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# Diversification strategies for the resilience of small New England dairies

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## Abstract

Dairy farmers face persistent market shocks that force creative diversifications to enhance their resilience. In the summer of 2021, corporate dairy companies canceled over 100 contracts with organic dairy farmers in New England, a market shock to the industry across the Northeast. To better understand how farmers cope with market shocks in small dairy production, we studied small-scale dairy farms from the perspective of social ecological resilience, exploring the role of diversification in small dairies in Vermont and New Hampshire: which strategies are most effective, what factors influence diversification, and the barriers to diversification. Data came from interviews with dairy farmers and advocates from multiple sectors involving ecological, economic, institutional, cultural, and personal domains. We highlight why, how, and with what support small-scale New England dairy farmers have adapted, supplemented, or transformed their dairy operations.

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Dairy farms exhibited high levels of diversification, motivated by a range of economic, ecological, and personal incentives. Predominant diversification pathways include (1) higher premiums from organic or directly marketed liquid milk, (2) value-added dairy products, (3) nondairy farm products, and (4) efficient and sustainable land management practices. Our findings suggest that what supports diversification is the transparent and open sharing of knowledge among a network of farmers, based on strong interpersonal relationships. Institutions such as government programs and dairy cooperatives frame diversification, which is best supported by funding flexibility and accessibility of information. Diversification has enabled greater resilience for dairy farmers, despite continued dairy market volatility in the Northeast. Without structural and institutional changes, dairy viability will continue to be in jeopardy, and the need for diversification will remain.

**Keywords**
Organic Dairy, Regenerative Agriculture, Soil Health, Social Networks, Land Stewardship, Cooperatives, Local Food Hubs, Vermont, New Hampshire, Qualitative

## Introduction

Dairy consolidation, a process in which the number of dairies decreases while production demands increase, has intensified since the 1980s (MacDonald et al., 2020; Thornton, 2010; Yonkers et al., 1987). Prompted by low milk prices and high input costs, consolidation is increasing for both conventional and organic dairies (MacDonald et al., 2020). Amid these challenges, small dairy farmers are persisting. The ability to persist, or resilience, is a response to unpredictability—seasonality, climate changes, market shocks, shifting human preferences and political factors (Darnhofer, 2014; Folk et al., 2010; Snorek et al., 2017). It has been shown that diversification in dairy systems contributes to overall farm resilience (Darnhofer, 2014; Dumont et al., 2020; Sneessens et al., 2019). To understand what, why, and how dairy farmers persist amidst shocks, we explored one quality of resilience—diversification—as it is practiced in small dairies in the Northeast.

### *Context of the Case Study*

In August 2021, Danone, the parent company of Horizon Organic, the largest provider of organic milk in North America, informed 89 Northeast dairy farmers that their contracts would be terminated the following August. What caused the decision was a shift in Danone's business model; accessing the many small (<100 cows) dairies in the Northeast required more costs in trucking and transportation than buying from large-scale dairies in the Midwest (Cutler, 2021; Gilman 2021). Due to significant pressure from Northeast farmers and advocacy groups, including some requesting that Danone stay in the region and construct a regional processing facility, Danone extended the canceled contracts for an extra six months and added a conciliatory transition payment (Maltby, 2021). Nevertheless, this market shock was exacerbated in early 2022, when another liquid milk buyer, Maple Hill Creamery, terminated 46 contracts with organic dairies.

Formed to respond to the multiple shocks, the Northeast Dairy Task Force sent recommendations to the U.S. Department of Agriculture (USDA) highlighting the many challenges to maintaining a viable Northeast dairy industry (Allbee, 2018; Held, 2021). They emphasized the imperative to finalize and immediately implement the "Origin of Livestock" rule (Ginsburg & Lundgren, 2021), which "provides clear and uniform standards about how and when livestock may be transitioned to organic dairy production, and how transitioned animals are managed within the organic dairy system" (USDA, 2022, para. 2), as well as the "Pasture Rule," which dictates the number of days an organic milk herd must be grazing on pasture. The political stalemate on how to implement and enforce these rules has been one of the factors that indirectly supported Danone's transition, as Midwestern and Western large-scale "mega" (>1000 cows) dairies may not be compliant with the organic rules. While the iconic small farms typical of the Northeast remain embedded in the imagination of Americans consuming milk, the situation in the Northeast may prove this image to be a thing of the past, as the system transitions from small dairies (10–199 cows) toward more reliance on "efficient" feedlot (>2,000 cows) production systems.

Due to these market shocks, and other challenges to the Northeast U.S. dairy system, we ask: What systems, policies, and diversification strategies have supported Northeast dairies? We frame our analysis in theories of social ecological resilience to persistent crises and highlight social and economic diversification that supports and buffers the dairy industry in the Northeast.

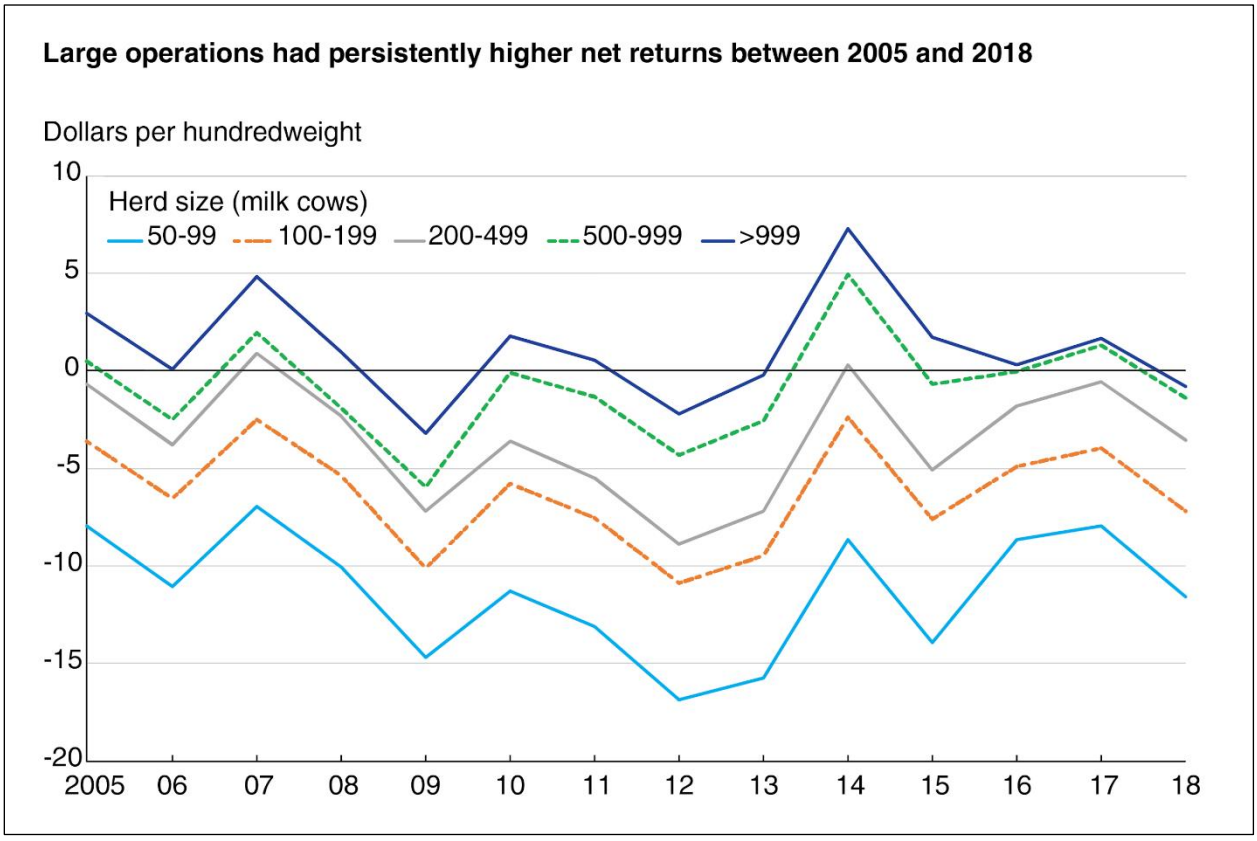
### *Literature Review*

Resilience is the ability of a system to recover from, adapt to, and/or transform in the face of shocks and stresses (Folke et al., 2010). There is a dominant view that nature returns to a singular equilibrium state through self-repair after a stress or human impact (Folke, 2006). Resilience thinking challenges this by recognizing that the system itself has never been in a constant state of equilibrium, but rather of constant evolution and change (Folke, 2006; Walker, 2020). While conceptually resilience has faced broad critiques (Davidson, 2010), the concept serves as a starting point to understand how humans are coping, adapting and transforming in light of the interlinked challenges of climate and environmental change as well as market volatility (Snorek et al., 2014).

Large-scale dairy farmers produce milk more efficiently and cost-effectively (Figure 1), and thus are able to more easily rebound when the price of milk plummets, which is a financial advantage of large- over small- and midsized- farms (MacDonald et al., 2020).

Large systems that strive toward more efficiency and cost-effectiveness do so often by reducing redundancy and creating monocultures (Walker, 2020). In the context of dairy, this often results in

**Figure 1. Returns of Large Dairy Operations (2005–2018)**




Note: The USDA Economic Research Service (ERS) used comprehensive data from the USDA Agricultural Resource Management Survey to generate baseline estimates of costs and returns for 2005, 2010, and 2016. For other years, ERS relied on data on milk and input prices and milk production to extend baseline estimates.
Source: USDA ERS (YEARS??).

greater distance between producers and consumers due to long supply chains and centralized processing facilities (Wang et al., 2020). Yet, smaller, agroecological systems are often more resilient to stresses such as pandemics, pest outbreaks, natural hazards (Perrin & Martin, 2021), while larger and more efficient systems can fail (Gallopin, 2006; Walker 2020; Wang et al., 2020). Gallopin (2006) and Gupta (2010) identify redundancy, diversity, flexibility, room for autonomous change, and effective leadership as qualities of a system that build adaptive capacities and enhance resilience.

Case studies are emerging around the world that demonstrate how diversification beyond commodity production systems can increase economic and ecological resilience (Dumont et al., 2020; Liebman & Schulte, 2015), with relevant examples in Zambia (Chonabayashi et al., 2020), India (Birthal & Hazrana, 2019), Brazil (Szymczak, 2020), and France (Perrin & Martin, 2021). In the dairy industry, transformation of the overall system (social, economic, ecological) is crucial to building resilience (Sinclair et al., 2014), especially in geographies not suited to large-scale agriculture, e.g., mountainous regions (Madelrieux et al., 2015).

### *The Northeast Dairy System*

The dairy-centric Northeast agriculture economy is highly vulnerable to market shocks (Lin, 2011). Early settlers harvested timber and raised sheep, practices that swiftly transitioned to dairy in the 19th Century when Australian sheep took market precedence (National Park Service, 2000). In 1925, Vermont had one-third of all dairy cows in New England and produced 30% of the dairy products consumed in the region (Schoenfeld, 1927), shipped on the famous "milk trains" to city centers such as Boston and New York (Bezio, 2009; Schoenfeld, 1927). In contemporary Vermont, 80% of the land base, 60–70% of state revenue, and 85% of exports are derived from the dairy sector (Parsons, 2010); no other state is dominated by a single agricultural commodity (Wironen et al., 2018).

Liquid milk price is perhaps the greatest stress on farmers, especially since the 1980s (Parsons 2010). Until the 1982 Farm Bill (Sinclair, 1981), milk prices were set at 75–90% parity with production costs, giving farmers a stable living wage and prompting surplus production. Parity was part of the New Deal, when the dairy sector was modernized, mechanized, and supported with federal price controls through the Agriculture Adjustment Act of 1933 and the Federal Milk Marketing Order of 1937 (USDA Farm Service Agency, 2004; U.S. General Accounting Office, 1988). These price controls were dismantled during the Reagan administration (Figure 2).

Dairy farm and co-op consolidation began in the 1990s. From 1995 to 2020, the number of operating dairy farms in America decreased by 74.1% (Walsh et al., 2020). Prices are controlled by the Federal Milk Marketing Order system, which prompts co-ops to offer restrictive contracts to farmers. The Dairy Margin Protections of 2014 (Figure 3) failed to support dairy producers because the margin was too low to compensate for price volatility, and price supports provide only a final defense to market collapses (Figure 2). For instance, 2–3% overproduction can lead to a milk price fall of 20–30% (Jeffords, 2010). As production costs have increased, the average price of milk has steadily decreased, leaving most farmers unable to survive without consolidation. The problem is compounded in the Northeast by its geography, which is not conducive to the scale of consolidation that would permit fair competition with large dairies in other regions.

Northeast dairies once could cope with price fluctuations by switching to organic milk production, which offered more stable premiums. But several events have caused even organic milk prices to fluctuate, such as White Wave being sold to Danone in 2017 (Reed & Weiss-Tisman, 2021; Walsh et al., 2020). As Midwest dairies have grown in size and numbers of cows (Figure 3), supply quickly outpaced demand and organic milk prices dropped (Cotton, 2021). These conditions have been exacerbated by the loosening of National Organic Program rules, permitting cost-cutting measures that impact the margins of compliant dairies (Parsons, 2010).

Farmers have always had to find solutions to unpredictable change, such as hailstorms that destroy crops, shifts in consumer interest that impact their markets, and diseases that unexpectedly infect

livestock. Climate change is prompting multiple and more frequent shocks, culminating in greater vulnerability to already challenged dairy farmers (Darnhofer & Strauss, 2014). In the face of low milk prices, the loss of organic markets to western farms, and other pressures on the Northeast dairy economy, we investigate how dairy farmers in Vermont and New Hampshire are building resilience, looking particularly at processes of diversification. This case study of Northeast dairies builds on existing knowledge of diversification and provides insights into how to build resilience in the global food system to multiple stressors that are amplified by climate change (International Panel on Climate Change, 2019; International Panel of Experts, 2016).

## Research Methods

The research project began November 6, 2021, with a panel discussion at a farm in New Hampshire, "Climate and market changes: What contributes to a resilient dairy system?" hosted by the Northeast Healthy Soils Network (NEHSN), a collaboration of farmers, advocates, government officials, researchers, and community members to establish healthy soils throughout the Northeast. Panelists consisted of several dairy farmers from New Hampshire and Vermont, an industry representative from the host farm, and a government representative of the dairy task force. We recorded, with note taking and audio recording, both panelist and audience comments. Afterward, several members of our research team held in-depth, semi-structured interviews with panelists, addressing our main research question—what diversification processes have built resilience on dairy farms in Vermont and New Hampshire in the face of consistent market shocks?

These initial interviews supported the development of a semi-structured interview guide that ad-

**Figure 2. Timeline of Dairy Pricing Policy in the U.S.**

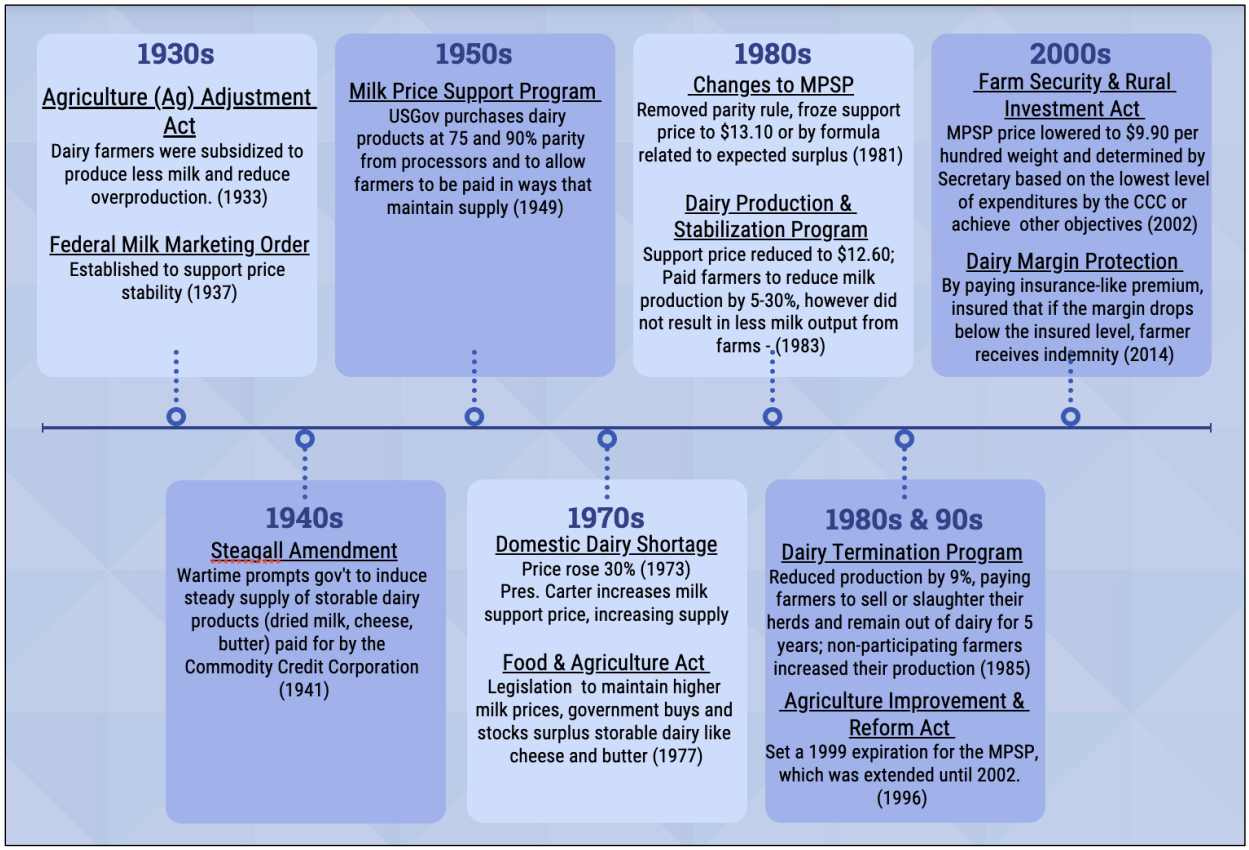



Image produced by author.

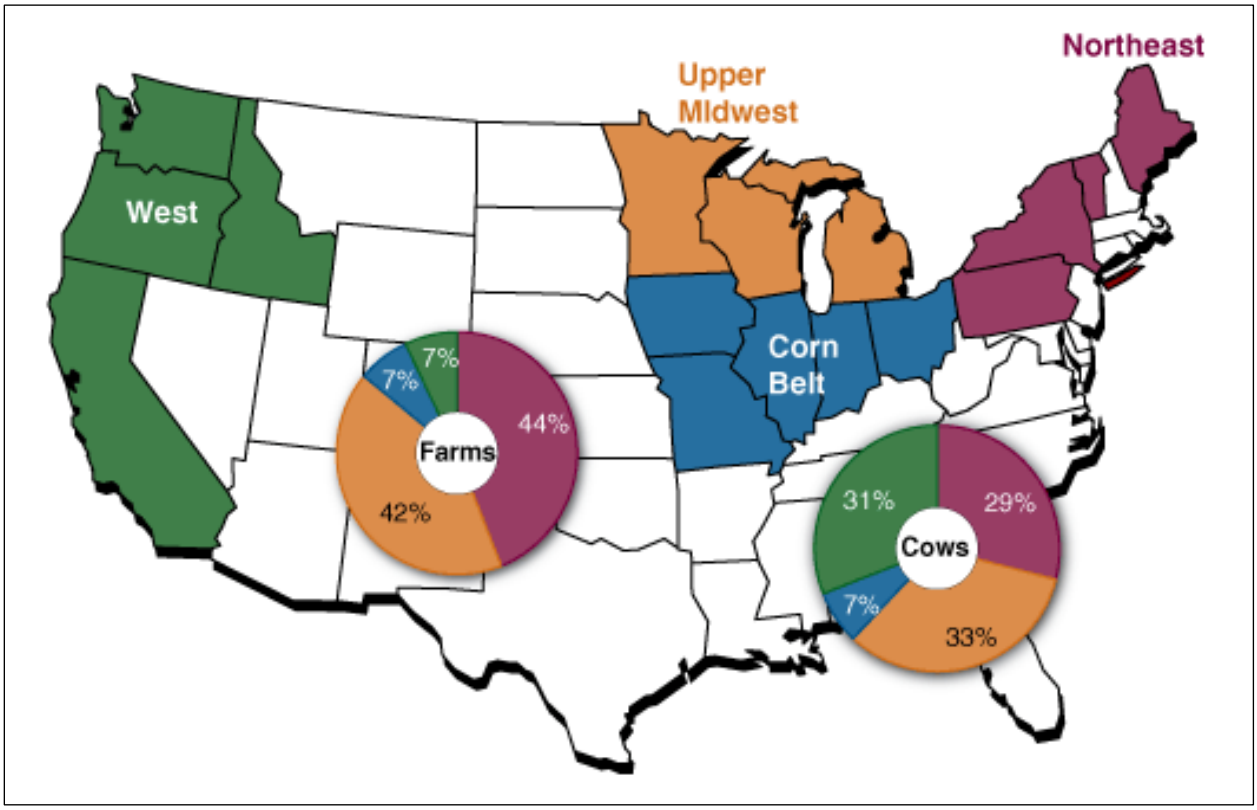
dressed what elements motivate diversification, how and why a specific strategy is chosen, and what socio-political elements support individual agency when diversifying dairy farms. These questions supported our objective to understand how, why, and with what support smallholder dairy farmers persist amidst uncertainty and frequent shocks. Our qualitative data collection followed the theories of Glaser and Strauss (1967), utilizing a grounded theory approach (a qualitative approach during which the researcher(s) iterates and proposes new theoretical concepts along the course of empirical research).

We interviewed 10 farmers, six organic and four conventional, and seven nonfarmer dairy advocates from government and nongovernmental organization) during the second week of November 2021, using a convenience and snowball-sampling process. Due to budget and time limitations, we targeted dairy farmers located within 100 miles of Brattleboro, Vermont, where the study was based. To find institutional actors, we carried out a literature review and cold-contacted each individual. Respondents represented a diversity of farm types, owners, production systems, and demographics (Table 1). Interviews lasted 45–90 minutes and were carried out by a team of three (consisting of both male and female researchers) who contacted the respondent and sought his/her/their consent and engaged in a conversational and relaxed interview (either in-person or virtual) that was recorded through audio and handwritten notes, anonymized, and uploaded into otter.ai, a password-protected application for interview transcription.

A limitation of this study was that we did not have sufficient time to carry out an exhaustive data collection process. There is risk that the conven-

**Figure 3. Share of Organic Dairy Farms and Cows by Region**

During the 2005 livestock census, only 7% of organic da iry farms were located in the West region, but these farms held 31% of the cows. This trend has continued to increase.




Source: USDA, Economic Research Service. Calculations based on data from the USDA 2005 Agricultural Resource Management Survey.

ience sampling process introduced bias, but our selection was based on farm diversity (size, location, topography) of farms, which reduced bias. The information from farmers was triangulated with interviews with institutional representatives (farmer advocates and government representatives), and in our analysis the data appeared to express redundancy.

The data were analyzed using a basic qualitative coding process. Substantive themes were identified and analyzed through our team's collective discussion as to how the farmer employed strategies to build resilience. Thematic coding was employed to identify patterns and relationships, in order to develop generalizations as to how and why farmers are attempting to increase resilience of their operations through diversification.

## Results and Discussion

### *Diversification for Resilience*

Similar to the findings of MacDonald (2020), these Northeast dairy farmers do not perceive small-scale dairy production as economically feasible in the current system, which increasingly favors large-scale operations. As the costs of dairy inputs (e.g., hay and grain) increase and the price of liquid milk decreases, smaller-scale dairy farms are unable to make ends meet. One farmer stated that due to price hikes they spent an additional $100,000 in 2021 on grain. Farmers repeated variations of the following remark when asked about the current predicament faced:

> That's one of the tricky things…the cost of living is going up as well as the cost of inputs. As both are going up, and the price of the milk is not. And you need the same amount of labor. (Farmer of Farm G)

Due to the stagnancy of conventional and organic liquid milk prices and the high cost of inputs, farmers are looking to diversify. Dairy farming in itself was not seen as a viable livelihood by our respondents. Many dairy farmers rely on social services (e.g., SNAP benefits) or nonfarm supplementary income to maintain a quality of life that includes sending their children to college, having enough food, and maintaining their home as well as the farm.

Farmers diversify their products, practices, and marketing, each of which depends on the farmer's individual philosophy, personal constraints, geography, and the support of the community and institutions around them. These diversification strategies (Table 2) were categorized as: Livestock Care (practices involving the general physical and emotional care of the cows from pre-conception through death; e.g., nurse cows, calving cycles), Land Stewardship (practices geared toward increasing soil health and ecological resilience; e.g., rotational grazing, conservation easements), Feed Production (practices departing from the norm of purchasing commodity feed; e.g., onsite feed production), Dairy Processing/Energy Production (ways in which farmers are diverting their milk from wholesale buyers; e.g., onsite processing facilities), Farm Products (what is produced and sold through pathways other than wholesale milk buyers; e.g., raw milk, surplus hay, eggs, etc.), and/or Off-Farm Employment. Farm Products were divided into typologies: value-added dairy products, by-products, and nondairy products.

**Table 1. Summary of Demographics of Interviewees**

| | Farmers | Dairy Advocates |
|---|---|---|
| All (total #) | 10 | 7 |
| Women (#) | 5 | 3 |
| Men (#) | 5 | 4 |
| Age (50+) | 4 | NA |
| Age (36-50) | 4 | NA |
| Age (20-35) | 2 | NA |
| Farm Size "Large" | 1 | NA |
| Farm Size "Medium" | 0 | NA |
| Farm "Small" | 9 | NA |
| Type of Interviewee | | |
| Farm | 10 | NA |
| NGO | NA | 2 |
| Business | NA | 2 |
| Government | NA | 3 |

*Land stewardship, livestock care, and feed production*

Many farmers consider themselves stewards of land, animals, and communities. When asked how Farmer A cares for the soil, they stated: "I see us more as land managers first, animal managers second, and food producers third." These principles were often solidified by established conservation easements on their land—an "irrational" decision from the perspective of a classical capitalist economic vision, as it limits land uses to agricultural development. As shown in past studies, farmer motivation to practice stewardship is based more on multiple and subjective factors than pure economic reasoning (Carlisle, 2016).

Multiple strategies made stewardship financially viable. Farmers found that they could reduce external inputs (e.g., hay) by restoring the health of soil and land, aspects related to regenerative design and practice (LaCanne & Lundgren, 2018). Farmers earned premiums for their milk by changing their livestock care practices—diversifying their herd genetically or nutritionally to earn the premium for fat and protein percentages (one did so in order to support a local cheese producer). Another changed their grazing practices to earn the premium for a grass-fed label, generally with the support of a dairy cooperative (Snider et al., 2022). Transitioning to organic fodder supported some farmers, earning an additional premium for certified organic hay. Five (C, F, G, H, J) of 10 farms grow as close to 100% of their feed as possible, which, in ecological terms, creates a closed-circuit input-output system that reduces hay input cost, transport emissions and regional nutrient extraction while incentivizing soil regeneration (Jones, 2008). Strategies that provide healthy on-site feed for livestock included managed intensive grazing and seeding plant biodiversity, measures that improve soil health, enhance livestock feed quality and reduce illness. A diversity of livestock species (e.g., cows and chickens) produce co-benefits and reduce the need for pesticides, as chickens eat the fly larvae in cow manure, reducing larval loads. To protect water quality, farmers repurpose their waste products (e.g., collecting whey from cheesemaking partners to feed pigs).

Farmer stewardship practices were predominantly concerned with soil health—building organic matter content, preventing erosion or compaction, increasing water infiltration and quality,

**Table 2. Selected Types of Diversification Organized by Product-based Categories and Practicing Farms (# Used among the 10 Farms)**

| Diversification | Types identified |
|---|---|
| Livestock care | Improve nutrition (4), Calving practices (3), Selective breeding (2), Enhance shelter (2) |
| Land stewardship | General regenerative practice[a] (4), Rotational grazing (3), Managed intensive grazing (3), Easements (2) |
| Feed production | Leased and free use of local pastures (6), Grow more feed than buy (5) |
| Dairy processing/Energy production | Shift to organic (6), On-site processing, packaging, marketing (3), Direct sale to cheesemakers (2), Solar energy (2) |
| Value-Added products | Pudding (1), Ice cream (1), Flavored milk (1), Raw milk (1) |
| Non-dairy products and by-products | Maple syrup (4), Chicken (3), Culled beef (3), Surplus hay (2), Vegetables (2), Veal (2), Pork (2), Beef (2), Flowers (2), Ducks (1), Turkey (1), Honey (1), CBD (1), Grapes (1), Airbnb (1), Timber (1), Other fruit (1) |
| Off-farm employment | Spouse holds job off the farm (3) |

[a] Regeneration is derived from agroecological practices that build soil health.

and managing waste. Six (A, B, C, D, F, G) of 10 farms shifted away from conventional continuous grazing methods toward rotational or intensive grazing (Gerrish, 2004) to build soil health. Rotational grazing utilizes repeated periods of grazing and rest among two or more paddocks or pastures; managed intensive grazing is a flexible approach to rotational grazing in which animal nutrient demand through the grazing season is balanced with forage supply and available forage (Andrae, 2008). Farmers practicing managed intensive grazing also used the term "holistic" to describe their approach to caring for soil, pasture and woodlands. Two (Farms A and F) employ additional practices that reduce erosion, plant trees for their ecosystem functions, establish land conservation and river barrier easements (Farm F), and reseed native, perennial grasses.

All those engaging in differentiated grazing practices spoke of wanting to increase both the breadth (forest management) and depth (knowledge of soil health and its layers of organic constituents) of land stewardship. Grant programs that fund farm conservation practices catalyzed stewardship for some. Although these strategies were achieved for varying reasons and through varying means, they all contribute to ecological resilience, the ability of a system to absorb and adapt to environmental shocks and stresses (Meuwissen et al., 2019).

*Dairy processing, value added, and nondairy livelihoods*

The COVID-19 pandemic brought on supply chain disruptions, which reverberated with dairy farmers. As institutions closed, milk was being dumped due to lack of markets. In response, Northeast dairy cooperatives instated milk quotas on their member farms. Three farmers who were producing beyond the quotas decided to utilize the surplus by creating value-added products. This was accomplished through new, small, onsite processing facilities, some of them funded through pandemic relief programs. The three farmers who have installed processing facilities on site were making unique products. High fat content, organic milk was processed as ice cream or bottled with flavors such as coffee, chocolate, and maple; another farmer was making pudding (although their production started before the pandemic disruption). These value-added production schemes filled niches in the market; farmers connected to consumers through their locally produced and processed products. Their market diversification enabled farmers to prevent loss, provided higher margins for liquid milk, and utilized byproducts to offset changes in supply chains and markets.

Small, onsite processing facilities provide autonomy, support redundancy of types and distribution of processing and expand the adaptive capacity of Northeast dairy farmers (Brinkley, 2018; Gupta et al., 2010; Walker 2020). With more processing infrastructure in the region, and with enhanced infrastructure diversity, a farmer can market their own products, build local-product demand, and normalize consumption of local food (Brinkley, 2018). However, this strategy is highly demanding of time and capital, concerns that institutions and policy need to address (Darnhofer & Strauss, 2014).

Value-added products supported farm viability (Born & Bachmann, 2006), built new market strategies, and were linked to a farmer's stewardship practice (Maye, 2016; Sherwood & Uphoff, 2000). "We didn't want anything that anyone else was doing and so we wandered around the grocery store and tried to figure out what was being done and what wasn't being done" (Farm E). Farmer H had particularly fertile soil and thus chose to start growing his own crops for feed, while Farmer C chose to grow grapes on his well-drained hilltop land. Farmer A established a maple sap operation on land too steep to clear for pasture or farming, a traditional strategy of New England dairy farmers. Farmer C experimented with different tree plantings to encourage wildlife.

The choice to develop different products is often more essential for farms with smaller dairy herds (Figure 4). Farm A possessed the fewest cows and produced the greatest diversity of product; Farm J, with the greatest number of cows, sold only surplus hay in addition to conventional milk. The farms with the smallest herds, Farms A and B, have also been able to sell raw milk through a community-supported agriculture program, and at least one of them uses a low-waste model by reclaiming milk bottles. Of the farms with larger herds, diver-

sification strategies included surplus hay (Farm G and J), maple syrup (Farm H), poultry (Farm H), flowers (Farm I), and flavored milk (Farm I), the latter of which was developed during the pandemic.

### *The Social and Well-being Benefits of Diversification*

Beyond physical and monetary benefits of diversification, farmers spoke of more affective or emotional reasons to diversify. These include relationships, quality of life, and human and nonhuman justice. Their decisions go beyond the farm's business model to enhance farmer reputation and build relationships with neighbors and the wider community.

#### *Relationships*

Farmers spoke of feeling more connected to others through processes of diversification. For instance, development of value-added products depends on transparency and personal relationships in contradistinction to a disassociated, opaque wholesale milk system (Darnhofer et al., 2016). To sell flavored milk, Farm I established a network of farm stands and markets where they could refrigerate and sell their product. For one cheese producer, producing and marketing locally was found to be

**Figure 4. Farms Connected to Product Diversification**

Farms A-J are organized on the left axis by smallest to largest herd size in descending order (top to bottom). Each farm is connected by a line to the products it produces, labeled on the right axis.

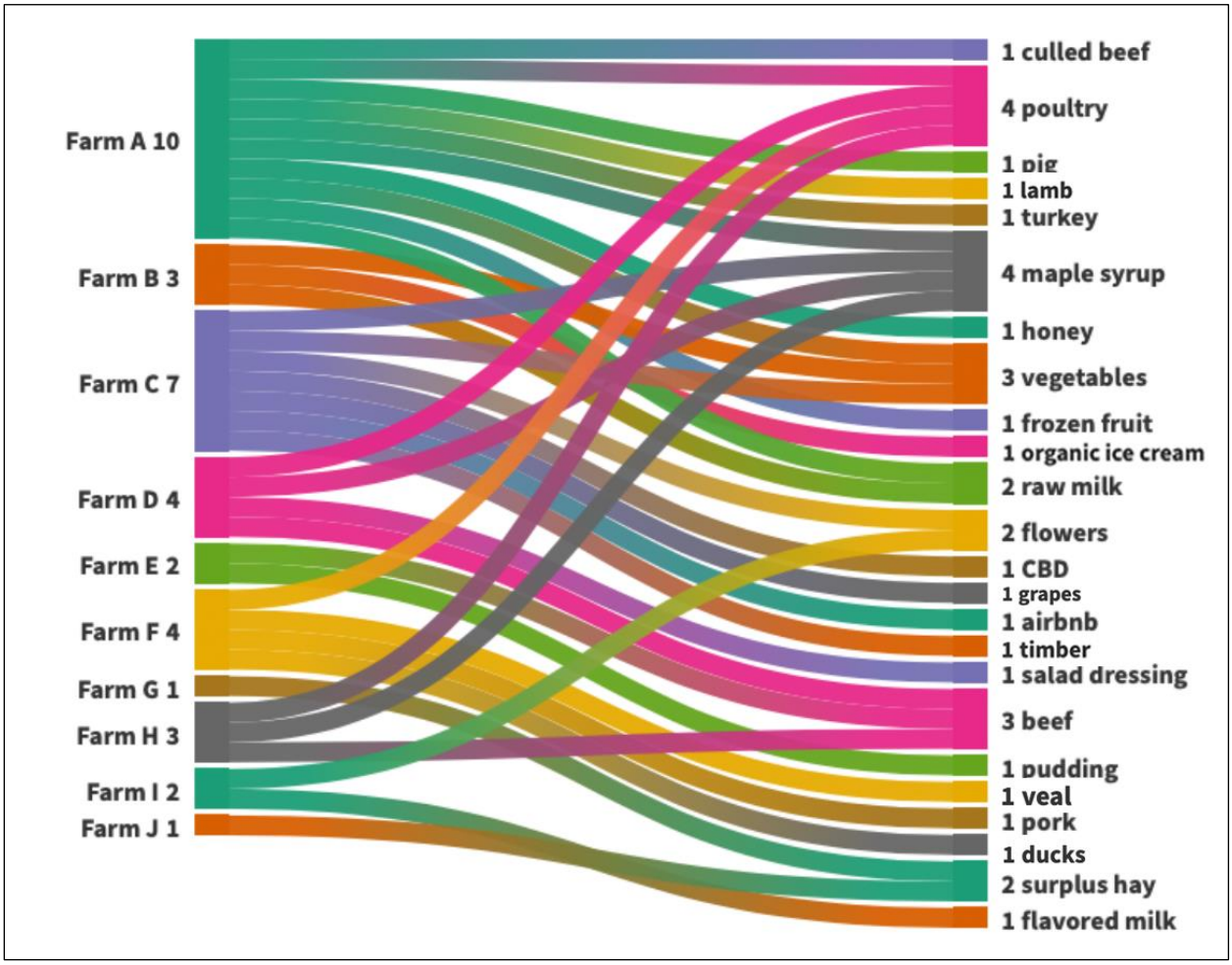



Figure produced using flourish.studio.

much more rewarding than "taking what he can get" by selling his milk wholesale, a process that transformed his milk into powder and some "unknown" product.

> Everything about doing business with my cheesemakers…is wildly more rewarding than sitting here and taking what I get. … To not feel like you're in control of what you earn is awful, and with what's happened in the dairy industry. … I struggle with it. (Farmer H)

The disassociation of the wholesale system versus the relationality of the direct market system was expressed by other farmers and institutional representatives. For Farmer H, the care of his cows is directly related to his relationship with the cheesemaker, who believes that care for the cows is reflected in the quality and taste of his cheese. This direct connection may establish a longer-term interaction between consumer and farmer, which leads to better quality of life and supports the burgeoning local food movement (Olson, 2019).

*Quality of life*

Farmers often stated how little money they made annually (in one case, just $8,000), primarily due to the low amount paid for liquid milk and difficulties in breaking even with other forms of on-farm income. Nevertheless, beyond a paycheck, farmers preferred to stay in the dairy business. Much of this choice was related to the quality of life provided on a dairy farm.

Diversification provides the feeling of independence. In addition, the versatility and multiplicity of roles on a diversified farm was perceived as more exciting than the "routine" of mundane daily tasks. Innovation is intrinsic to many of the farmers' practices, which include experimentation and assuming multiple roles. One is not just a dairy farmer, but a soil scientist, wildlife steward, and a hog and chicken caretaker.

Many of the farmers had a farm store on their property to enable direct marketing. Some expressed appreciation for the convenience, trust, and ease of direct marketing, which has been shown to increase a farmer's quality of life (Silva et al., 2015). Direct marketing removes the need for loading and transporting products to farmers markets. These farmers have established sufficient trust with their community members that they leave a cash box, Venmo QR code, or other electronic means of customer payment, saving the farmer considerable time in customer service. Other sources of trust include community supported agriculture (CSA) arrangements, which represents consumer confidence in the farm.

An important value for many of the farmers was close interpersonal relationships. The cohesion of a farmer's nuclear and extended family, connection with community members, and mental and physical support in general are nurtured in the daily activities of dairy production. Several farmers noted that diversification enabled more family members to return to (or stay on) the farm and engage in the "new" activity. For example, Farmer I moved back to the family dairy farm, leaving a lucrative career in order to be close to his family:

> Most people work themselves sick. … I would have made a lot more money sticking with my [previous profession], but I've lived a much richer life doing this. [M]y kids had access to me all the time. … [Speaking of a fraught relationship with his brother] We went back to actually cherishing each other. … [In this work,] relationships [are] the big thing.

By defining quality of life as being more than a paycheck, the farmers we interviewed emphasized how their relationships had improved, and that they were happier and healthier, and more connected to those around them. These immeasurable elements sometimes resulted in further diversification, as individuals returning to the land (farm) found the time and energy to pursue personal interests such as growing and selling flowers or working with their children to start new farm ventures, such as hosting guests at an on-farm Airbnb. Farmers spoke about how privileged they were in comparison to young first-generation farmers who struggle to enter the industry due to exorbitant capital costs.

*Human and nonhuman justice*

Building more socially just farming systems was

emphasized by many of the farmers we spoke with. Dairy farmers are beholden to the stringent pricing systems and restrictions laid out in contracts from liquid milk companies. Some of the institutional representatives we spoke with described the farmer's inability to advocate for higher prices, due to the contracts and the unfair monopolies that buyers hold over the liquid dairy markets. In addition, the dairy workers who come to the Northeast, often from Latin America, are heavily exposed to difficult working conditions with little capacity to seek better conditions and speak out for human rights. Dairy farmers face the dual pressures of an imposed silence about the unjust pricing of wholesale milk and external social pressure to change labor practices and pay workers higher wages while maintaining good quality working and living conditions on the farm. While most of the farmers we spoke with did not hire foreign workers, they were familiar with these challenges and expressed a strong desire to pay their employees a good, livable wage. "You know, it'd be really great to be able to pay employees better, but some of those things are, you know, a function of being involved in a market that is crazy" (Farm E). To manage the challenges in the milk pricing system, some farms have provided opportunity for training an apprentice to support farm labor. Others have been transitioning to robots to milk the cows, which have freed up family members to carry out other necessary tasks.

In terms of the claims of nonhuman justice, farmers are experimenting with care practices over the lifetime of cows and bulls. Farmers often viewed these practices holistically. For instance, farmers chose to control calving cycles or selectively breed within or between species to support herd health and environmental conditions. Pairing nurse cows with two to three calves makes for more harmonious and safer growth conditions. Three of five farms (Farms A, D, G) engage two or more different livestock care practices. Three of five also crossbreed cow breeds and/or adjust feed to produce higher nutrition levels, resulting in milk with higher protein and butterfat and thus gaining a premium from organic co-ops or cheesemakers. Of the two farmers selectively breeding their cows, one crossbred different species and the other selectively breeds for smaller hooves, that less disrupt hillside soil. Nutrition, breeding, and culling practices played into maintaining the overall health of the herd and land.

Each additional animal cared for on their farms had its own "place" or "job," performing some useful action for the health of the farm prior to its sale as meat or byproduct. In addition to generating income from their products, these animals served as a capital investment, returning value by performing key functions on the farm or increasing the value of the land. Farmer F describes her farm as a holistic collaborative system: "The pigs…help compost my bed pack before they go to market. The chickens are constantly working to aerate the entire bedded pack to control maggots [as] the pest control team. The ducks are…my water pumping station, keeping that clean. [All] have a place." Other farms kept bees for pollination, and rotationally grazed animals for carbon sequestration in the soil. These types of diversification yield benefits to humans and nonhumans alike, replacing destructive practices.

To summarize the prior two sections, farmers are increasing their resilience to shocks by implementing a variety of strategies, including physical and nonphysical changes to their farms, providing alternative income and redundancy against market shocks (Gupta et al., 2010). In addition, through many of their diversification efforts dairy farmers have reconnected with family members and the surrounding community. The resulting social networks provide support, ideas, and income while producing a more resilient, locally based, and productive dairy system (Cassidy & Barnes, 2012; Olson, 2019). Moreover, increasing the social and biological diversity of an agroecosystem increases a farm's ability to recover from natural disturbances as well as market fluctuations (Liebman & Schulte, 2015).

### *Supports and Barriers to Diversification*

Farm resilience is related to economic viability, flexibility, and the ability to withstand market shocks (Craddock-Henry, 2021). To better understand what institutions support and hinder diversification (Ostrom, 2006), we outlined national, regional, state, and local-scale laws, cooperatives, programs, and networks that were mentioned by

farmers (Table 3). Using theories about what institutional characteristics best support resilience (Gupta et al., 2010), we examine the flexibility, resources, and learning capacity of the various institutions that farmers mentioned engaging with in their process of diversification.

*Temporal financial support*

Financial resources are essential to building resilience to shocks (Craddock-Henry, 2021; Gupta et al., 2010). In the process of diversifying, farmers relied upon federal financial resources to purchase equipment, provide training, and obtain certifications. One farmer (Farm G) was able to reduce energy costs by setting up a solar array using funds from the Rural Energy for America Program (REAP, Table 3). The Value-Added Producer Grant (VAPG) program which began in 2000 (USDA Rural Development, 2000) provides funding for farmers to establish value-added processing businesses for their products. The American Recovery Plan Act (ARPA) of March 2021 was a useful channel for aiding farmers in the state; two farmers (Farms C and I) in Vermont utilized it to diversify their operations. The Dairy Business Innovation Center (DBIC), one of four national innovation hubs located in Vermont supported farmers with grants that enabled diversifications related to agritourism, technical assistance, and building a noncow dairy operation. Each of these programs channel federal funds into regional and local diversification efforts across the Northeast.

While farmers benefited from short-term federal programs like the ARPA (Table 4), farmers had longer-term, more direct relationships with state and local entities. For instance, one farmer (Farm A) often sought support from the Vermont Farm and Forest Viability Program organized by the Vermont Housing and Conservation Board (VHCB), which assists small farmers intending to implement diversification strategies. State institutions are well-situated to collaborate with farmers, such as through development of a market-relevant branding program to highlight the quality of local

**Table 3. Programs That Farmers Stated Supported Diversification Processes**

| Financial resources and information supporting small dairy diversification | | |
|---|---|---|
| **Type** | **Program** | **Description based on farmer responses** |
| Federal Government | REAP | Rural Energy for America Program: USDA initiative to finance renewable energy systems on rural farms. |
| | VAPG | Value-Added Producer Grant: USDA funding for farmers to establish value-added processing businesses |
| | COVID Relief | ARPA (American Recovery Plan Act) and other federal relief initiatives |
| Regional Government | DBIC | Dairy Business Innovation Center: provides funding and technical assistance for dairy diversification |
| State Government | VFFVP | Vermont Farm and Forest Viability Program: Vermont Housing and Conservation Board (VHCB), an initiative facilitating diversification of small farms |
| | State Branding | Efforts in Vermont and New Hampshire striving to establish premiums for dairy production in the state |
| Private | Co-ops | Useful networks for farmers to connect with each other, share knowledge, and learn about dairy economics |
| Nonprofit | NOFA | Northeast Organic Farming Association: forum that connects farmers and organizes programs |
| Nonprofit | DGA | Dairy Grazing Apprenticeship: national program that connects aspiring dairy farmers with mentors |

dairy products. Collaboration is often facilitated through multi-stakeholder networks such as the Northeast Organic Farming Association that support information sharing and flexibility, both perceived to be conditions that enable transformation in the face of market shocks (Anderies et al., 2004).

*Flexibility and autonomous change*

Flexibility and room for autonomous change are lacking in the capital support systems that promote diversification (Gupta et al. 2010). Pandemic relief funds, for example, are temporary measures to boost economic viability, so when these supports are removed farmers may lack the capital for the transition. Farmers suggested that government actors should support multiple and more flexible funding opportunities, emphasizing fewer restrictions and less reporting requirements. This flexibility provides a more robust institutional environment to support farmers engaging in the diversification process (Anderies et al., 2004).

Some farmers distrusted state governments, due to their potential for finding noncompliance with state regulations, unmet codes, and other barriers to business development. Three farmers (Farms A, C, and D) stated that they considered state regulations barriers to diversifying. In New Hampshire, Farm E described a lack of resources and programs at the state level that would support dairy diversification. For example, in some areas, strict regulations prevent the production, sale, and in-house processing of raw milk. Act 250, Vermont's development code, stifles the addition of certain nontraditional processing operations like winemaking, preventing farmers from diversifying by establishing vineyards.

*Social networks, relationships and information sharing*

As farmers pursue new diversification strategies, they find more people with whom they can exchange information, concerns, and ideas about specific crops and animals. Strong informal farmer networks provide opportunities for farmers to obtain funding, knowledge, and build relationships, contributing to their resilience. In the face of broad-scale shocks, community networks provide an effective way to share strategies that have and have not worked, especially in smaller communities (Ghose & Pettygrove, 2014).

Similarly, nongovernmental organizations serve as important sources of communication about grant opportunities and expertise supporting diversification that cross multiple levels of governance from federal to local (Table 4). The Northeast Organic Farming Association (NOFA) connects farmers and organizes educational programs to share information such as how to build soil health. The Dairy Grazing Apprenticeship, a national program that pairs aspiring dairy farmers with "grazing mentors," strengthened social networks between participating farms (A, D, and G) that in turn received monetary and technical assistance.

Despite these social networks, farmers discussed concerns in which networks are absent but needed. One concern is connecting products to consumers. When farmers introduce new products, they may find it difficult to enter the market, which can cause significant losses. Regional nonprofit networks can provide both a forum (at regional conferences) and an information network where farmers can find new ideas or gain support that will allow them to focus on their farming operations. One farmer (Farm A) lamented the closure several years ago of the Rutland Area Food and Farm Link (RAFFL), a nonprofit in central Vermont dedicated to connecting agricultural products with local markets, which left a gap in the southern Vermont agricultural network. The Intervale Center in northern Vermont is a nonprofit connecting farmers to local markets and supporting regenerative agriculture, but a similarly robust organization is not found elsewhere in the two states. RAFFL and Intervale demonstrate the role of local organizations in building resilient farming networks. The presence of Intervale strengthens farmers' ability to diversify, but the absence of RAFFL reduces their confidence in their ability to remain economically viable.

Personal connections were the most cited source of information supporting diversification. "It's all visual, really. We go by each other's farms. We see what the others are doing. And if something sparks our interests, we pull in and ask the farmer, you know, how'd that go for you?" (Farmer A). Sharing information enables farmers to learn about diversification before committing time

and resources. "We all just feed off each other and we share information. It's very noncompetitive, that makes a big difference when you're in the area or an industry where you're helping each other because…not one family can figure it all out" (Farmer F). During a "pasture walk," farmers take a tour of another farmer's pasture while discussing soil health, grazing practices, and fostering relationships. One farmer (Farm H) investigated raising wagyu beef because a friend's father started raising the cattle. Another farmer (Farm C) learned grazing strategies from a college professor and wanted to try them out himself. Overall, these exchanges greatly support diversification.

Land sharing is also common among those practicing regenerative grazing techniques. Six (A, D, G, H, I, J) of 10 farms graze cows part time on neighbors' pastureland. Several of them have informal agreements to "mow" the neighbor's lawn. Many of the neighborly relationships go back several generations. Farms also rent grazing land from others.

Because these networks are widespread and informal, those not involved have usually made the effort to stay independent. Many farmers see themselves as self-sufficient, which tends to build individual over collective responsibility and discourages engagement in networks and programs: "Some farmers just really kind of want to be left alone…there [are] some clichés about the personality of folks who go into dairy … it is kind of an isolated profession." Despite this tendency, many farmers emphasized the importance of connection to others as critical to building farm resilience.

*The support and rigidity of cooperatives (co-ops)*

By establishing strong and enduring relationships between their members, co-ops build social capital and share knowledge. For example, farmers who transition toward organic are often "welcomed" into not only a new market, but a new social network, group of advisors and technicians, and an institutional arena where grants, loans, and services can be obtained. Farmer G commended Organic Valley:

> That's one of the things that Organic Valley does extremely well. … We have multiple staff veterinarians, nutritionists, agronomists … and you can … interact with him often about … the feed quality [to know] what we need to do. … I hear from other farmers that that's something that is really lacking for a lot of other farmers.

Remaining within the fluid milk market with premiums helps dairy farms maintain much of their original function and structure without too much infrastructure change. It also requires minimal new training for experienced farmers, allowing for consistent labor throughout the transition. Importantly, some of these transitions also help farmers expand their market base beyond that of their co-ops and fluid milk markets.

All but one of the farmers with whom we spoke belong to one of three dairy cooperatives in the region. Four farmers (Farms C, E, F, and J) felt that co-ops build the social network of farmers. This typically occurs through co-op meetings, where farmers influence co-op operations and rules, share knowledge about diversification strategies, and learn the latest trends in commodity markets. Stronger social networks tend to correlate with greater system resilience (Cassidy & Barnes, 2012), so engagement in a co-op likely contributes to farm success. While one institutional actor stated that not enough farmers are involved in co-op management, Farm F claimed that his co-op had generally "good attendance…I bet you 30% to 40% of the farmers might go to these meetings." Two farmers (Farms C and G) specifically stated that they felt their co-op cared about the well-being of small farmers. According to two institutional respondents, value-added production, such as cheese and yogurt, can be much easier and profitable at a co-op scale than through an individual farm.

On the other hand, some aspects of co-ops create "rigidity traps" (Stedman, 2016), i.e., self-reinforcing elements of a system that tend toward certain ways of thinking and behaving that ignore others and are difficult to transform (p. 891). Co-op rules can restrict farmers from engaging in their own value-added dairy businesses. Co-op participation and democratic decision-making is reduced when smaller local co-ops are absorbed by larger regional or national co-ops. One institutional actor

felt that larger co-ops care less about the well-being of small farmers; another expressed concern about farmer ability to participate in the policy-setting of larger co-ops headquartered outside northern New England.

> I think [participation is] harder. It's not impossible, but it's certainly harder. … The DFA [Dairy Farmers of America] … their headquarters is in Syracuse. … That's an overnight trip and not as easy to stop in and, you know, take an afternoon … and still be able to get home to do the farming at night. (Inst 4)

The size and location of co-ops impacts the ability to challenge rules, share information, and engage in the political process in defense of their livelihood (Méndez et al., 2019). In smaller co-ops, farmers not only receive the knowledge sharing and technical support discussed above, but they also have more confidence that their co-op has their interests in mind. In a larger co-op, diversification is hindered by the need for large-scale commodity milk, and the community connections that are so important to farmers are difficult to form.

The process that the co-op uses to determine prices each year is also rigid, not always reflecting market shocks. "All the producers have to tell Organic Valley at the beginning of the year how much milk they're going to produce throughout the year. Organic Valley takes those numbers and goes to its sales team, and says, 'Okay, this is what we're going to have to sell, this is what we have to market,' and they give us a price." (Farmer D). The annual price determination insulates farmers from market fluctuations, but also means they would not benefit from a price increase. An institutional actor explained that the determination can result in the co-op losing money if the price of milk drops, so that the co-op may choose to lower the price it pays farmers the following year.

In summary, farmers found many ways that diversification is supported or hindered through institutional processes. Primary barriers are regulations that restrict small farms from diversification while benefiting larger operators. At the state and co-op level, especially, farmers are prevented or hindered from carrying out new diversification strategies. More favorable regulations could allow a boost in diversification. The most important supports to diversification are capital, through grants and support networks, and information sharing through official networks and community groups. Capital is necessary to overcome the costs of establishing new forms of production, especially value-added dairy operations. Open information sharing, especially among neighbors, is crucial in enabling farmers to try new strategies.

## Conclusions and Recommendations

This study has assessed the ways in which dairy farmers have conceived of and embarked upon pathways toward resilience by analyzing processes and institutions supporting or inhibiting diversification. Overall, small dairies in the Northeast provide an important case study as to how diversification can contribute to a more resilient food system, which is enhanced by social networks and institutional support. As evidenced by the diversification of small dairy farmers in the Northeast, the dairy industry is adapting to a shifting market characterized by dichotomous patterns of both farm consolidation and farm-to-consumer re-localization. While some have argued that the Northeast is not able to compete with Midwestern dairies to produce milk, whether organic or conventional, under the current structures (Benson, 2020; Real Organic, 2022), the individuals we spoke with see dairy as essential to the social fabric of the Northeast as well as an important part of a national strategy to build a climate resilient food system.

Choosing when and how to diversify a dairy operation is no small task and demands significant risk, financial capital, management ability, and physical and mental energy. For most farmers, their broad motivation for diversification was based on both survival and betterment of their situation, based on quality of life for humans and nonhumans. As past research on dairy farms shows (Cradock-Henry, 2021), Northeast farmers are utilizing a range of responses to cope with stresses, including those related to environmental and economic shifts. We identified multiple diversifications including higher premiums from organic or directly marketed liquid milk, value-added dairy products, nondairy farm products, and building soil health

through land management practices. We have discussed factors that influence diversification, as well as some of the perceived benefits and barriers.

The elements which, when conjoined, tend to support Northeast farmer diversification include transparency and open sharing of knowledge and information and strong social networks based on interpersonal relationships as well as networked institutions, both NGOs and government (Cassidy & Barnes, 2012). Perceived barriers to diversification include lack of capital (natural, social, and economic), a strict regulatory environment, prohibitive wholesale commodity contracts, limited time and labor, and milk market saturation. Despite these barriers, farmers persist in experimentation with dairy and other modes of farming, motivated by a long-standing relationship with their land, their community, and their animals.

Diversification provides expansive market opportunities when liquid milk buyers withdraw. In March 2022, in light of Horizon/Danone and Maple Hill's withdrawal, the co-op Organic Valley/CROPP offered to purchase milk from 90 of the 135 dairy farms whose contracts were to be terminated in late 2022 (Cotton, 2022). While boosting the Northeast dairy market, the co-op cannot alone provide the buffer needed to create a more resilient dairy system. To bolster the dairy industry and improve its viability in the Northeast, farmers need more and consistent institutional support that supports diversification, such as local processing facilities, more diverse and inclusive dairy cooperatives, and enforcement of quality controls, such as the pasture and origin of livestock rules, to strengthen organic standards and promote regenerative practices.

Diversification processes support both resilience of the dairy industry and a transformation of Northeast agriculture. We find that these processes will continue to be necessary to support the viability and resilience of dairy farming in the Northeast. Overall, the issues facing dairy farmers originate in an unfair pricing system that deeply undercuts the balance of price of milk and costs of production. Finding pathways for transformation is essential. These innovative farmers have demonstrated that this is difficult, but possible even within the continuing unfavorable economic system for dairy farming.

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