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The sustainability paradox: Experiences of farmers in Vermont

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Abstract

Concepts of sustainability have been used for decades as goals for agriculture and food systems, with the 3-legged stool (social, economic, and environmental) as a common model. Other models include the Donut Model, which posits a zone where human needs are met without sacrificing environmental integrity, and the Planetary Boundary model, which identifies specific areas of environmental danger. While these models highlight critical issues and trade-offs, few studies center the farmers' perspectives and their efforts to contribute to sustainability goals and outcomes. Our farmer-research partners expressed that the conceptualizations of sustainability that ground our research were problematic and were denials of ecological and social-economic precarity. We explore

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these issues in dialogue with our farmer participants to question the existing paradigm of agricultural sustainability and its implications. Our research fosters dialogue between researchers and farmers on how to move forward. When we study sustainability, does the neoliberal tendency to focus on the individual (farm) rather than our entire food system disproportionately blame the farmer for agricultural unsustainability, absolving society, policy, and financialization of agriculture? How could food-system researchers reorient definitions and goals of sustainability to help policy makers and the public recognize the dire state of our farms and food systems? Interviews with farmers at six consumer- facing Vermont farms focused on how farmers understand, measure, and utilize concepts of sustainability in farm management. All farmers described barriers to contributing to the goals of sustainability while remaining economically viable and expressed that these problems are difficult or are stigmatized to talk about. We examine the impacts on the well-being of farmers who find deep meaning in sustainability goals but experience cognitive and practical dissonance when they realize that they cannot achieve these aims. We call for scholars and outreach professionals to revisit and reframe the concept of sustainability and its central role in agriculture and food systems. This research was a part of the Sustainability Metrics research project within the Food Systems Research Institute.

Keywords
sustainability metrics, food systems, farmer-centered research, climate change, ecological economics, social sustainability, socio-ecological systems, farm viability, policy

> *Do we start from a current perspective whether sustainability is even viable at all? (Farm Two)*

> *I don't know when we'll lose the ability to farm entirely. That might happen. (Farm One)*

Food Systems and Sustainability Analysis

Agriculture and food systems supply essential human needs, but at the same time are major contributors to "interlocking crises" or polycrises, deepening issues like climate change, biodiversity loss, nitrogen and phosphorous pollution, overdrawing fresh water, and unjust access to nutrition and health (Campbell et al., 2017; Rockstrom et al., 2025). Because food systems are a major leverage point for sustainability as well as securing basic human needs, much research has been done to develop programs to analyze the sustainability of farms, agriculture, and food systems to better understand both challenges and opportunities for improvement (Abson et al., 2017; Godfray et al., 2010; Hoekstra & Wiedmann, 2014; Kavak, 2025; Wiltshire et al., 2024). The Sustainability Metrics initiative based at the University of Vermont Food Systems Research Institute (FSRI) and the Department of Community Development and Applied Economics (CDAE) is rooted in the above contexts, with the aim of identifying and measuring sustainability indicators for targeted action that will reduce socio-ecological-economic risk, enhance resilience, and improve farmer livelihoods. The present study, part of the Sustainability Metrics initiative, set out to measure farm-level sustainability for what we call "consumer-facing farms": farms that interact directly with their end consumers via direct sales (onsite at the farm or offsite at farmers' markets) and/or agritourism. We use the state of Vermont as a pilot to test this analysis, which could then be scaled up to regional and broader levels of analysis.

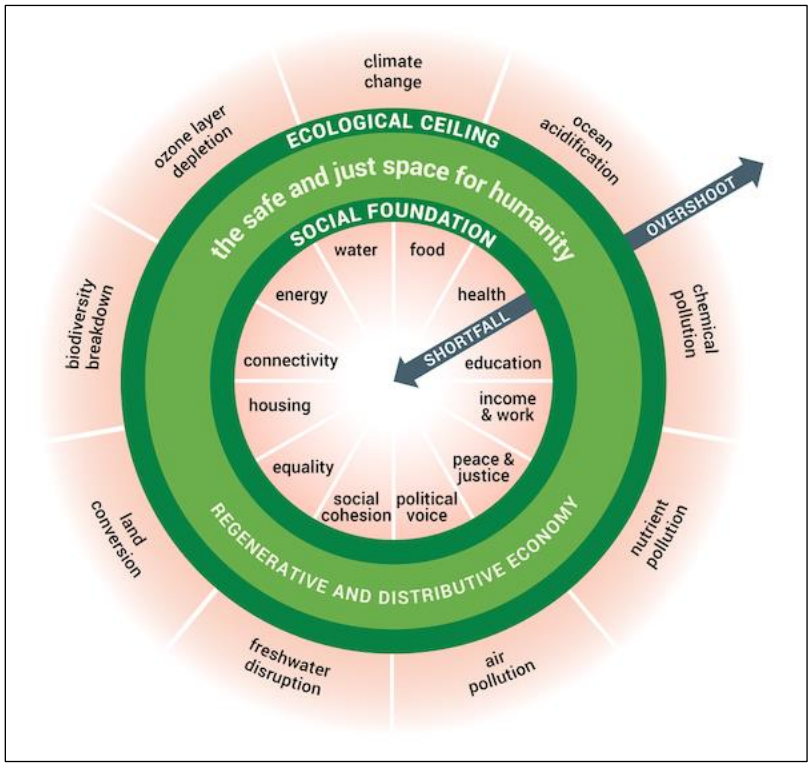
The FSRI Sustainability Metrics initiative further breaks down food-systems sustainability from the three pillars model (environmental, social, economic) (Purvis et al., 2019) into five categories by adding "human" and "production": "human" includes factors such as health, equitable distribution, appropriateness, and education, and "production" includes factors such as quantity, quality, waste, and imports versus exports (Wiltshire, et al., 2024). Based on farmer feedback that expressed that the five dimensions model was overly complicated with overlapping and redundant dimensions, in this paper we have reverted to the initial three dimensions of sustainability. We also draw from the Donut model (Figure 1), which depicts the economy as nested within society, both in turn nested within ecology (Raworth, 2017, 2025).

It is well established that farms, farmers, and

food systems are at great risk due to shocks that interact and feedback across the fields of ecology, society, and the economy. Earth system boundaries denote thresholds within which there can sustainable and stable functioning of abiotic, biotic, and human elements, depicted by the "ecological ceiling (Figure 1)" and the "safe operating space (Figure 2)," and beyond which there are tipping points propelling systems into unsustainability. Because society and the economy entirely rely on ecological health, surpassing earth system boundaries (ESBs) produces feedback affecting social, economic, and food systems functioning, increasing their brittleness and precarity (Raworth, 2017; Rockstrom et al., 2025). Our case-study farmers experienced dissonance between academic food systems research and lived realities on their farms and in their communities, recognizing common societal ignorance or denial of social, economic, and ecological precarity. The dissonance our farmers shared aligns closely with the observation that "socially organized denial" is pervasive in universities, encouraging lack of accountability and recognition of ecological crisis with consequent extensive negative social ramifications (Thierry et al., 2023, p. 3). Along with the increasing neoliberalization in academia, denial leads to a "business as usual" attitude, further entrenching complex socio-ecological problems (Thierry et al., 2023, p. 1).

The farmer perspectives from our research inspire the premise of the sustainability paradox: that the prevailing concepts of sustainability applied to market food systems are not attainable and are built upon a false premise of socio-ecological-economic stability and possibility. A striking example is a case study of a New York farm, which had set out to be financially viable while practicing the highest perceived ecological and social values, but ultimately became economically forced to sacrifice some of their social and ecological goals (Morgan, 2025). In terms of these trade-offs, we found that farmers experience an inversion of the donut model: they are forced to consider economic viability first and socio-ecological issues last, unless they have significant individual/family economic privilege.

Figure 1. The Donut Model



Source: Figure from Raworth (2025, p. 11), reprinted under Creative Commons license, CC BY-SA 4.0; no changes were made.

Conceptions of Sustainability and Contemporary Crises

The term sustainability has been used for decades to describe the dynamic states of the environment vis-à-vis human natural resource management, usage, development, waste, and pollution. The three-pillar model of sustainability has become ubiquitous, breaking it down into overlapping social, economic, and environmental fields (Purvis et al., 2019). Warnings are intensifying that sustainability is increasingly in jeopardy. For example, nearly 40 years ago, the United Nations (UN) World Commission on Environment and Development (1987) reported that development was on a collision course with earth's capacity to support stable earth-human

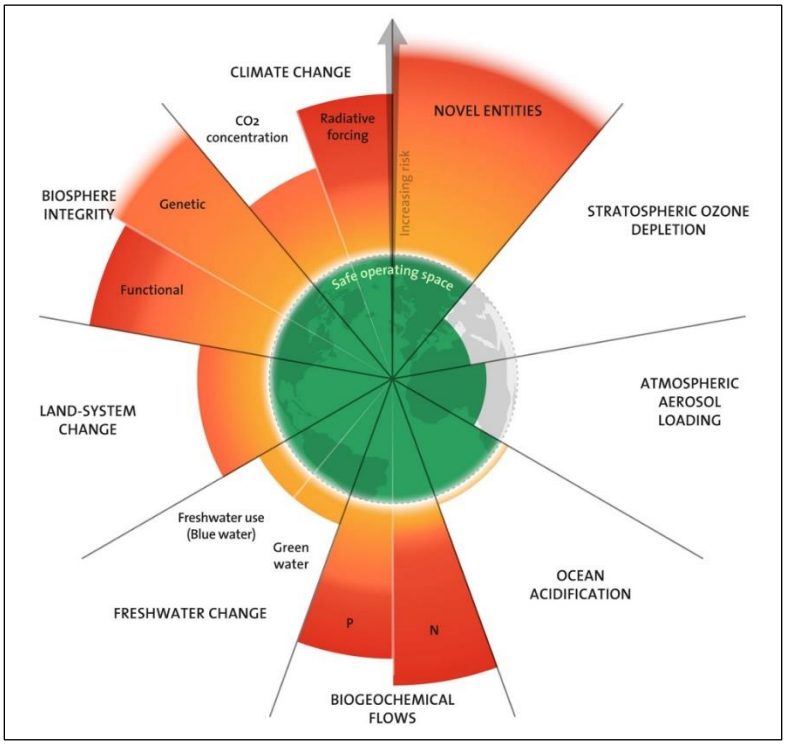
systems, and that humanity must drastically reorient how we manage our impacts and entangled crises, creating sustainable development, within the limits of earth and ecosystems to meet present day needs without diminishing the capacity of future generations to meet their own needs. Growing out of *Our Common Future* and almost 30 years of global work on conceptualizing a sustainable future, in 2015, UN member nations adopted the 17 Sustainable Development Goals (SDGs) to be implemented by 2030 (United Nations Secretary General, 2024).

Despite the warning calls almost 40 years ago for industrial society to change its course, and a decade after the SDGs established a collective framework for sustainability, extractivist industry has largely ignored the message. Espinosa Garcés (2024) asserts that global governance has failed to address these critical issues while many destructive modern human practices intensified "biodiversity loss, deforestation, climate destabilization, increasing pollution, and human vulnerability" (p. 90). The United Nations Sustainable Development Group recently released a report, "Global Progress Alarmingly Insufficient," stating that only 17% of global sustainability goals are on track, 30% have had marginal progress, and 35% have either stagnated or regressed (2024). An editorial in *Nature* (2023) stated that no SDG goals have been met, and that we are running out of time to act in concert to address dwindling ecosystem integrity. Rockstrom et al., (2023) use the concept of earth system boundaries to analyze nine fields for safe and resilient operation and find that humanity has already exceeded seven of nine boundaries (Rockstrom et al., 2023; Sakschewski et al., 2025).

Sustainability implies there is something reliable and normal that is sustained—but if ecological conditions and climate are trending toward precarity (Figure 2), and away from reliability and normality, *is it possible that we are moving into a system that is not sustaining or sustainable?* If this is so, then does talking about and working within the current paradigm of sustainability preclude us from addressing some of our most urgent problems while they continue to intensify? There is scientific consensus that our institutions continue to fail at managing human-earth systems in sustainable ways and must radically change to avert greater disaster (Costanza et al., 2013; Raworth, 2017; Rockstrom et al., 2023).

Sustainability is commonly measured in terms of scales greater than farms; but if farms are not sustainable, then neither is society. Insisting that individual small farms must be sustainable in isolation places an impossible burden on farmers, however, and denies the primary importance of high-level systemic change (Clapp & Isakson, 2018). To avoid this trap, we set out to study agricultural sustainability in a way that centered farmers' expressed needs and experiences as Eastwood et al. (2022)

Figure 2. Donut Model Depicting Seven of Nine Planetary Boundaries Surpassed as of 2025



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have proposed, detailing the need for and the importance of more effectively including farmers as co-designers in agricultural research, and how this practice will ease transitions in food systems facing immense social and ecological pressures. Bohan et al. (2022) describe how we must include farmers as leaders in agroecological research and innovation to be able to respond to issues such as climate change and create successful transitions to sustainable, agroecological food systems, and thus improve our scientific practices as well as the planet.

The Vermont Agricultural Landscape

This study took place in Vermont in 2024 and 2025 amid a tenuous landscape for Vermont farmers. While sales in Vermont of Vermont produced-food increased about 361% from 2010 to 2020, 298 million dollars (VT Farm to Plate, 2022), the number of Vermont farms reporting net *losses* slightly increased from 2007 to 2017, 56.3% to 57.9% (U.S. Department of Agriculture National Agricultural Statistics Service, 2022); thus, only 42.1% of Vermont farms made net profits. In 2024, Vermont experienced the greatest rise in home prices nationally (Berlin, 2024), and the highest health insurance premiums nationally (Public Assets Institute, 2025), putting further pressure on farmers and farmworkers. Though Vermont has been touted as a refuge from climate change (D'Auria, 2023), from 2011–2024 the state has had the most FEMA disaster declarations per capita in the last decade (Rebuild by Design, 2025), including multiple "hundred-year" (i.e., more severe) floods just in 2024–2026, and is facing other aspects of deteriorating ecological stability, including droughts (Brady, 2025; Gaffney, 2025), invasive agricultural pests, powerful wind storms, and increases in average annual precipitation and moisture that encourage fungal and other disease issues (Pasanen, 2024). These combined natural disaster and affordability crises form the background of farmer perspectives in our interviews.

Methods: Exploring Challenges to Sustainable Food Systems

This paper draws on results from the first year of our sustainability metrics project on consumer-facing agriculture (CFA). For this qualitative stage of our study, we selected a purposeful sample of six farms in Vermont engaged in CFA. The sample sought diverse perspectives to be representative of CFA farmers in the state, in terms of location in Vermont, agricultural products, consumer-facing activities (including both agritourism and off-site sales), and farmer demographics and experience. A farm selection task force of researchers and community partners began with 49 possible farms and narrowed them down to 12 that best represented the criteria. From them we chose six and one alternate; five of the six agreed to participate, and the alternate. Table 1 describes each farm in our research, including their aliases, types of production, and ways that they practice CFA. We have limited the demographic information shared here to protect farmers' identities, so we have not included categories such as race, age, and gender.

Farmers agreed to be involved for 2–3 years of research involving multiple rounds of interview and survey questions, and were compensated for

Table 1. Descriptions of Farm Production Types and Consumer Facing Agriculture (CFA) Practices, with Aliases

Farm Alias	Product type(s)	CFA type
Farm 1	Meat, Fiber, Egg Fruit, Veg	Farm stand, tours, farm stay, education
Farm 2	Fruit, Veg	Farm stand, markets
Farm 3	Meat, Veg, Egg	Farm stand, markets, dinners
Farm 4	Veg, Egg, Meat	Farm stand, markets
Farm 5	Veg, Fruit	CSA
Farm 6	Fruit, Beverage, Meat, Fiber	Farm Stand, Education, Events

their time and input. Our initial interviews were conducted in-person and on-farm. We followed a semi-structured interview protocol, and each interview lasted about three hours and included a farm tour. We recorded audio from the interviews and used University of Vermont in-house computer-assisted transcription services, then manually reviewed and edited the transcripts for accuracy.

Three research team members coded each interview in multiple iterations and cross-checked the codes and themes that emerged using grounded theory (Freeman, 2017; Saldaña, 2016) and thematic and inductive coding (Cope, 2021). After identifying themes, we cross-checked our analysis with farmer-partners for validity. The lead author communicated with farmers to share our analysis through phone calls and emails; we found that farmers generally agreed with the themes and patterns that emerged. With further follow-up, two of the six farms were available and motivated to contribute content to share our findings centered on the experiences from our farmer/research partners in facilitated discussions through a speaking tour at 13 conference and classroom venues in Vermont and Oregon (the 2025 location of the Agriculture, Food & Human Values Society annual conference). Our discussions with farmers at these conferences about their experiences have contributed to developing this paper, and two farmers contributed substantially at the post-interview stage. Conner et al. (2026) give greater detail on the methods and context of the study.

Results: Farmer Perspectives from Interviews

Data from our in-depth farmer interviews reveals that the farms in our research do not experience strong overall sustainability in *any* of the three dimensions, although they strive to be sustainable in *all* three. Only one of the six farms in our research reported that their farm was economically sustainable, and all six deeply questioned their social and ecological sustainability.

The farmer perspectives inspire the premise of the sustainability paradox: the dominant models of sustainability applied to market food systems are not attainable and are built upon a false premise of socio-ecological-economic stability and possibility. Perhaps these models of sustainability *were* attainable in the past, prior to the surpassing of most planetary boundaries and in more favorable economic circumstances for farm owners (lower labor, land, and input costs, and less consolidated food systems). This understanding suggests that at best prevailing models of sustainability are misinformed, and may cause more harm as distractions from crucial and major systemic changes that could mitigate deepening socio-ecological crises. Yet, despite the sustainability paradox, our farmers described the practices they use to make their farms as resilient and adaptable as possible and shared their visions for a food system that better supports farmers through precarious times.

The farmer-research partners did affirm that the conceptualizations of sustainability that ground our research and the larger FSRI Sustainability Metrics project were problematic and are a denial of ecological and social-economic precarity and food systems crisis. The farmers also found the expansion of the three pillars model of sustainability into five dimensions to be unnecessarily complex, repetitive, and confusing; and to their point, our team had difficulty explaining why our FSRI Sustainability Metrics project added the dimensions of "human" and "production," which overlap with environmental, social, and economic dimensions. One farmer told us that the language of our questions felt like a belittling test that was "designed by a grad student" (although the interview instrument was primarily made by a team of faculty and community partners). These critical farmer perspectives gave us much to reconsider and, ultimately, helped to realign our research goals to be more parallel with the needs expressed by these farmers.

Case-study farmers experienced dissonance between academic food systems research and lived realities on their farms and in their communities, and recognized common societal denial of social, economic, and ecological precarity. When we asked farmers how they experienced and conceptualized sustainability across the five dimensions, their responses questioned our underlying paradigm. All farmers interviewed were concerned that their farms were not sustainable socially, economically, and/or ecologically, despite concerted efforts. We fit their concerns into six themes:

1. Farm economics: Challenges to profitability
2. Farmer well-being issues
3. Desire to produce food for community
4. Ecological (un)sustainability
5. Excessive plastic usage/waste
6. Imagining food system futures

Farm Economics: Challenges to Profitability

> I can tell you we've stopped thinking about profitability. I think viability is a mirage and how we're pursuing it in Vermont is problematic. (Farm One)

At the same time that Vermont local food sales have grown, so have farm input, labor, land, energy, insurance, and living costs, negating the benefits of increased sales. The statement from Farm One is emblematic of farmers moving away from earlier expectations that farming could be an economically viable livelihood for them, and is a warning sign that without economic viability many farms on the precipice. The farmers we interviewed all felt these economic pressures, compounded by downward pressure on food prices from large-scale producers and retailers. Five of the six farms did not generate sufficient income to support their households, and farmers relied on off-farm jobs or other sources of income or wealth to support both their households and their farms. "Being able to support our family and live a modest lifestyle [is what matters], we're not trying to drive Rolls-Royces and Range Rovers, but being able to have reliable vehicles and pay the bills and not worry about where the money's coming from…that's why I work off the farm … [for off-farm income and benefits]. March is kind of my fry-out month" (Farm Three). By "fry-out month" the Farm Three respondent described the burnout and exhaustion farmers experience from how difficult it is to work their off-farm job during March while they are also extremely busy getting the farm ready for another season. Another farmer said that their off-farm job was a prerequisite to farm: "me having off-farm income, it definitely relieves the pressure on what the farm has to sell, because ultimately, we'll be okay. We will have our house, the bills will be paid. … Because I work full time off-farm, we have health insurance, but then what do people do if they don't have access to health insurance? But then there's the burden on the person working off-farm, where you acutely feel that there's a lot of stress on you … but also be contributing to the farm." (Farm Four).

Multiple farmers shared the frustration that market price for their products was *less* than costs of production: "[I was] just venting with a farmer friend…he was telling me, 'I'm starting to get pretty pissed when people say, Oh, you're a farmer. What wonderful work you do. It's like a pat on my back and I'm starting to feel like saying, Hey, wonderful. Why don't you pay more for my work? If you value me so much, why don't you pay me more?'" (Farm Five). Another farmer echoed the experience: "Stuff like this really irritates me. [At] the market someone's selling chicken for $4 a pound for a whole bird, and [I'm] like, 'How? You're literally making $2 a chicken.' *That's not sustainable*, and those actions hurt the whole community. It's also tough to explain that to customers because they're like, 'Are you gouging me? Why is it worth so much more and if I can get the same thing there, why?'" (Farm 3).

Consumer expectations of buying food cheaply, without the full social and ecological costs of production reflected in the price, is normative; and even underpriced food seems unaffordable, with many lower-income consumers unable to budget for anything but the cheapest food (Carolan, 2024):

> So, we might have our cost of production, but we know we'd get laughed out of the market if we put the real price on it. So we all take that and all our good coaching and then we just put our pricing here. What I think is obscured for the community is how difficult the finances are for every farm. We have written this article, *The thorny issue of farmer pay* (Omland, 2014). We've outed ourselves of not paying ourselves. Every conference I go to someone whispers, 'Oh, us too.' (Farm One)

Farmer Well-Being

> Increasing extreme weather and climate disruption, it makes something we already do that's challenging twice as challenging. So is that sus-

> tainable? The emotional toll. It's just, what was the word? Demoralizing. (Farm Two)

Like the environment, human social systems have thresholds for safe and healthy operation, beyond which we experience physical and mental disease, social disorders, and, in the case of farmers, failure to sustain the arduous work of farming and food production. Between increasing ecological instability and wealth disparities, farmers in our research report increasing challenges to their well-being and to that of their workers. While many farmers pursue agritourism to boost revenue outside agricultural production (Chase et al., 2018), welcoming visitors can be energy-intensive and further fuel burnout. As one farmer stated:

> I've done these agritourism events. I did a sheep camp last year, and it filled up in five seconds. And same with my cheese camp that I did, it was a two-day workshop. And people paid good money, and I was like, 'Wow.' I feel like I tried to do something like this a while ago and it didn't work. But now I'm taking a little break from events, because I got a little over it. And talk about sustainability, it's hard to sustain the energy it takes to do events. So I'm pulling back right now…it can be an emotional toll on you. Although I know some people do really giant events and it feeds them, they just love it. But I'm always like, 'Oh, I love it, I hate it.' (Farm Six)

Four of the six farmers spoke about the challenges of finding skilled but affordable workers. They discussed how inadequate healthcare and lack of affordable housing puts pressure on their workers, leading to burnout and resignations: "We have had a couple of mental health crises of people working here, especially young people. Sometimes they work here and they work somewhere else, because either they don't want to work full time, or we could not provide full time. And so they have other jobs and get very exhausted and then they don't have a secure place to live, and they don't have health insurance. It's just a lot of uncertainty." (Farm 5).

Food and Community Engagement

> Do they care about the practices? At some point, we're not going to market differently or grow differently if they don't care … but you catch us at a moment in time where 16 years in, I think something happens psychologically when you don't pay yourself. … And so it's hard. (Farm One)

The farmer research partners were motivated to grow nutritious and delicious food for their communities, neighbors, and local institutions, but expressed that the reality of farming led to disillusionment with their earlier social ideals: "We felt very idealistic and just like, 'What is better to do in the world? What is more concrete and real than growing food for your neighbors?' And then you realize you have to make all these compromises, and one of them is that most of your neighbors can't afford your organic apples, or they want to buy the 59-cents-a-pound apples at the store…I'm always worried that everything's about to collapse and will be hard." (Farm Six). Another farmer shared a similar concern: "Since we started this farm…it's bothered me that all the beautiful local food that is produced here is not available to everyone in the communities. And so you have to sell your stuff for a premium dollar, but also how can other people access that?" (Farm Four). Two farmers experienced dramatic sales growth at the beginning of the COVID-19 pandemic, but this boom was short-lived. "I think for some the post pandemic market has maintained, but we definitely experienced this cataclysmic drop off. People filled their freezers and panic-bought and told their friends, and the friends did buy from us, but they're back at Costco or eating out every night." (Farm One).

Farmers also talked about the effort required to grow and maintain a local community following and that this work required a great deal of energy above and beyond the physical work of farming. Some felt that if they paused their public relations work, their community and neighbors would forget about them:

> So at any point in time we would've been more or less positive. I think now we're sort of sen-

> sitive. Our feelings are hurt that these people forgot us and you have to write. … Every time we wrote a newsletter, it's 10 o'clock at night, and so we write 452 of them and then you fall off and people stop coming. … We're glad to support the community. But again, all the gift certificates that were given out at the school play or all the real food was given out at the play every year … but 10 years later we're like, wow. … We always ask if we have a new customer, 'how did you hear of us?' It was never from the school play, but that's okay. We love the school play. But at some point, we are like, 'Shit, how are we relevant to this community?' (Farm One)

Systemic racism is an added challenge that involves farmers' social mission and their own well-being. Vermont is the second whitest state in the country (U.S. Census, 2020), and systemic racism is an entrenched problem nationally in the United States, emblematic through statistics like Black ownership of farmland decreasing 5.5% to 1% from 1910-1997 (Casey, 2021) and 38.3% of incarcerated people in the U.S. are Black (BOP, 2025) while only 14.4% of the total population (Martinez & Passel, 2025). We interviewed a married couple with a farm who had racist experiences in their community, and they discussed White supremacy in Vermont, where they felt disrespected, excluded, unfairly targeted, and at times unsafe because of their race:

> We've had experiences as a family that aren't so positive that end up really draining you of time and energy that you really don't have to give. Just as an example, one of the farmer's markets that we go to … the rules are set up … from a white supremacy culture, except they don't know that because they've never had to analyze it, they've never had to look at it. [But] it's a very profitable market for us. We do probably 80% of our sales there, so we don't want to give up that sales channel. [We went] to a membership meeting—I had to leave early for the kids, but [my partner] ends up the … only black person in the room. And he brings up this very uncomfortable subject matter [of racism] and then is just met in a really negative way. … If you're thinking about diversifying agriculture in this state, people need to really grapple with what does that mean? How are we going to actually include people from other cultures and other backgrounds? Because it's easy to say that you do, but what action steps are you taking? So unless people have gone on their own or studied [racism] in higher education they aren't going to know how to disrupt white supremacy culture. It's not innate knowledge that you have. (Farm Four)

Ecological (Un)Sustainability

> And then when you start to see that sort of overarching depiction of sustainability, you're like 'Holy smokes! Same's true for the planet, we can't sustain what we're on.' (Farm One)

> I think sustainability is such a new fad word. (Farm Three)

We have presented context, with the concept of surpassing planetary boundaries, to how global ecological instability has been created that is been unprecedented in human history. As the Donut model shows, ecological stability is of the utmost importance as the foundation for our socio-economic systems, of which our farmers were acutely aware:

> The micro-level is, is the soil able to sustain itself and all the issues we're facing here on the surface of planet Earth. But overall, for me, sustainability has to do with the environmental impact first and foremost. Because I think without that being addressed, the economics fall apart pretty quickly. (Farm Two)

Our farmer-research partners were highly aware of this precarity in their own region and felt that societal efforts at sustainability were superficial, particularly with the recent annual "hundred-year" floods and extreme droughts in Vermont and the region:

> In terms of sustainability … here's where my stomach almost turns over. It's just repulsive

> to me to think that we could think we were relevant to sustainability if we were not thinking in 100- and 500-year timeframes or at least a 50-year cycle. … Not meaning to be critical … [or] anything of a wet blanket … the term sustainability became less inspiring to me. At the same time, I recognize its durable significance, but in general you can see that we're flailing about with great concern about all the things that are embedded with any of the interpretations of the term sustainability. (Farm One)

All six farmer partners felt that the concept of sustainability as used in our project design failed to recognize the severity of rapid changes to our ecosystems. The impacts of projects aiming to bolster sustainability appear to be too little, too late, and are shortsighted. The stress of farm work that relies on earth-human system stability during the era of climate change likewise has negative effects on farmer and farm worker well-being.

Plastic Waste

> I just wish we don't have to produce that waste, that plastic. And sometimes, it's a lot of plastic. … The old one is going to be re-used, but most of it, I just rip it up to be thrown away, and it's killing me because it's just throwing out tons of plastic. (Farm Four)

Our farmers reported that they had high ideals when they started farming, intent on a triple bottom line—becoming a profitable farm operation that nourishes their community with affordable healthful food while also building living soils and boosting local ecological vitality. In direct conflict with these values, all farmers we interviewed expressed deep concern about their use of agricultural plastics. They felt coerced to use plastic because of dramatic cost savings on the product itself and on labor compared to non-plastic alternatives.

> [Our] good practices … are they sustainable? We would hope so, but I'm not sure they always are. You know, putting plastic down on our field certainly makes us more economically viable. Does it create sustainability? No. We're bringing a non-biodynamic process that all the inputs are coming from elsewhere. And at the end of the season we have a pile of plastic over there. Is it desirable? No. And it doesn't feel sustainable at all. (Farm Two)

All farmers expressed at least disappointment, and five felt deep inner turmoil about on-farm plastic use.

> The biggest waste is plastic wrap on the bales. That's the worst waste we make … you used to be able to take [bale wrap] to be recycled, but you can't anymore. So now it's just going into the landfill, which is so depressing. So I guess we just deal … with guilt. I really don't know what we would do if we didn't have bale wrap, because we depend on [hay] a little bit wet … when it's really dry, it's really poor quality and you can't really use it. Or … you buy small bales and then they cost four times as much, and then you can't afford to keep sheep anymore. (Farm Six)

> We try to mimic nature where there is no waste. And so we think about it at that holistic level and then we find ourselves surrounded by plastic, but we refuse to grow under plastic, and we were mentored by people who refused to grow under plastic but now grow under plastic. I understand why, they can't afford weeders. But everyone's having to buckle under these things. So we're preoccupied by the amount of waste that we still have and we're very disappointed by the amount of waste in ag in general. (Farm One)

Existing On-Farm Responses

> Sustainability may not be about the continuation of certain things, it may be about significant ability to make change, and it could potentially be radical change. I believe it is a very long-term, incremental antidote, but it still may be radical. (Farm Two)

> It's what you do with what's happening to you that's important. And not just sit and cry [over] bad things but do a good thing with all that.

> Use it to grow … and speak out loud. That is the main thing. No matter where you are, no matter how many people you have in front of you … do it with a shaky voice [rather] than shouting. At the moment that you're silent, you are putting yourself in some sort of jail that you'll never get out. (Farm Four)

While case study farmers identified multiple systemic challenges to farm and household viability, well-being, and sustainability, it is important to also recognize what the farmers have power to control. Despite the external and systemic nature of unsustainability, they still can exert some agency to act, within limits, to fulfill their agricultural goals regarding ecological, social, and economic values.

Two farms won small grants to fulfill their social missions. Farm Three received funding to renovate a farmstand with the condition that they devote $1,000 to fund a pay-what-you-can option to help feed low-income people in their rural community. Farm Four received funding through a Local Food Purchase Assistance (LFPA) grant from the USDA Agriculture Marketing Service to provide food at a nearby food shelf for low-income households:

> Anything that we didn't sell retail was sold wholesale through an LFPA … and it's just a win-win for everyone because it's getting local food to communities that don't traditionally have access to it … so it's reaching all these people that otherwise wouldn't be sourcing local food. So that was a huge win. (Farm Four)

While their LFPA grant was approved for another year, into 2025, all future LFPA funding was cut as of March 2025, and the USDA has ceased accepting new applications (Brown, 2025). Farms Three and Four reported that these one-time grants helped them fulfil social values which would otherwise have been difficult to implement given their overall lack of profitability. Farm Five received substantial funding from an "angel investor" CSA member who paid for her CSA share as well as for a low-income single mother, "for the rest of my life and her life," helping the farm maintain a stable, known income year-after-year. In the absence of common farm financial viability and local food affordability, the above types of funding prove crucial for farms to approach socio-economic sustainability. However, the unreliability of grant provided funds in general exacerbated by the cancellation of LFPA funding amid broad dismantling of the USDA by the Trump administration has increased farmer precarity and decreased programs that support farmers in their social mission to provide food access for low-income consumers.

To help mitigate high input and labor costs and enhance profitability, Farm Two invented a machine to sweep potato plants to remove potato bugs, then suck them into a tank with a shop vacuum. This helps avoid costly organic pesticides such as Bacillus thuringiensis as well as reduce tractor operating costs and fuel. This is the sole case-study farm that was profitable without off-farm income or other wealth, and the only one that sells their produce outside the state, as they are not always able to find market demand for their products within Vermont. They also are the largest farm in our research and so are likely the only farm with a scale of production that exceeds local demand. Another two farms that aspire to profitability practice agritourism to bring in more income than farm products alone can provide. Farm One hosts bus tours in the fall, holds special events, and has farm stays in an extra residence on-site, and Farm Three hosts regular on-farm dinners. Farm Six has done agritourism events in the past but has put them on pause because they find them too demanding and exhausting to be worthwhile.

Farmer Recommendations: Imagining Food System Futures in Vermont and the U.S.

> If there were a way for everyone to be more transparent about their actual circumstance, would customers rally in a different way? (Farm One)

Farmers in our study envision a future where farming is considered an essential public utility, and farmers are supported and respected, allowing them to focus on socially equitable and ecologically nourishing ways of production for which they are

adequately compensated. These visions of a more just, sustainable, and resilient food system are not just romantic daydreams, but align with how farmers and food are treated in some other parts of the world such as Canada and Poland and relate with secure accessibility to basic social safety nets such as health and disaster insurance, basic income, and retirement pensions (Bak & Szałkowska, 2020; Becot & Inwood, 2020; Hlochova et al., 2025; Organisation for Economic Co-operation and Development, 2025):

> The farm that does bus tours has another unique, long term, and collective educational approach to enhance the viability of all small farms in the region … we just [practice] radical vulnerability, moving people heart to heart by just telling our story. … If everyone [could] be more transparent about their actual circumstance, would customers rally in a different way? Would we collectively organize all the expertise that's available and organize just our movement and our approaches differently? (Farm One)

Farm One strives to communicate with customers and tourists about the many economic, ecological, and climatological challenges they face, and that they often cannot sell their products for what they cost to produce because of larger market forces.

Reversing Subsidies that Support the Largest U.S. Farms

> I hope that we have gotten to a point where small-scale agriculture is also subsidized … we should have fight enough to get small-scale farms subsidized. … Because the largest scale growers, they're the ones getting the subsidies now, whether it's animal or human food … they're the ones getting the subsidies. (Farm Five)

The narrative that farmers just need to scale up and increase yields in order to increase income is potentially dangerous: if one farmer increases production, that one farmer could bring in more revenue, but if many farmers increase production, it increases supply which decreases price, ultimately reducing revenue per unit of production. Encouraging increased production also tends to lead to greater externalization of ecological costs and multiple inefficiencies (Benton & Bailey, 2019). Supply control helps stabilize farms and food prices in other countries, such as Canada (Heminthavong, 2015). Supply control coupled with a universal basic or guaranteed income for farmers could help them by stabilizing food pricing and farm income.

Farm Five also asks for public funding to better support independent small farmers and adequate nutrition for the public through practices like basic income for farmers: "In my ideal world farmers will be paid to grow the food that taxpayers are already working for…it [should] be part of taxes, because you're paying taxes, what are you paying taxes for?"

More Access to Technical Assistance

Four farms expressed that they would benefit from more substantial and more frequent access to technical assistance through public institutions such as Extension services from land grant universities:

> Our state does not currently have the technology necessary to offer what I'm talking about and the funding's not there, so we're back to economics … [but] it would be so incredible. You have no idea. … It's what we've been asking for, a lot of us have been asking for it for a while. Well, I certainly have. Canada has an amazing infrastructure of people who are technically vectoral specialists. We have people who are good people and we're all learning together in some ways. But the funding for. … I want somebody who's here four times a month and they're coming through and they're working with me constantly on production and yields and maybe we're working on certain crops, there's no question it would be invaluable. Invaluable. (Farm Two)

Farmers Grow Food, Government Does Marketing

Farm One shared a story from an international visitor who told them that, in their own country, Austria:

> … We market for the farms. We do all the marketing for the farms. The farmers have to grow things." The farmer replied "Oh, you don't have to market your own? Crazy. Your job is to grow food. And so many farmers could grow food so much better. And I die of embarrassment for us, as humanity, when I watch farmers dance in [costumes] to sell their meat at a reduced price … but the question I have, as a society, is why are we looking for farm viability when it just doesn't really appear to be with us right now? And if we just combined that with the knowledge that 2/5 of Vermont is food insecure. … I think I could do more ecologically and grow more food if I wasn't still trying to do the uphill thing of marketing this food. I think NOFA's starting to work on base pay for farmers. (Farm One)

The farmer sees wearing costumes for marketing purposes at farmers' markets as demeaning their work and the value of the nutritious food they and other farmers produce. They also value the model that some countries, like Austria, have for supporting the marketing needs of farmers as important for allowing farmers to focus on the farm work itself (Food and Agricultural Organization of the United Nations, 2019).

Treating social safety nets such as public healthcare, childcare, and eldercare as fundamental human rights would ease the pressure on farmers who are fulfilling essential human and public needs. Unfortunately, since we interviewed these farmers, many U.S. social safety net programs have been drastically slashed. All the farmers in our research affirmed how valuable access to these services would be, and that they would be able to focus more on farming and producing food for their communities if they did not feel the constant stress of working off-farm jobs to afford healthcare or childcare, and if they were guaranteed a stable retirement. Farmers emphasized that if there were more reliable aid for farms to respond to shocks such as disaster and illness, they could focus on recovery without going bankrupt and losing their farm. And with better technical support, farmers could make their farms even more resilient to climate and ecological change. Farm Two was able to access critical temporary aid for flood disaster mitigation:

> The state kicked up what, $10,000 towards us [recovering] from this friggin' flood, and [the Northeast Organic Farming Association of Vermont] kicked in five or ten. … It's like, wow. We didn't expect to see anything. And I would say without those, we would never have made it. But Ag has it pretty good … in our state, in our community, people recognize the value of ag. That is not always true.

Conclusion: How Can We Reorient Food Systems Sustainability Research?

The Three Legs of Sustainability Are in Competition With Each Other, Revealing the False Premise of Sustainability

The barriers to sustainability reported by the farmers in our study necessitate re-examining the main model underlying our work: the three-legged stool (ecological, social, economic) of sustainability. For the farmers in our study, the prioritization of the three dimensions is effectively inverted. To continue operations, farmers are forced to prioritize the economic sustainability of their household and farm, causing ecological and social factors to be traded-off (out-competed) to attempt at financial viability. However, as we see from the triangulation of data from our farmer-interviews with secondary data (presented in the Food Systems and Sustainability Analysis section, above), while farmers are often forced to prioritize the economic dimension on their farms, most Vermont farms, as well as most U.S. farms, are not profitable and median farm income is negative (U.S. Department of Agriculture, Economic Research Service, 2026). Farmers in our research do not experience strong sustainability in more than one of the three dimensions, though they strive to be sustainable in all three.

Herein lies the sustainability paradox—the dominant models of sustainability applied to market food systems are not attainable and are built upon a false premise (and promise) of socio-ecological-economic stability and possibility. Perhaps these models of sustainability *were* achievable

decades ago, prior to the recent breaching of seven of nine planetary boundaries and during more equitable or favorable economic conditions for some—lower labor, land, and input costs, and less consolidated food systems. Given that history, contemporary models of sustainability appear to be misinformed at best, and may cause harm as subtle forms of greenwashing, of climate change and ecocide denialism which distract from effective high leverage-point systemic changes which could abate intensifying socio-ecological crises.

Recommendations for Sustainability Research at Large

While our findings, combined with the literature, suggest that agricultural sustainability is well out of reach, we do not believe that transformational change is impossible. Rather, we assert that we must accept rather than deny our increasing socio-ecological precarity and create change at the highest leverage points to create resilient food systems that generate accessible nutrition for all (treating food as a human right), consider farming as a public utility and support fair livelihoods for farmers, and lead to a more stable, verdant environment. The farmers in our research proposed a wide array of political and economic changes to improve agricultural sustainability at the structural level, including strengthened environmental protections, programs to combat ecological collapse, wealth redistribution through tax policy, antitrust enforcement in the food industry, a basic income for farmers, improved social safety nets, simplified food and farm permitting for small producers, and more effective support services for independent family farmers.

Our farmers' critiques of sustainability research led us to change the goals and methods of the remainder of the study. First, we paused the release of our follow-up farmer sustainability survey for one year and revised the survey instrument to incorporate findings from the case studies. During this pause in data collection, we held a speaking tour to present the information in this paper and destigmatize transparent communication about farm challenges and agricultural unsustainability. We facilitated 13 discussions at academic and practitioner conferences, classrooms, and other public venues, inviting our farmers to speak with us whenever possible, and showing a short film made by one of our farmer-interviewees, which detailed their hard work at attempting to be sustainable while facing insurmountable challenges related to external factors beyond their control, revealing the paradox of sustainability.

This study is part of the Sustainability Metrics initiative at the FSRI, and we initially set out to measure sustainability at the individual farm scale. After our conversations with case-study farmers, we shifted to gathering data on farmer needs, experiences, and sustainability trade-offs. Because we see (un)sustainability as more a society-level problem than a farmer-caused issue, we have decided not to end our project by creating individual farm sustainability scorecards and instead are focusing on advocating for systemic reform at state, regional, and national levels to alleviate external and systemic challenges for farmers. We hope that reorienting our research perspectives and output to better represent farmer experiences and voices, configured in planetary-level sustainability science, will open up more honest conversations and lead toward more resilient, better supported food systems and farmers.

Based on our farmer perspectives and triangulated with secondary data, to bring about more just and sustainable food systems we recommend that small, independent farmers' supports could be strengthened to counter consolidated conventional food production which externalizes costs onto society and ecosystems to produce cheap food, undercutting small farmers. At risk are increasingly brittle food systems that are more susceptible to sudden shocks, and farmers that may not be able to tolerate continued and more severe precarity. Basic rights could include the right to fair prices in the market (not driven by oligopolies), the right to accessible and affordable public health care, the right to affordable childcare, retirement, and elder-care support; and, in the absence of the capacity to make an adequate livelihood through farming, a guaranteed basic income for farmers below a certain wealth threshold. The farmers in our research express the need for such economically just markets and basic social safety nets.

Limitations and Future Research

We understand that our research is limited by small sample size and geography. We have made efforts to situate our findings alongside recent secondary data to improve their relevance. With the last year of our project now underway, we have launched a survey based on these perspectives to broaden the sample to hundreds of farmers to better understand sustainability in Vermont. We believe it will be valuable for future research to delve into the above topics elsewhere in the U.S. and internationally. Future research will also need to examine farm types not included in this focused study on consumer-facing agriculture, as large-scale commodity farms, nurseries, aquaculture, and other operations may have unique experiences.

Because climate-change effects and the surpassing of planetary boundaries and social limits are felt unequally across the country and planet, we would expect some differences across regions and demographics. We likewise anticipate that the largest farms, which receive the most subsidies and carry large agricultural insurance policies, may currently be more insulated from precarity. Studying farm precarity and needs vis-à-vis access to subsidies, insurance, and other supports will be crucial to understand existing farm safety net efficacy and how we can best bolster farms and food systems. We recommend for scholars and outreach professionals to revisit and reconceptualize sustainability and its central role in agriculture and food systems within the condition of currently increasing *unsustainability*, moving toward adaptation and just transformations that deeply support agroecological farmers and food systems.

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