient, energy-efficient, socially just urban projects and a bottom-up strategy for locally based food and energy production (Altieri, 1995; Gliessman et al., 1998; Mougeot, 1999; Holt-Giménez and Patel, 2012; Marasas, 2012). However, this potential to change the "everyday life of the city" is only attainable when the people who build and maintain that everyday life are able to exercise their rights to live in that city (Harvey, 2013). For instance, urban land tenure as a common good could incentivize the emergence of more community garden initiatives (Federici, 2013). We must be careful that these heterotopian places are not absorbed by dominant practices, such as gentrification driven by real estate development. In the case of Querétaro, and in cities more broadly, urban agriculture depends on affordable and secure land tenure, i.e., the main factor that can foster resilience through time. Looking forward, further cultural drivers should be considered to understand the dynamics of urban agrobiodiversity in Querétaro's metropolitan city.

4.2 Resilient, biocultural-systems based, and affordable access to food in the Latin-American, semi-dryland, and medium-sized city of Querétaro, Mexico

Our study shows that urban and peri-urban agroecological practices enhance agrobiodiversity in a semi-dryland city. Enhanced agrobiodiversity is a baseline requirement for creating more resilient food systems. Furthermore, the appearance of highly heterogeneous and complex urban gardens within the urban system has the potential to reactivate the ecological interaction of a diversified genetic pool of plant species which is intrinsically linked to human management. This interaction over centuries has been described as domestication, made possible through socialization and axiological priorities such as exchanging seeds and the continuation of common codes of biocultural memory. Independent of public policies, the marginal and heterogeneous design of urban farming in Quéretaro is creating a baseline ecosystem function for resilience. This is vital to sustain the landscape matrix of the food and farming systems we depend on. Compared to the 209 species reported by Whitney et al. (2017) in the drier peripheral semi-evergreen Guineo-Congolean rainforest, and the 340 species of edible plants – higher in urban than in rural areas – documented in Tucson, Arizona, a UNESCO City of Gastronomy (Nabhan et al., 2017), we documented the agroecological management of up to 86 crop varieties in plots of approximately 200 m^2 and a total of 142 species in Querétaro, a semi-arid city that is experiencing both extensive urban sprawl and water conflicts.

This article suggests that emerging urban farming practices need to be further characterized. An action-research agenda should consider the following. (1) Urban agroecological management practices in Querétaro city have been shown to enhance agrobiodiversity. (2) Gardens of approximately 200 m^2 showed the

highest agrobiodiversity, representing a reasonable size for city planners, landscape designers, and policymakers to address food sufficiency. (3) Diversified gardens promote complexity in the urban ecosystem by harboring a biodiversity richness of up to 86 different crops per site. They produce on average between 5 to 7.5 kg/m^2 of horticultural crops. (4) The three key and most frequent species resulting from 142 total landraces were chili, *aloe vera*, and chard. In the interviewed sample, nearly two-thirds of the urban farmers were formally educated women between 40 and 49 years old, and over 85% had no municipal support. (5) Urban gardens with the highest productivity were more significantly associated with location (higher productivity in peri-urban than in urban areas) than with management, demonstrating that private family or backyard gardens (Orsini et al., 2013) were the most agrobiodiverse due to the biocultural memory associated with the urban farmers.

This case study aims to inform policymaking regarding adaptative governance through urban agroecology. The crop richness found in Querétaro's semi-dry garden ecosystems confirms that endogenous solutions may be available thorough sharing local knowledge and practices, while activities such as the *De urbicultor a urbicultor dinners* should be further stimulated and engage both practitioners and scientists. These ideas enable a practice of deliberative democracy that is needed to change daily practices and build the capacities to produce strategies for public affairs (Habermas, 1989; Niemeyer, 2022). At the producer level, agrobiodiversity may not be related to income and social status but rather to a deeper network of significance between culinary traditions and biocultural memory. Due to the fact that higher agrobiodiversity was present in medium-sized and middle-class or high-income gardeners with culinary traditions, further research will require in-depth patterns of biocultural heritage, local network interconnectedness, and land tenure.

Across much of Latin America, temperature thresholds and drought are beginning to limit the production of most maize and bean varieties (Stiller et al., 2021), and the extremely high summer temperatures are causing the abortion of flowers and fruits (Nabhan, 2013). As most of Mexico's population now dwells in hot, dry climates and the arid food-producing landscapes dominate 60% of the national territory (Pontifes et al., 2018), clearly, food production and diets in the "new climatic normal" will have to employ a set of food crops different from and far more diverse than those currently employed in conventional agriculture (Nabhan, 2020). Besides this, the use of biocultural food systems based on native farming practices reinforces cultural identity.

Identifying key players for an agroecological transition and local efforts that are already underway in the city – along with key challenges, such as land access and tenure – is critical to understanding the impacts, scope, and qualities of current and emerging processes (Right to Food-UN, MDG 1 and 7, 2016). Furthermore, collecting and reporting primary data on the occurrence and contributions of urban agriculture to food sovereignty and urban biodiversity are urgently needed. While the urban poor, especially those coming originally from rural areas, have practiced horticulture as a survival strategy, the sector remains largely informal and usually precarious in Querétaro. Besides citizens' emerging self-organized efforts, municipalities need to realize the possibilities of nurturing small urban farming cultures and local ecological knowledge while becoming drivers of social inclusion and violence reduction. To do this, securing long-term access to land is essential. Recognizing the environmental and social justice initiatives already taking place in the urban context – whether they are formal participants in food sovereignty movements or informally operating in line with agroecological principles like the participants of this study – and listening to their voices and needs, could inform a cultural shift that diminishes violence, builds an alternative future of social inclusion and community cohesiveness, improves public health and well-being, and promotes landscape urban resilience.

5 Conclusion

From our study, it follows that further ecological analysis of crop diversity across a wider range of urban gardens is necessary. Due to the lack of geographic information regarding urban gardens of food growers, we relied on a sampling method that biases low-income areas, where crop diversity and cultural appropriation might be underrepresented by the scope of the present study. There is potential sampling bias towards middle- and higher-income areas, and therefore there is a need to further research low-income areas to better understand patterns of biocultural food systems appropriation, as well as the revival, continuity, and change of diets. As a recommendation for decision-makers, further peer dialog should be promoted by municipal programs and policies directed at urban agriculture. We think that it is important to cross-pollinate agricultural practices through interaction between people with different socio-economic backgrounds. In order for the social fabric to be restored, biocultural food systems need the interaction and exchange of advice between *urbicultores*, especially regarding water and soil management, integrated pest management control, and crop diversification.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Comité de Bioética, Facultad de Ciencias Naturales, Universidad Autónoma de Querétaro. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

GV-V contributed to the formal study and survey design, data analysis, writing of the paper, and design of graphics, and conducted field implementation of the survey with primary advising from HS-A. GV-V and JJ both authors contributed to the research article and approved the submitted version. MS contributed with formal analysis. MA contributed to the conceptualization. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2023.1066428/full#supplementary-material

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A knowledge creation framework for academia toward agroecological transformations of food systems

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Industrialized agriculture, characterized by high inputs, large-scale monocultures, and confined livestock production, with a narrow focus on profit, is a major transgressor of societal and planetary boundaries. It fuels climate change, biodiversity loss, water and soil degradation, nutritional deficiencies, public health issues, cultural erosion, and socioeconomic inequalities. As early-career researchers in agricultural sciences, we are concerned about these systemic crises and recognize that participating in normative academic practices without reflection may reinforce the prevailing industrialized food system. Motivated by the dissonance between the potential impact of our work and our vision of a better future, in this paper we describe and challenge academic praxis in agricultural sciences to tackle the interconnected crises. We do this by developing a framework of two drivers of academic knowledge production, power and values, and two mechanisms, motives and relationality. We argue that in the current dominant food system, power is consolidated and hierarchical, driven by the values of growthism and reductionism, motivated by efficiency and productivism, and characterized by extractive and anthropocentric relationality. Furthermore, we highlight evidence of the negative outcomes associated with this system, including the challenges we face and may potentially contribute to as participants. We then envision transformed food systems through examples of counter-hegemonic knowledge production systems, grounded in agroecological principles, in which power is distributed and horizontal, the primary values are solidarity and holism, motives enhance sufficiency and sovereignty, and relationality is reciprocal and based on care. By examining the current system and offering examples of alternatives, we aim to help distinguish between research that upholds the statu-quo and research that fosters change. We aim to inspire ourselves and others to reconnect with our agency and contribute towards transformed knowledge systems where food systems, underpinned by the values of agroecology, are more capable of sustaining life on this planet in an equitable and just manner.

KEYWORDS

academic praxis, agroecology, counter-hegemony, food sovereignty, power, motives, relationality, values

1 Introduction

> *"El mundo al revés nos enseña a padecer la realidad en lugar de cambiarla, a olvidar el pasado en lugar de escucharlo y a aceptar el futuro en lugar de imaginarlo: así practica el crimen, y así lo recomienda. En su escuela, la escuela del crimen, son obligatorias las clases de impotencia, amnesia y resignación. Pero está visto que no hay desgracia sin gracia, ni cara que no tenga su contracara, ni desaliento que no busque su aliento. Ni tampoco hay escuela que no encuentre su contraescuela."*
>
> *"The upside-down world teaches us to endure reality instead of changing it, to forget the past instead of listening to it, and to accept the future instead of imagining it: this is how it practices crime, and this is how it recommends it. In its school, the school of crime, the classes in impotence, amnesia, and resignation are mandatory. But it's clear that there is no misfortune without some luck, no face without its other side, no despair that does not seek some air. Nor is there a school that does not find its counter-school."*
>
> Eduardo Galeano, Patas arriba. La escuela del mundo al revés. 1998.

Industrialized agriculture is a major transgressor of societal and planetary boundaries (Rockström et al., 2009; Raworth, 2012; Campbell et al., 2017). This form of agriculture is typified by large-scale monocultures grown for confined animal production and biofuels, high external agrochemical inputs, and a focus on economic profit at the expense of social and environmental integrity (IPES-Food, 2016). Mounting evidence indicates that industrialized agricultural production erodes ecosystem health and reduces biodiversity (IPBES, 2018), contributes substantially to anthropogenic greenhouse gas (GHG) emissions (Crippa et al., 2021; IPCC, 2022), and degrades soils and water bodies (Foley et al., 2005). Agribusiness interests not only limit the health, autonomy, and agency of those who grow food (Altieri and Toledo, 2011), but also affect individuals' and communities' ability to consume a healthy diet (Neff et al., 2009; Ambikapathi et al., 2022).

The main proponents and benefactors of industrialized agriculture are multinational corporate agribusinesses (McMichael, 2009, 2012). They consolidate land and resources, and appropriate or decimate socio-cultural heritage in favor of mass capital accumulation (Cotula, 2012; Lawrence and Smith, 2020; MacDonald, 2020; Fanshel, 2021). These global agribusinesses operate within and reinforce a neoliberal capitalist paradigm which encourages market-driven privatization of food systems (Olssen and Peters, 2007; Lawrence and Smith, 2020). Corporations exert dominance over food systems by shaping the production, processing, distribution, and consumption of food, while also influencing policies that govern the food supply chain (Clapp, 2018). Through this multi-scale consolidation of power, global agribusinesses actively shape our food systems to serve their interests, with negative implications in food security, health, community sovereignty, cultures, the environment, and knowledge systems (Holt Giménez and Shattuck, 2011; Gámez-Virués et al., 2015).

Historically, academic institutions in the United States (US) reinforced the neoliberal paradigm through narrowly focused agricultural research agendas in which researchers generate knowledge that can further optimize the industrialized agricultural system (DeLonge et al., 2016). Norms that serve to maintain the dominance of the current industrialized system can be through a variety of mechanisms, such as unintended reinforcement (e.g., path dependency limiting agricultural diversification; Spangler et al., 2022), systemic pressures (e.g., funding; Frickel et al., 2010), and lack of awareness or systems-level training (e.g., effect of pesticides on bees; Kleinman and Suryanarayanan, 2013). Unfortunately, the extractive conditions of industrial agriculture are emulated by academic research culture. Research participants and early-career scientists find themselves working long hours and making difficult sacrifices which contributes to the widespread mental health crisis among graduate students and academic staff (Pretorius et al., 2019; Gallea et al., 2021). On top of that, we experience despair due to the impacts of systemic crises created and contributed to by the current food system such as climate change, injustice and inequities, food insecurity, and biodiversity loss, among others (Wallace et al., 2020).

The creation of an alternative vision for socially and environmentally just food systems is not easy or straightforward. Under dominant narratives that fail to address root causes or contribute to food systems transformation (McGreevy et al., 2022), it is challenging to discern which agricultural knowledge and research framing is fostering social-environmentally just food systems and which is reinforcing the degradation of socio-ecosystems. As agricultural researchers, we are not trained in methods for critical research praxis (i.e., the iterative combination of action and reflection in the process of research) (Freire, 1970; Nicklay et al., 2023) that can facilitate meaningful and urgently needed food systems transformations. As scientists who have worked within but want to challenge our position in this system, we work with each other to find our way in this new terrain. We feel that this is necessary if we are to ever achieve goals of sustainability and justice—goals that we feel are crucial to the ongoing thriving of human life on this planet. Continuing on traditional research trajectories does not address the urgencies of the moment for us or our communities, who suffer from climate grief, climate anxiety, as well as food insecurity and tenuous housing situations. So where do we go from here if we want to develop research programs that respond to the urgencies of this moment of vast social inequity and rapid climate change? Fortunately, alternative models challenging the dominant paradigm exist, and they are being propagated in local spaces of resistance (Archer, 2008; Anderson, 2020; Ong et al., 2024).

Feminist science studies scholars offer models that address social inequities and limitations in scholarly approaches, thus creating more equitable results that are also more accurate and impactful (Haraway, 1988; Harding, 2001; Roy, 2008; Intemann, 2010). Indigenous scholars point towards the strong stewardship legacy of tribal communities and nations, disrupted by colonial and capitalist regimes of dispossession and land management (Salmón, 2000; Roy, 2008; Smith et al., 2014; TallBear, 2014; Whyte, 2017; Lewis et al., 2018; Liboiron, 2021; McKay and Grenz, 2021; Hernandez, 2022). These and other scholars reveal how a reorientation towards a more just and equitable future requires considerable overhaul of academia including deliberate attendance to imaginative capacity (Pereira et al., 2019; Moore and Milkoreit, 2020), and different onto-epistemological approaches (ways of knowing and being) that acknowledge epistemic injustice (Cummings et al., 2023) and academics and their institutions as situated participants within broader food and knowledge systems (Haraway, 1988). The planetary challenges we face necessitate a shift beyond disciplinary expertise, and greater care given to the connections that sustain and give meaning to our existence. We believe that agroecology (Altieri, 1995; Holt-Giménez

and Altieri, 2013), as a science, practice and a movement (Wezel et al., 2009), is one such framework gaining momentum that could facilitate needed food system transformations (Ong et al., 2024). Agroecological principles include embracing transdisciplinarity and other ways of knowing, which can contribute to critical, change-oriented research necessary to address escalating 21st-century challenges (Freire, 1970; Hooks, 1994b; Morin, 2001; McGreevy et al., 2022).

Thus, this paper builds upon the work of agroecologists, Indigenous practitioners, farmers, and many other peoples to offer a framework based on power, values, motives, and relationality. We use this framework to (1) challenge the current agricultural academic knowledge system, (2) envision a transformative agricultural science field oriented towards the principles of agroecology, and (3) provide a reflective process for researchers to engage with their own work.

2 Positionality statement and creation process

The core team of authors began working on this paper as graduate students and postdoctoral scholars within the Gaudin Agroecology Lab in the Department of Plant Sciences at University of California, Davis. We represent multiple nationalities (United States, Chile, Spain), two native languages (Spanish and English), multiple genders, multiple generations (from Gen X to millennial), multiple racial and ethnic identities (White, read as White by most people, Hispanic, Latina), and multiple socio-economic classes.

Writing this paper built on years of conversations among lab and department members in an agroecology journal club. We began convening the agroecology journal club online in 2020 to create community during the COVID-19 pandemic and to co-learn about agroecological theory. Most of us also engaged with the UC Davis Feminist Research Institute through a course called Asking Different Questions, led by SR. This program gave us a call to action through training in critical reflection and research praxis grounded in feminist Science and Technology Studies and ethnic studies. At the same time, many of us grew more connected to and intertwined within the communities where our research was situated. We grew in our belief that research outcomes need to benefit local communities. Some of us also began growing skeptical of the concept of the academic as "the expert." This skepticism is supported by research that demonstrates how "expertise" has historically served to invalidate people of color, women, and others excluded from academia and influential professions (Faulkner, 2007; Hofstra et al., 2020; Grindstaff, 2022; Kozlowski et al., 2022; Weissman, 2023). The culmination of these experiences inspired us to work on an agroecological project collaboratively, and we began writing this paper in 2022. Later, the call for papers for this issue resonated with us, not as experts in academic knowledge generation, but as early-career scientists who struggle with the dissonances of normative research goals and our own personal values and perspectives as described in the introduction.

The actual writing of this paper took place through weekly writing meetings and a collaborative, iterative editing process. In an attempt to achieve equity, we followed the Civic Laboratory for Environmental Action Research (CLEAR) guidelines to discuss author order (Liboiron et al., 2017). All authors have made significant intellectual contributions to the framework we have developed, as have many people who were not directly part of the paper-writing process. We hope that we have adequately expressed our gratitude to them through the acknowledgements. The process of writing this manuscript has been an instructive and generative opportunity and we look forward to continuing to learn and grow with this work.

It is important to note that our social imaginary is limited by our western frame of reference (Vásquez-Fernández, 2020) and, as such, we welcome critiques and further transformation of the vision we present in this article. Recognizing the limited perspective that we hold as early career Western scientists, we commit to learning from the wisdom of multiple movements who are working towards and living under other paradigms, such as Indigenous peoples, on whose land we live, and who continue to steward their homelands despite continued land theft and colonization, the descendants of those who were forcibly brought to this continent and enslaved, and immigrants who have come to the US because of the international imperialist projects that the US government and agribusiness have inflicted on communities around the world (Hopkins, 2018).

3 Framework development

To inform the basis of our academic knowledge creation framework, we initially explored a series of questions to develop our own understandings of agroecology: how do socio-political factors shape the scientific question being asked and what are the implications for our work? Who benefits from the scientific question being answered? How do research methods shape the narrative of the scientific question? Our goal was not to definitively answer these questions, but to train ourselves to reflect iteratively on them throughout our research processes. We came to believe that researchers have an ethical obligation to recognize their relationality as participants in the production of knowledge and the ways in which knowledge practices shape their world (Haraway, 1988; Salmón, 2000; McKittrick, 2021; Hernandez, 2022). As Wendell Berry wrote in The One Straw Revolution by Masanobu Fukuoka: [we must pay] "attention to relationships, to causes and effects," and that we must be "responsible for what one knows," in this way "We cannot isolate one aspect of life from another. When we change the way we grow our food, we change our food, we change society, we change our values" (Berry, 1978).

To understand the current academic knowledge production system, we drew from our experiences and the literature to develop a framework with two drivers, power and values, and two mechanisms, motives and relationality (Figure 1). These determine a praxis of academic knowledge generation, in our case applied to the agricultural sciences. We understand power as the ability to influence the course of events (Foucault, 1980), and values as an individual's and community's principles and worldviews (Kenter et al., 2015). We chose power and values as drivers drawing from literature that finds these forces fundamental in shaping broad societal phenomena (Foucault, 1980; Hooks, 1994b). We understand motives as the reasons that guide decisions and actions, and relationality as the state of being connected (Tynan, 2021). Motives and relationality shape our perceptions of the world—situated within specific social, cultural, and political contexts—and, as such, are entangled throughout the processes of scientific knowledge production (Haraway, 1988). We believe that our

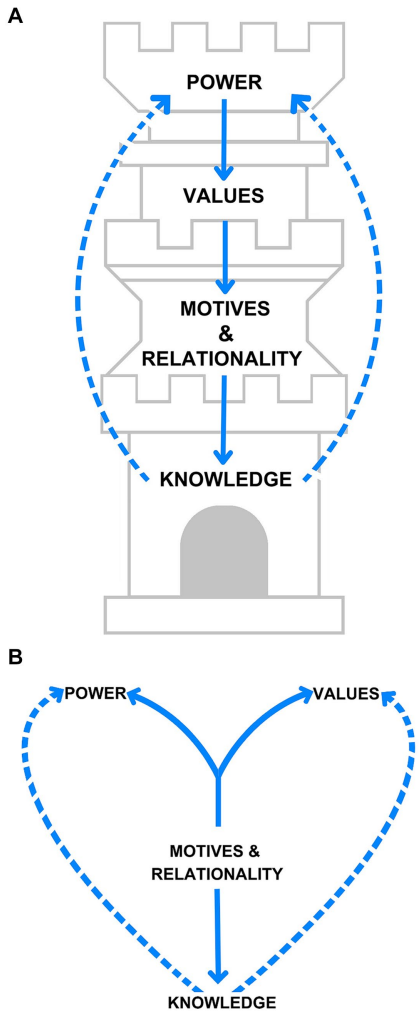

FIGURE 1
Two versions of our knowledge creation framework in academia. **(A)** The Ivory Tower that represents the current system. Power drives knowledge creation, shaping the dominant values, motives, and relationality in a hierarchical process. Knowledge informs the dominant power structure in a reinforcing way (Foucault, 1977; Haraway, 1988; Harding, 1994). **(B)** The Heart of Knowledge that depicts a re-imagined knowledge creation system. Motives and relationality are in the center of the diagram, shaping power, values, and knowledge. In this alternative system, knowledge is not influenced directly by power. Therefore, we envision a knowledge creation that still informs power structures, but has space to both reinforce and subvert them along with challenging or supporting the predominant values (Tynan, 2021; McGreevy et al., 2022).

framework can relate in different manners depending on the system's structure and we present two different arrangements of the drivers and mechanisms in this paper, represented by Figures 1A,B.

In the current system (Figure 1A), power is at the top of the framework and is fundamental in shaping the downstream knowledge production. We describe how power structures dictate the rest of the knowledge system in Section IV. In our re-imagined system, the framework is rearranged such that motives and relationality are at the center of the academic knowledge creation (Figure 1B), which we describe in Section V. In both systems, knowledge can inform societal structures, through either reinforcing or challenging them.

4 Critique of the current agricultural academic knowledge creation system

4.1 Drivers of knowledge generation

4.1.1 Power

Power, defined as who is able to influence or control behavior and resources, is inextricably linked with knowledge (Foucault, 1980). In the past several centuries, Western scientific thought, and how knowledge is generated, valued and shared, has been influenced and reinforced by racism, colonialism, settler colonialism, imperialism and patriarchy, all systems of oppressive hierarchical power structures (Foucault, 1977; Haraway, 1988; Harding, 1994). We acknowledge the strengths of Western science and emphasize that criticism should be directed not at science itself but at the institutional norms and pressures that lead to its misapplication, especially in serving hierarchical power dynamics. Current agricultural research in academia operates under consolidated and hierarchical power structures that confine research agendas to focus on specific knowledge generation and synthesis (Vanloqueren and Baret, 2009; DeLonge et al., 2016; Jin and Huffman, 2016; Miles et al., 2017), as shown in the Ivory Tower in Figure 1A. Power in this system has two main consequences: (1) a limited set of knowledge and people (experts) are legitimized (Montenegro de Wit and Iles, 2016); (2) only certain groups of people benefit from the knowledge that is produced.

The narrowly defined and legitimized way of knowing – the epistemology – of Western positivist scientific thought dominates agricultural research. This epistemology stems from Enlightenment principles and is enforced by the consolidation of power among academics and the institutions in which they do research (Banerjee and Arjaliès, 2021). For example, the Land Grant University (LGU) system in the US, which was founded in the tradition of Western scientific thought, was funded by the theft and sale of Indigenous land through settler colonialism (Lee and Ahtone, 2020; Fanshel, 2021) (Box 1). Concurrently, agricultural and land stewardship knowledge of Indigenous people has been repeatedly delegitimized, stolen, and co-opted within Western academic institutions (Smith, 2012; Kimmerer, 2013; Whyte, 2017; Wilson, 2020; Hernandez, 2022). This knowledge extraction is consistent with the extractivist practices of settler colonialism, in which the university legitimizes this knowledge as their own and serves to reinforce dominant power structures (Jordan, 1997). This has contributed to the widespread loss of Indigenous knowledge and has implications for agricultural practices in the US and in the Global South where agribusiness paradigms are imposed on farmers (Magdoff and Tokar, 2010; McMichael, 2012) (Boxes 2, 3).

In the current academic agricultural knowledge system, profit is power because it is the main driver of research priorities (Ellis and Bowden, 2014), which in turn determines who the main beneficiaries of knowledge production are. For example, decades of research focused on increasing yields of crops used primarily for animal feed and/or biofuels has been well-funded, while there has been comparatively little funding for research in diversified, ecologically sound agricultural systems (DeLonge et al., 2016; Miles et al., 2017). Furthermore, public funding for agricultural research has declined since the 1980s with the neoliberalization of public institutions, while private funding has increased (Nelson and Fuglie, 2022). This has led to a trend in research that is undertaken for the benefit of moneyed

Box 1 Land grant universities in the US are top-down gatekeepers that produce commodified research.

Farming in the US was a widely distributed livelihood with associated knowledge prior to establishment of land grant universities (LGUs) and extension services by the Morrill and Hatch acts, respectively (Danbom, 1986). The LGU system is a system of public universities, funded initially through land investments, to provide education to members of the working class. As such, LGUs in the US are often held up as an example of democratization of research and knowledge production (Ross, 1941), though notably their history includes endemic issues of gender and racial inequality (Herren and Craig Edwards, 2003) as well as being founded on the theft and sale of Indigenous lands (Lee and Ahtone, 2020). Furthermore, the mission of LGUs in agricultural research is complicated by the fact that one foundational purpose of agronomy and agriculture extension programs was to "professionalize" farmers (Danbom, 1986) and thus create an elite and distinct class of agriculturalists.

In 1980, the Bayh-Dole Act reframed research for public good as inferior to a knowledge economy that promotes public good through commercialization (Kenney, 1986; Buttel and Belsky, 1987; Slaughter and Leslie, 1998; Slaughter and Rhoades, 2000; Olssen and Peters, 2007). This allowed for private patents to be registered from inventions developed through public funding at universities. The substitution of private instead of public interests has since permeated the sentiments for which LGU administrators view the purpose of public research (Ostrom and Jackson-Smith, 2005; Glenna et al., 2007), situating LGUs as one of many gatekeepers of consolidated power in our knowledge framework.

Box 2 The narrative of feeding the world has not eradicated hunger.

While often used to justify the need to increase agricultural production, the widespread "feeding the world" narrative overlooks the fact that simply producing more food does not equate to, nor ensure, the eradication of hunger (Lichtfouse, 2012). Despite global increases in productivity, the FAO reported that between 691 and 783 million people faced severe hunger worldwide in 2022 (FAO, IFAD, UNICEF, WFP and WHO, 2023), though actual numbers may be significantly higher (Holt-Giménez, 2019). Hunger continues to increase in Western Asia, the Caribbean and all subregions of Africa (FAO, IFAD, UNICEF, WFP and WHO, 2023), which shows the limitations of increased production without ensuring equitable distribution. The growthist value system that undergirds capitalism will always incentivise more production—but critically, not more access to food for those with low purchasing power (Rasmussen et al., 2018; Holt-Giménez, 2019), who may instead suffer the externalized social and environmental impacts (Hickel et al., 2022). Even with high production, a significant portion of the world's crop calories is used for animal feed, and only a small fraction of these calories ends up in the human diet through animal products (Cassidy et al., 2013). The focus on increasing production becomes less critical when considering the massive amounts of food currently being wasted (Stuart, 2009; Mokrane et al., 2023). Thus, there is a need of shifting the focus from traditional agricultural productivity metrics to evaluating how effectively cropland feeds people (Cassidy et al., 2013), as well as embracing the agroecological principles of sufficiency, distribution, and care (McGreevy et al., 2022).

Unending growth is a value that has deep historical roots in attempts to increase efficiency of communal resources, especially land. In the enclosure of the commons (Young, 1808), laws were enacted to limit communal land management and characterized peasants as obstructing progress (Handy, 2009). Though the scale of effects and underlying motives of the Enclosure period are contested, historians broadly agree that this growthist focus came at the expense of rural livelihoods and increased inequality (Burchardt, 2002). Widely successful at increasing yields (Conway, 1997), the growthist values underlying the Green Revolution meant that increasing yield efforts were largely undertaken without consideration for regional, social, or ecological limits. As Patel (2013) points out "the scientific breeding strategy was not geared towards the requirements of poorer peasants, but instead produced seeds requiring irrigation and an intensive use of material inputs." Thus, through the promise of increased agricultural output, the Green Revolution opened new markets for agricultural inputs and machinery, creating new forms of economic dependency for nations in the Global South (Holt-Giménez, 2019). And even as we continue to quantify continued hunger in the face of high production, we miss the opportunity to eradicate it instead, and thus remove the need to continue quantifying it.

stakeholders (see Box 1). For instance, there is evidence that the livestock industry invests in shaping research and climate policies, minimizing its environmental impact while advocating for strategies that serve its interests, rather than transformative solutions (Morris and Jacquet, 2024). Agricultural research at LGUs is thus a key component of public-private investment that directs the creation and extraction of knowledge generated by LGUs towards the advancement of privileged agribusiness agendas (Frickel et al., 2010; Heisey and Fuglie, 2018).

4.1.2 Values

Values refer to guiding and normative principles shared by communities that influence individual and group behavior and provide a common understanding of what is worthy (Kenter et al., 2015). Values work in tandem with power structures to shape societal motivations and our relationality (Koltko-Rivera, 2004; Buchholz, 2012). Value systems are unavoidably expressed within research narratives – whether implicit or explicit, intentional or unintentional (Dahlberg, 1988). Thus, like power, the application of personal values can reinforce or subvert the system in which they operate. The dominant values across agricultural research are founded in growthism [continuous agricultural growth and increasing affluence (Lara et al., 2023)] which is reinforced by reductionism [studying components of a system in isolation (Fuenmayor, 1991)] and individualism [prioritizing individuals without accountability to a collective (Hooks, 1994a)]. It is therefore necessary to describe and discuss these values—thereby making them explicit—so we can challenge and reconfigure current dominant value paradigms (Kenter et al., 2019).

Reductionism is a research norm in which researchers prioritize knowledge that is simple, atomized, and examinable outside of context (Fuenmayor, 1991; Schiere et al., 2004; Jordan, 2013). Reductionism is often justified as a way to identify direct causes through the isolation

Box 3 Sustainable intensification: refeeding the world with the same underlying motives.

Sustainable intensification is a concept coined in the context of increasing productivity in smallholder farms in Africa by Pretty (1997), and was later backed by the FAO as a means of producing greater yields without bringing more land under cultivation and without greater environmental externalities (Bless et al., 2023). However, the underlying motives of this narrative might not address deeper systemic issues within the food system.

While increased production is an important component of food sovereignty and security in specific regional contexts (Gerten et al., 2020), research and recommendations for sustainable intensification are mostly high-input, technology-based, and focused on large-scale commodity production for international trade (Godfray, 2015; Mahon et al., 2017; Bless et al., 2023). The sustainable intensification narrative may reinforce the reduction of biodiverse agricultural systems into specialized, simplified landscapes dominated by monocultures—mainly for factory meat production and biofuels for the Global North—under the premise of higher productivity and efficiency per unit of product (Loos et al., 2014). While the narrative affirms sparing land for nature, there is little evidence that this rationale leads to meaningful reductions in agricultural expansion, nor that it is beneficial from a socio-ecological perspective (Ceddia et al., 2014; Kremen, 2015; Pratzer et al., 2023; Burian et al., 2024).

Sustainable intensification can be understood as a continuation of the narrative of feeding the world, backed by neoliberal policies in the form of subsidies that proliferate a narrow range of crops, mainly grains and soy (Hendrickson, 2015). It can contribute to an imbalance in food production, with farmers overproducing fats, grains for feed, and sugars, and not enough fruits, vegetables, and protein to meet nutritional needs (Kc et al., 2018). Additionally, a focus on efficiency can paradoxically lead to increased resource consumption, a phenomenon known as Jevon's paradox (Hamant, 2020). For example, improvements in irrigation efficiency have sometimes led to increased water use overall (Paul et al., 2019; Wang et al., 2020). The US renewable fuel standard – the world's largest biofuel program – has resulted in an increase of greenhouse gas emissions and along with increased food prices and greater environmental degradation (Lark et al., 2022). Additionally, increased agricultural yields are associated with higher deforestation in Sub-Saharan Africa and Latin America, and with farm expansion in East Asia and the Pacific (Goulart et al., 2023).

The outcomes of our dominant agricultural system suggest there may be other motives underlying this narrative, such as continued capital accumulation and the maintenance of entrenched power structures. While attempts at reforming the narrative of sustainable intensification may be possible, it currently lacks transformative solutions to shift the power dynamics, motives, and values within the dominant food system (Mahon et al., 2017; Bless et al., 2023), and may disable attempts towards agroecological transformations (Walthall et al., 2024).

of factors, but this approach does not recognize that in reality those separated factors are inextricably intertwined (Gilson, 2015). As such, knowledge creation within this value system perpetuates the simplification of processes and homogenization of socio-ecologically complex systems in agricultural sciences. This reinforces repeated patterns of oppression and the delegitimization of Indigenous and traditional ecological knowledge built upon generations and, in some cases, thousands of years of observation (Kloppenburg, 1991; Kimmerer, 2002). Reductionism contributes to growthism and hinders our collective capacity for systemic adaptation and transformation because complex processes are reduced to purely biophysical aspects with no consideration of socioecological and political dimensions (Bawden, 1991; Schiere et al., 1999; International Commission on the Future of Food and Agriculture, 2009; Stetsenko, 2018).

Within a growthist value system, research focuses on unending growth of agricultural land, yields and livestock units without consideration of planetary boundaries (McGreevy et al., 2022). The growth and intensification of agriculture have led to the homogenization of natural and cultural environments (Foley et al., 2005; Altieri et al., 2015), resulting in the depletion of biodiversity (Estrada-Carmona et al., 2022), soil carbon (Sanderman et al., 2017), and local, traditional knowledge (FAO, Alliance of Biodiversity International, and CIAT, 2021). During the Green Revolution, researchers from the US and other parts of the Global North promoted homogeneous agricultural systems through the global manufacturing, distribution, and widespread utilization of hybrid seeds and chemical inputs under the justification of feeding the world (Box 2). The benefits of the Green Revolution did not necessarily improve food accessibility for vulnerable groups around the world (Kiers et al., 2008; FAO, IFAD, UNICEF, WFP and WHO, 2023), yet the accompanying loss of ecosystem function has profoundly impacted their livelihoods (López, 1998; Rasmussen et al., 2018). The resultant agro-industrial intensification can consolidate land tenure (reducing the number of farmers, particularly smallholders), destabilize local markets and processing infrastructure, and lead to widespread environmental degradation (López, 1998; MacDonald, 2020). These consequences diminish the adaptive capacity and viability of rural communities which leaves the entire human population vulnerable (Shiva, 2000; Gámez-Virués et al., 2015).

4.2 Mechanisms of knowledge generation

4.2.1 Motives

Motives are the primary reasons guiding decisions and actions towards an objective. In our framework, motives are the "why" that underlies academic knowledge creation processes, or "why we do what we do" (Vickers, 2007). Linked with power and values, motives encompass a range of strategic socioeconomic and political considerations that contribute to specific outcomes in our current food system. Critically, the values of those with power in the current system have significant influence over which motives are considered valid (Figure 1A). Researchers and academics within the current knowledge system of agricultural sciences often include efficiency for the sake of profit and productivity as primary motives for their work. One example of these motives in action is the subfield of sustainable intensification in agriculture (Box 3).

In the positivist view of Western science, researchers consider high-yielding monocultures a tool to realize the motive of efficiency

because they are highly productive under high input paradigms which rely on substitutive chemical applications that replace ecological function (Hoffman et al., 1995). This narrow framing disregards long-term impacts and socio-ecological dimensions of food systems, which might be necessary to achieve a more just and equitable society, and fails to address current system failures like high rates of global food waste (approximately one third of global food production) (Stuart, 2009; Mokrane et al., 2023; Zhu et al., 2023). Some examples of alternative framings include food sovereignty (Holt-Giménez and Altieri, 2013), agroecology (James et al., 2023; Ong et al., 2024), indigenous food systems (FAO, 2021), and taking a feminist approach to food systems (Gilson, 2015; Zaremba et al., 2021). While a narrow framing may increase the profits of multinational agribusinesses (and their shareholders) in industrialized agriculture (Lawrence and Smith, 2020; Ashwood et al., 2022), persistent failures to accomplish equitable and reliable food access around the world (recent examples include the food shortages during the beginning of the COVID-19 pandemic and the war in the Ukraine) call into question the "efficiency" of the current food system, the continual focus of agribusiness-funded research on increasing yields, and how wisely we are using resources.

A framework of efficiency may also consider the broader societal or ecological harms of industrial agriculture as externalities, without recognizing and addressing the causative motive of profit maximization. One current estimate of the "hidden" cost of the industrialized food system is $12.7 trillion, primarily due to negative public health outcomes from unhealthy food (FAO, IFAD, UNICEF, WFP and WHO, 2023; Ong et al., 2024). On the ecological front, recent capitalist frameworks for climate change offsets, such as carbon farming, have resulted in fewer benefits than claimed (West et al., 2023). Academics have shown concern about the lack of transformative motives backing regenerative agriculture (Bless et al., 2023), soil health (Lehmann et al., 2020), and sustainable intensification of agricultural production (Loos et al., 2014) (Box 3). Without serious examination, questioning, and critique the underlying power structures and associated values of these narratives may continue to support business-as-usual (McGreevy et al., 2022).

4.2.2 Relationality

Relationality is a state of connection that creates attachment and responsibility; relationality can be within the self, with other humans, and with the more-than-human world (Nicklay et al., 2023). We acknowledge that the concept of relationality stems largely from Indigenous communities, and that "relationality is not a new metaphor to be reaped for academic gain, but a practice bound with responsibilities with kin and [land]" (Tynan, 2021). In the dominant food system (Figure 1A), relationality is not treated as a central component, but rather stems from power structures and value systems and is a mechanism through which knowledge is created and reinforced. Within the current system, relationality is anthropocentric (structured hierarchically to prioritize humans) and perpetuates relations of domination, extractivism, and simplification of nature.

Anthropocentric relationality stems from Western societal norms for various aspects of the human experience, and specifically from Enlightenment concepts such as the mastery of nature and rationalization being valued over experiential knowledge, which underpin much of academia (Figure 1A) (Banerjee and Arjaliès, 2021; Cubillos et al., 2022). The mechanistic worldview of Descartes and Newton, which fosters an anthropocentric perspective, perceives the Earth as a machine to be controlled and exploited by humans (Capra, 1996). This perspective isolates humans from the natural world, neglecting our origin and the intrinsic value of all life, non-life, and the interconnectedness of all ecological phenomena (Capra, 1996). Consequently, global issues are often approached in isolation, overlooking their systemic nature and interdependence, which hinders our ability to fully comprehend and address the complexities of environmental challenges (Capra, 1996).

Anthropocentric relationality in academia, particularly within the current food system, often results in the dismissal of Indigenous science and knowledge as mere folklore because of their explicit reciprocal relationship with nature. For example, if we consider the narrative discussed earlier of feeding the world, the expression more accurately means feed people in a paternalistic relationship of domination over communities whose food sovereignty has been denied through (neo-)colonialism and imperialism. This relationality of the current food system is informed by power structures, as discussed above, in which academics legitimize only a limited set of knowledges. One example of how relationality interacts with power is in the land-sparing vs. land-sharing debate (Fischer et al., 2014; Kremen, 2015; Grass et al., 2019). The dominant relationality that artificially separates humans from the rest of the world and conceives of land as "better" when it is untouched and pristine (i.e., land that is untouched by humans), despite the co-evolution of human habitation with numerous ecotypes globally (Ellis et al., 2021). Current biodiversity loss is primarily a result of appropriation, colonization, and intensification of land use in areas previously inhabited and utilized by earlier societies, rather than the disturbance of pristine ecosystems (Ellis et al., 2021). Lands in what we now call the US were managed by Indigenous peoples for millennia until settler colonists, and later the US government, occupied these territories and, often by extreme violence, dispossessed Indigenous peoples from their land. Settler colonists and the government then proposed to conserve these same lands (Mazel, 2000). And, while intensifying agriculture for commodity crops does not necessarily spare land as advertised, Indigenous land stewardships, based on relationality between humans and nature, does (Pratzer et al., 2023). The history of global land use demonstrates that supporting Indigenous peoples and local communities in their role as environmental stewards is essential for both biodiversity and agrobiodiversity conservation worldwide (Ellis et al., 2021).

Nevertheless, anthropogenic relationality to land allows agricultural researchers to view nature through an instrumentalist and extractive lens in which culture is stripped from agriculture (Flora, 2014). The same dynamic encourages early-career researchers to extract information from the communities they engage with, without reciprocity. At the same time, researchers are subjected to hierarchical structures that exploit them in many ways (Box 4).

5 Discussion of a re-imagined agricultural academic knowledge creation system

As early-career researchers, we advocate for continuous and iterative societal transformations to address the global systemic crises and achieve just and equitable food systems (Kinzig et al., 2013; IPBES, 2022; IPCC, 2022). However, as Galeano (1998)

Box 4 Academic extractivism: the journey of early career scientists.

Relations of domination, extractivism, and simplification extend to how academic spaces are structured. Relationality informs researchers' connection to their study system and contributes to whose voices are valued and which stakeholders are included. Many disciplines, especially in the biophysical sciences, are siloed instead of working in relationship with other fields (Gardner, 2014). Lack of interdisciplinary conversation minimizes opportunities for diverse coursework, critical engagement with a diversity of ideas, and how science is reflective of dominant social, political and economic structures (Hodson, 2020). Teacher-centered classrooms institute a hierarchical, dominating classroom structure in which knowledge is presented by professors and teaching assistants and passed down to students (the banking model described by Freire, 1970), with limited opportunity for horizontal learning and critical discourse.

Once students face graduate school, their success is measured in the increasing number of manuscripts published, and programs are evaluated by growing number of students who have graduated (Slaughter and Rhoades, 2000; Chagnon et al., 2022). Early-career scientists are expected to extract information from nature and communities, while they themselves are exploited via low wages and poor working conditions (Bannister, 2005; Levecque et al., 2017; Woolston, 2019). This exploitation often occurs in hierarchical, harsh environments, in which individualism is a prevalent value to succeed under the current system (Gill, 2016). Furthermore, racial, economic, and other privileges allow historically overrepresented groups to thrive in academia, while keeping out large portions of historically excluded groups (Hooks, 1994a; Clauset et al., 2015; Matias et al., 2022). All of this contributes to the mental health crisis in science (Hall, 2023), highlighting yet another reason for transformative changes in academic spaces.

TABLE 1 Characteristics of how the current and re-imagined academic agricultural knowledge creation systems operate using the drivers and mechanisms from our knowledge creation framework.

	Power	Values	Motives	Relationality
Current academic agricultural knowledge creation system	Consolidation Hierarchy	Growthism Reductionism	Efficiency Productivism	Extractivism Anthropocentrism
Re-imagined academic agricultural knowledge creation system	Distribution Horizontalism	Solidarity Holism	Sufficiency Sovereignty	Reciprocity Care

describes in our preface, the upside-down world give us the impression that we must endure this reality and limit the potential impact of our work. In this section, we acknowledge his counter-school of thought, that challenges or subverts dominant paradigms. We define counter-hegemony as movements and actions aimed at disrupting the dominant food system ruled by capital accumulation (Carroll, 2010). Figure 1B illustrates the revised structure of knowledge production for agroecological transformation of food systems that we envision.

Here, motives and relationality govern academic knowledge production side by side, in a non-hierarchical structure. They shape power and values explicitly, and then both produce knowledge through a conscious praxis. Finally, we envision that the knowledge produced can challenge and provide checks on power and values systems. For comparison, we provide a summary of the drivers and mechanisms in both the current dominant academic knowledge creation system and our proposed system in Table 1. We summarize these key aspects of a re-imagined system in a set of vignettes (Boxes 5–7). These vignettes describe creative and holistic methods of alternative knowledge creation systems through stories from people working in the counter-hegemonic food movement. Stories and storytelling are widely acknowledged as culturally nuanced ways of knowing, produced within networks of relational meaning-making (Tynan, 2021).

The transformation of power, values, and motives requires that researchers recognize and build new patterns and priorities of relationality in a transformed system. Instead of anthropocentric extractivism, we recognize a different relationality that connects people and non-people from a place of care and responsibility, also known as reciprocity (Tynan, 2021). Reciprocal relationships are defined by interaction with and responsibility to humans, non-humans, landscapes and any part of the natural world. Reciprocity creates an increased commitment and desire to take care of our world rather than viewing the natural world through an instrumental lens in the dominant normative manner (Chan et al., 2016; Klain et al., 2017; Allen et al., 2018; Díaz et al., 2018).

As Chan et al. (2016) point out, a collective understanding of connectedness and care is the basis for several worldviews that operate with relational values at their core: back to land movements in North America, Ubuntu in South Africa, care in the ethics of feminisms, and *Buen Vivir* in Latin America (Box 5). Importantly, relationality based on reciprocity is a concept that we understand mainly due to the intellectual labor of Indigenous writers and activists. Our intellectual debt to them highlights the complementary need for relationality and solidarity as a core value, to support sovereignty of communities whose knowledge and power is unacknowledged within the current system. Finally, rather

Box 5 Care and connectedness at the core of Indigenous worldviews and agroecology.

Care and connectedness are concepts we see in many counter-hegemonic examples, such as the book Fresh Banana Leaves, in which Dr. Jessica Hernandez explains how essential it is to shift the way we relate to our contexts and that from her Indigenous perspective:

"Taking care of nature, and nature taking care of us in return, is the greatest teaching my father has taught me. Indeed, nature protects us as long as we protect nature. This is something Western science has failed to understand or explain." [p. 30] *"(…) On top of this, as an Indigenous person, I can see how both biology and ecology are interconnected to health, education, and other systems that are deemed far removed from biology or ecology within Western academic frameworks. This is due to the holistic way of thinking and knowing that we hold as Indigenous peoples, that everything is ultimately connected to us and our environments. […] While this may be deemed as scattered, this is the way we as Indigenous peoples look at the world. Everything in our environments has a relationship with us and this is why it is hard for us to box things like Western ways of knowing does."* (pp. 11–12).

Agroecology is rooted in Indigenous perspectives, and thus connectedness is at its core. Researchers working in Canadian academic institutions developed a meta-narrative review and a framework to describe the links between agroecology and well-being, and used it to assess how grassroots actors involved in agroecological movements in southern Brazil described and defined agroecology (James et al., 2023). Their results suggest that "agroecology is a philosophy of life that promotes well-being" in the context they studied. Connectedness is highlighted as a core principle of agroecology, as described below.

"Underpinning these goals of solidarity and alliance-building across social groups and spatial scales is a commitment to collaboration and partnership, instead of competition. For example, two agroecological farmers, Leticia and Natalia, began their journey by visiting another farmer, Geraldo, known as a reference point for agroecology in the region. As fairly new farmers, they emphasized how important it was to them that Geraldo "saw us as a companion, not as competition. That was really cool." This sense of cooperation and interdependence actually serves to bolster farmers' perceptions of autonomy, self-determination, and resourcefulness, as they aim to rely on one another and to work with natural inputs and processes (i.e., native seeds and species, mulches, organic fertilizers), instead of relying on agribusiness and the private sector. As Eduardo stated,

Eduardo: Why are there so many poor people in the world? It's because someone is consuming a lot. Then it centralizes that power. In agroecology we do not see this, and neither can we – the more you concentrate, the worse things work. In agroecology you reach a certain level – I have a little money, I have a few assets, I can survive, and that's enough – I do not need any more. What am I going to create empires for? If you start creating empires within agroecology, then your philosophy has to change – it stops being agroecology … Agroecology as a concept is cooperative, not private. It is not a company that owns and that will rule everything. It is always that cooperative idea. (April 28, 2019)."

Box 6 Community-based participatory research contributes to pertinent, situated knowledge.

Community-based participatory research (CBPR) is an interdisciplinary field that was developed within public health fields to shift research from being done "on" communities to doing research "with" communities (Israel et al., 2010). CBPR also provides a fruitful set of methods for research within food systems and natural resource stewardship, as the principles are appropriate for acknowledging and uplifting Indigenous knowledge and expertise. For example, in her book Fresh Banana Leaves, Jessica Hernandez, PhD, describes community-based participatory research (CBPR) as a collaborative, bottom-up research approach. She points out how CBPR is a tool to distribute power:

"CBPR can become congruent with Indigenous communities because it attempts to dismantle some of the impacts of research and settler colonialism. It allows Indigenous peoples to serve as the leaders and consumers of the research projects meant to benefit their communities rather than just serving as research subjects. It also allows for the creation of an effective collaboration and destruction of power differentials between the researchers, community members, and relevant organizations." (Hernandez, 2022).

Dr. Hernandez draws five principles to guide implementation of CBPR:

1. Follow and create fluid and dynamic approaches that do not follow the linear research method.
2. Respect tribal sovereignty and Indigenous autonomy.
3. Follow Indigenous protocols and their way of being and doing things in their communities.
4. Respect intellectual property.
5. Embrace all Indigenous epistemologies relevant to the community.

While Dr. Hernandez applies these principles to working directly with tribal nations and Indigenous communities in North and Central America, they can apply to other community collaborations, especially those conducted with historically oppressed communities whose knowledge has not been respected by researchers in the past.

than prioritizing efficiency solely for profit, change-oriented food system scholars advocate for sufficiency (McGreevy et al., 2022). This viewpoint brings the importance of agroecology and producing foods that align with nutritional needs and sociocultural preferences (Van Zutphen et al., 2022). It aims not just to boost production but also to ensure fair food distribution, targeting issues like malnutrition, excessive consumption, and wastage, as well as affluent diets and lifestyles.

A transformed system of knowledge production requires broadening who has authority to determine what is legitimate and who the primary beneficiaries of knowledge production are. For example, academic knowledge creation must aim to meaningfully benefit a plurality of people; this is particularly true for public institutions which have a mandate to serve the public good. This can be accomplished by research decisions being made through participatory and democratic processes, which would increase accountability of those inside institutions to the greater public. Current attempts to achieve this include biocultural approaches to understanding food and land that deliberately legitimate multiple types of knowledge (Hanspach et al., 2020). Another example is knowledge co-creation within agroecological projects, which recognizes

Box 7 Addressing the complexity of our food system and giving students space to reflect creates opportunity for change-oriented learning.

Researchers at University of California, Davis developed and implemented an undergraduate level Food Systems course in 2008 in which the instructors "*fostered an explicitly democratic and collaborative learning environment by increasing student participation in a less hierarchical structure… by creating seven ground rules that validate everyone's perspectives, questions, and contributions*" (Galt et al., 2012). Student-centered and self-reflective learning allowed students to grapple with the tension between their values, their understanding of how they have arrived at their current worldview, the current state of the food system and what they would like the food system to look like. Through self-reflection, students came to understand the existence of multiple perspectives and the complexity of food system problems, as described below:

"Another noted the complexity: "many of the issues we have covered in examining food systems are not linear and with that it is difficult to write an essay that begs for an intro, thesis, body, and conclusion. I almost cut up my paper and pasted it on a poster, with lots of arrows" (Student 9)."

This class provides an example of how important it is to "understand, situate and change our own cognitive processes" or "think about thinking." It is important that universities give students the space to do so as it can lead to socio-political action as described by Student 7: *"I want to walk lightly, speak loudly, and be respectful and accountable to people who do not have the power, resources or desire to act in the ways that I do. I want to face the toughest challenges and join hands to overcome them."*

The food systems curriculum is one of multiple examples of exciting innovations in undergraduate education (e.g., Valley et al., 2020; Dring et al., 2022). However, there are comparatively few opportunities for students at the graduate level in agricultural research to engage with complexity and to critically reflect on their research. To address that gap, Nicklay et al. (2023) propose a pedagogical model to support critically-informed learning in agroecology within the institutional context of the University of Minnesota – Twin Cities. The model centers around a learning cohort and draws from situated knowledge, with three key components: critical inquiry, relational centering, and participatory practice. The model was developed through a 7-year long, iterative visioning process. The findings of their iterative process are as follows:

"*Our findings particularly highlighted the importance of critical and collective processes/structures, and we focused on epistemological interventions because, as prior scholarship has shown, they help teachers and learners develop new vocabularies, deepen analysis, navigate discomfort and uncertainty, and overcome cognitive or emotional blocks to dialogue.*"

and expands whose knowledge is valued as well as who benefits from the outcomes of research (Utter et al., 2021). Community-based participatory research (CBPR), in which researchers make explicit consideration of the normative values, politics, and possibilities their work supports, can be useful for guiding research praxis (Box 6). This method is most effective when researchers are embedded within communities where they are doing research "with" instead of "on" community members and agricultural systems.

A participatory knowledge creation system with deep relationality and distributed power requires that researchers acknowledge positionality and the inherent partial perspectives that we inhabit. The model of partial perspectives, from Feminist scholar Donna Haraway, describes a "limited location and situated knowledge, not about transcendence and splitting of subject and object." (Haraway, 1988). In Barad (2007) words, we cannot separate the experiences of being and knowing. When we recognize partial perspective, we also recognize that scientific knowledge is not objective, but rather, situated within a context of normative power relations, values, motives, and relationality. The acknowledgement of partial perspectives can help researchers shift from siloed, hierarchical knowledge production towards egalitarian approaches, fostering transdisciplinary collaboration, and recognizing and celebrating complexity and multiple ways of knowing. This complex, horizontal transformation of knowledge production could contribute towards a world in which knowledge production is in solidarity with social movement goals. Recognition of the complexity of the reality we study may also allow us to embrace the complexity of our own nature as researchers. As a tool for addressing complexity, we have developed a set of questions for researchers to reflect on how the drivers and mechanisms we have described interact in their own work and how they can contribute to systemic transformation (Table 2).

A transformed system of knowledge production could be accompanied by concomitant shifts in how academic training is undertaken (Box 7). For example, a non-hierarchical classroom structure would encourage instructors to value relationship creation and knowledge production with and between students. Additionally, valuing students' lived experiences creates a more horizontal knowledge creation approach, rather than a top down, teacher-centered didactic approach (Freire, 1970; Hooks, 1994b). Action-oriented classrooms also allow for students to connect their coursework holistically to the broader, local context, providing real life complexity. This allows for relationship building in the community and can encourage students to commit to sociopolitical action that aligns with their values (Hodson, 2020).

6 Conclusion

Examining the relative centrality and relationships among relationality, motives, values and power in the knowledge creation process is an effective tool for agricultural scientists to critically engage with their work. In this paper, we demonstrate how a framework that concentrates power in limited knowledge legitimacy and money, with values, motives and relationality following that concentration of power, has led to research supporting an ecologically and socially unsustainable food system that contributes to climate change, biodiversity loss, pollution, and socioeconomic inequalities. In contrast, we offer a vision of relationality-based knowledge creation that can effectively address the urgent ecological and food access crises we see in our world by operating within ecological limits and benefitting society. Our ultimate goal is to act consciously through the praxis of our own version of a counter-hegemonic food system transformation. We want to build on and continue to co-create transdisciplinary academic spaces centered in critical reflection, where we are encouraged to value the complexity of our own identities and of the systems we live in. We envision power within the public institutions we work in to be distributed so that we can better serve public interests and to be spaces where we can imagine and contribute to more just food systems.

TABLE 2 Questions for researchers to reflect on their own academic knowledge creation.

Drivers/Mechanisms	Reflective questions
Power (Who)	Who benefits from this research? Some possible beneficiaries could include businesses, smallholder farmers, large holdings, local communities, large corporations, other researchers, etc. Who has agency in defining priorities for this research, and for implementing the results? Are certain groups more empowered than others? What is the relationship between agency and money/funding? What are the decision-making processes in this research? Is it top-down, horizontal, or something else?
Values (What)	What core values guide this research? What values do you bring to this research? What are the approaches to address diversity and complexity in this research? What is the balance between specialization and holistic/transdisciplinary thinking in this research?
Motives (Why)	Why is this research being conducted? What vision of the future does this research contribute to? Will this research contribute to reinforcement or transformation of current conditions? Why are you as a researcher doing this research? Why are other stakeholders/collaborators doing this research? Why is this research being funded? What outcomes are the funders most interested in?
Relationality (How)	How are relationships created and/or sustained through this research process? What is the relationship of this research to humans and non-humans? Are humans considered separate from, or part of nature? How does this research recognize and integrate Indigenous knowledge? How is place understood in this research? Is there consideration of the unique cultural, historical, and ecological significance of places? How do you practice accountability, reciprocity, and responsibility in this research?

Author contributions

MM-A: Conceptualization, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. SW: Conceptualization, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. PG: Conceptualization, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. DO-G: Conceptualization, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. KM: Conceptualization, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. KB: Conceptualization, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. EA-S: Conceptualization, Visualization, Writing – review & editing. SR: Methodology, Writing – review & editing. VW: Conceptualization, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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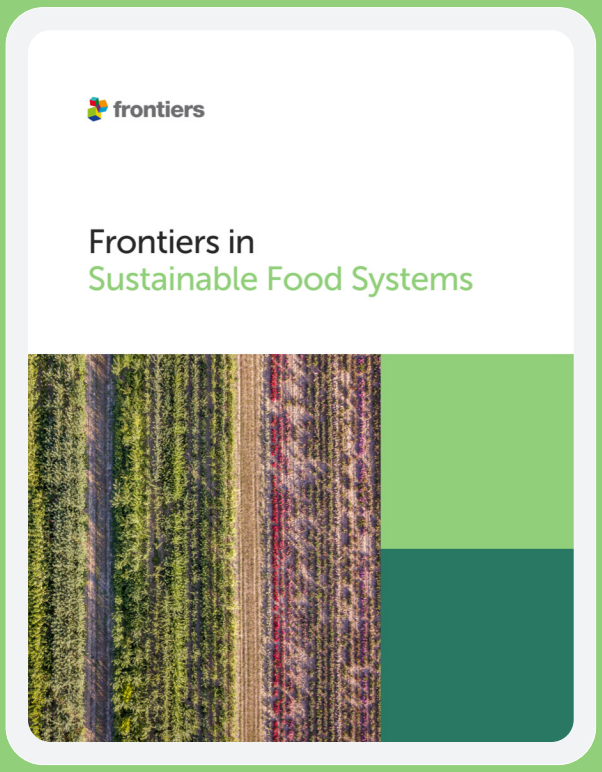

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