

RESEARCH ARTICLE



Farming along desire lines: Collective action and food systems adaptation to climate change

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Abstract

1. We examine collective action in the food system of the Canadian Maritimes to determine its effect on the resilience and adaptive capacity of food producers, distributors, retailers and governance institutions.
2. Our data suggest that beyond their immediate benefits for their participants, expressions of collective action generate higher-level impacts which often translate into drivers of adaptive capacity.
3. Drawing on a metaphor from urban design, we suggest that collective action should be considered a *desire line* for food systems adaptation: rather than building adaptation strategies based on top-down design, collective action emerges from farmers' needs and capacities to build financial resilience, enhance human and social capital and strengthen institutional agency within the system.

KEYWORDS

Canada, climate adaptation, collective action, desire lines, farmers, food systems

1 | INTRODUCTION

Are there ever any shortcuts in food systems adaptation? One wishes there were, but the complexity of the global food system resists quick fixes. Rising average temperatures; uncertain or intensified precipitation; and more frequent extreme-weather events will lead to crop failures and loss of nutrition (FAO, IFAD, UNICEF, WFP, & WHO, 2018; IPCC, 2018a). The increasing vulnerability of transportation and storage infrastructure will affect distribution and supply chains (Ericksen, Ingram, & Liverman, 2009; Vermeulen, Campbell, & Ingram, 2012). The nature of the global market suggests that the financial and physical hardships caused by climate impacts will primarily fall upon rural populations, especially food producers (Hallegatte, Bangalore, & Bonzanigo, 2016). If it is to succeed at all, climate adaptation planning needs to match the complexity of the problems it faces, reaching across scales (Adger, 2003; Adger, Arnell, & Tompkins, 2005) and centres of

power (Ostrom, 2008). Rather than exclusively focusing on specific risks and their mitigation, it must also bolster adaptive capacity—the 'ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences' (IPCC, 2018b, p. 541)—to account for unpredictable shocks and unaccounted drivers of change (Adger et al., 2011; Brooks & Adger, 2005).

Part of the difficulty in finding solutions to the wicked problem of climate change lies in the nature of institutions, which—as the means through which transactions are made predictable—are resilient for better or for worse (Dovers & Hezri, 2010). Institutions in climate adaptation are a paradox: while they provide an alternative to an entirely chaotic reshaping of the world, they also make us “prisoners of history”, [given that] institutions typically embody past understanding and imperatives, not present or future ones' (Dovers & Hezri, 2010, p. 212). The challenge of climate adaptation

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is therefore also the challenge of institutional change. Berkes (2009) points out the importance of networks and 'bridging organizations', which provide a space multiple types of knowledge to interact and coordinate so as to co-manage and ultimately transform institutions. As organizations, they 'respond to opportunities, serve as catalysts and facilitators between different levels of governance, and across resource and knowledge systems' (Berkes, 2009, p. 1695). How do these elements, necessary as they are to adequate climate adaptation, manifest on the ground?

Urban design and planning describe a common phenomenon that may be helpful to understanding adaptation. In cities, tracks often appear where people repeatedly leave city-imposed sidewalks behind in order to navigate more efficiently. These repeated paths are called *desire lines*: communally generated vectors which solve the problem of getting from one point to another while nimbly ignoring ineffective structures (Smith & Walters, 2018). Like institutions, they become 'behavioural grooves where many people tread' (Sherren, 2009, p. 52). They are socially generated; they react constructively to poor planning; and they are sufficiently obvious to be followed by others (Nichols, 2014).

Desire lines remind us of the collective nature of adaptation, which is just as important in solving the problem of climate change as it is in solving how to get home on time. In systems-level adaptation, collective action is an essential vector to communicate information and technology (Meinzen-Dick, Markelova, & Moore, 2010); bridge compromise between political levels (DeMarrais & Earle, 2017); allow for local experimentation and social learning (Atkinson, Dörfler, Hasanof, Rothfuß, & Smith, 2017; Christmann, Aw-Hassan, Rajabov, & Rabbimov, 2015; Rodima-Taylor, Olwig, & Chhetri, 2011); and strengthen the capacity for effective decision-making (Adger, 2003; Nelson, Adger, & Brown, 2007).

Food systems adaptation policy has generally been implemented with a top-down approach, rarely considering the importance of collective action. Literature in the area has mainly focused on modelling studies, to the detriment of observational and experimental research (Porter, Howden, & Smith, 2017). Some literature has raised the importance of collective action in farm-level adaptation (Andersson & Gabrielsson, 2012; Leclère, Jayet, & Noblet-Ducoudré, 2013; van Bers et al., 2016); however, its methodologies have tended towards revealing more mechanistic, individual aspects of adaptation, focusing on crop yields and production systems (Darnhofer, Bellon, Dedieu, & Milestad, 2010). Crucially, research initiatives have failed to bring farmers to the table in order to develop solutions, despite a growing consensus in the literature that producers' expert knowledge should be leveraged (Kent & Sherren, 2017; Soubry, 2017; Soubry, Sherren, & Thornton, 2019; Sumane et al., 2018). Doing so leaves a gap in understanding the relationships between farms, farmers and other areas of the food system such as distribution and sales (Darnhofer, Lamine, Strauss, & Navarrete, 2016; Porreca, 2010; Wynne-Jones, 2017). Top-down methods may be more efficient at delivering policy, but they risk presuming the needs of parties and creating the untenable expectation that such policy will single-handedly solve the problem of adaptation (Ostrom, 2010a).

Collective action and desire lines may follow the same path: both react to an imposed environment with tacit knowledge adapted to local conditions. Both provide emergent and endogenous solutions independent of what could be elaborated exclusively from theory. And both may be useful in bringing to light the role of collaboration in creating robust, adaptable land-based food systems.

In this paper, we examine how collective action, climate change and food systems interact by asking: How does collective action emerge in land-based food systems? How does it affect these systems' resilience and adaptive capacity? And how can it contribute to the broader goal of successful climate change adaptation? Our research aims to build on the emergent understanding of how collective action affects food systems adaptation and to inform decision-making at the regional and federal levels in Canada. It may be that building policy goals in accordance with collective action is one path to building resilience in the food system at the regional scale.

2 | MATERIALS AND METHODS

2.1 | Research area: The Maritime provinces of Canada

The Canadian Maritime provinces of New Brunswick, Nova Scotia and Prince Edward Island (hereafter referred to as 'the Maritimes') have historically seen their economies defined by agriculture (Beaulieu, 2015), though these have diversified in recent decades. A trend towards farm agglomeration has decreased the number of mid-sized farms, leaving distributions of farm sizes centered around small and large farms (see Figure 1). Consequently, and helped in part by a Canadian focus on agricultural exports (Statistics Canada, 2017), farms have developed market niches based on their scale, with small farms selling more locally and intersecting less frequently with large-scale grocery and export-related sales. We focused primarily on small-scale vegetable production.

Climate change is projected to have largely negative impacts for the region's food system. Though models do show projected gains in crop production due to increased availability of heat units, they also highlight higher rates of crop failures and disruptions in production, distribution and consumption due to sea level rise; more frequent extreme-weather events; and shifting pest populations and diseases (Arnold & Fenech, 2017; Rapaport, Starkman, & Towns, 2017; Savard, Proosdij, & O'Carroll, 2016). Farmers report events and trends which suggest that the above have already affected the land-based food system in the region (Soubry, 2017).

Provincial governments' climate action plans leave significant gaps in food systems adaptation planning and implementation. Areas of action related to agriculture are primarily concerned with reducing greenhouse gas (GHG) emissions caused by machinery, fertilizer use and tillage (NB Govt, 2013; NS Govt, 2009; PEI Department of Communities Land & Environment, 2018). Critics have accused certain government agriculture and land planners at the municipal and

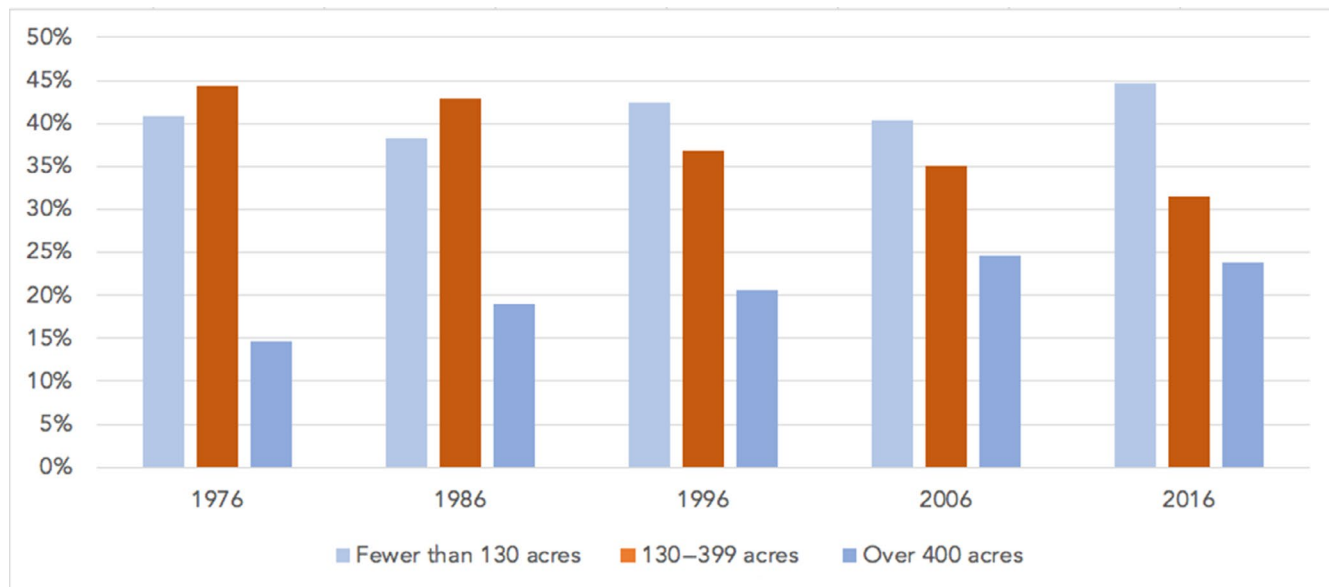


FIGURE 1 Proportion of total farms by size in the Maritime provinces, 1976–2016 (Statistics Canada, 2019)

regional levels of consistently misunderstanding the mechanics of climate change and the risks associated with its impacts in the region despite the information available to them (Fox & Daigle, 2012; Lieske, Roness, Phillips, & Fox, 2015; Wade & Robichaud, 2011). There exist few accountability processes or metrics to assess provincial governments' adaptation targets, which allow plans to be made without a system for evaluating their effectiveness (Auditors General of Canada, 2018). Finally, small-scale farmers in the Maritimes have a narrow relationship with government, either due to their ineligibility for support which is largely targeted at large-scale agriculture (Soubry, 2017) or a desire for independence and mistrust of government subsidy (Stock, Er, & Forney, 2014; Stock, Forney, Emery, & Wittman, 2014).

Reluctant though some may be to engage with government, farmers in the region have a history of cooperation and collective action in responding to economic and social disruptions (Burge, 1987; Coghlan & Brydon-Miller, 2014). The National Farmers' Union, formed in the 1960s and active in New Brunswick and Prince Edward Island, is a farmer-led organization which has catalysed collective responses to the industrialization of vegetable production (Burge, 1987; Desmarais & Wittman, 2014; McLaughlin, 1987; National Farmers Union, 2014). Nova Scotia, meanwhile, saw the rise of Antigonish Movement in the 1930s, which created a number of agricultural co-operatives to respond to rural economic decline (Coady, 1939); other provincial initiatives claim the movement as part of their ideological roots (Coghlan & Brydon-Miller, 2014; Macaulay, 2001; Macinnes, 1978; Sacouman,). All three Maritime provinces also have organizations member to the Canadian Federation of Agriculture: the Nova Scotia Federation of Agriculture, New Brunswick's Agricultural Alliance and the Prince Edward Island Federation of Agriculture (Canadian Federation of Agriculture, 2019). The Maritimes are therefore an interesting place to examine the capacity of collective action to generate change.

2.2 | Data collection and analysis

2.2.1 | Grounded theory methodology

We designed our research project according to constructivist grounded theory methodology (GTM; Birks & Mills, 2015; Charmaz, 2016; Glaser & Strauss, 1967). GTM aims to allow researchers to build theory without requiring preconceived theoretical frameworks to be imposed upon research (Birks & Mills, 2015; Glaser & Strauss, 1967). Within this frame, researchers are encouraged to structure data generation so that participants' experiences and concerns guide the research process (Dunne, 2011). We received clearance to proceed with interviews from the University of Oxford's Central University Research Ethics Committee.

2.2.2 | Data collection and analysis

Between 2016 and 2018, we conducted long-form interviews with small-scale farmers; retailers; government officials; and civil society actors across the Maritimes ($n = 60$). Interviews took place in French or in English, depending on which language was preferred. Interviewees were selected through advertisements in regional agricultural organization newsletters, as well as through random, anonymous sampling of farmer organization databases. Both led to an online form where participants could register their interest. We also directly contacted government offices and sought out interviews with relevant people. Additionally, snowball sampling techniques were particularly useful for meeting farmers in the region, given that some producers choose not to register their operations and are therefore untraceable in formal databases (see Chromy, 2011). The respondents were distributed across agricultural land in the region (see Figure 2).

We primarily targeted small-scale vegetable producers as part of our sample. In framing our research, we hoped to capture a sample

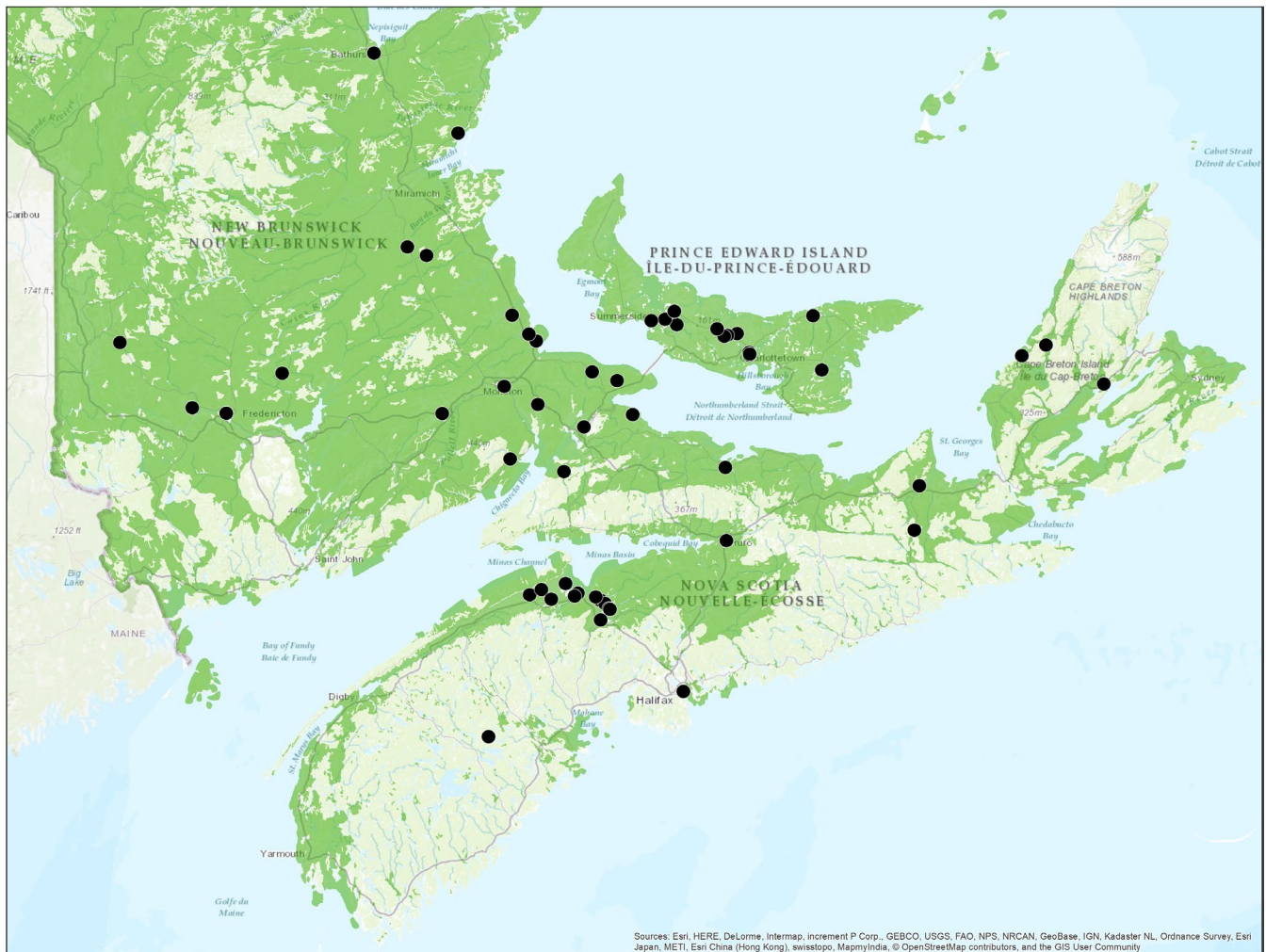


FIGURE 2 Respondents in relation to agricultural land capability. The shaded area represents available arable land in the region; dots are interview sites. Our interviews do not span the whole region of study, but are representative of the areas available for farming

population where farmers sell within similar market streams, work under similar production stresses and have similar response capacities. Small-scale agriculture in the region is primarily vegetable-based (Statistics Canada, 2017); vegetable producers are more likely to belong to same-scale retail or distribution associations. BS, the lead author of this paper, was a farm worker and manager in the region between 2013 and 2016, and has a close relationship with the small-scale vegetable production community in the region. This connection enabled a more trusting researcher–participant relationship and allowed for conversations which might otherwise have been more reserved. For these reasons, small-scale production is a suitable and justifiable research population for the type of data generation which we wished to elicit: working with larger-scale producers would have required either an unsustainable amount of time to gain the same amount of trust, or else the use of quantitative research methods which, while descriptive, would have led to a less subtle interpretation of actors' relationships (Darnhofer, 2014). We also recognize that the question of what 'small-scale' represents is contentious, given that definitions vary both in size and metric (Bronson, Knezevic, & Clement, 2019; Cohn et al., 2017; van Vliet et al., 2015). The largest

area of active production we considered was 150 acres, which fits within the distribution of smaller farms in the region (see Figure 3).

Ethics for the study were approved by the University of Oxford's Central University Research Ethics Committee. When participants were first approached and communicated interest in being interviewed, they were presented with a written consent form which informed them of the potential risks of the research and assured them that their interviews would be anonymized. In situations when participants were unable to provide written consent, verbal consent was recorded.

We conducted semi-structured interviews ($n = 60$) during the spring and summer of 2016, as well as during the winter of 2017; interviews typically lasted an hour. Table 1 provides a breakdown of the types of actors we interviewed in each province.

Interviews with farmers covered the perceived impacts of environmental changes on crops and farm infrastructure; the adaptation of production methods or business plans; support received or given from farmers, government agencies, and other food system actors; and any other concerns the farmer considered important. Interviews with retailers and distributors involved describing the state of food distribution in the region; environmental or other risks to distribution; forms of



FIGURE 3 Desire line, Brighton, UK (Hulme, 2013)

TABLE 1 Interview respondents by region

	New Brunswick	Nova Scotia	Prince Edward Island
Farmers	11	19	9
Retail/ Distributor	2	4	1
Government	2	5	3
NGO	0	2	2
Total	15	30	15

support given or received by farmers or other distributors; and other concerns. Interviews with government officials also considered the impacts of environmental changes on the food system. They covered a department's relationship with farmers and farmer organizations; programmes and support which were offered to promote adaptation; and future plans for relationship-building and adaptation. On farms, we also undertook participant observation: most interviews took place in the context of a day's work on the farm, and the researcher performing the interview often worked side-by-side with the farmer while talking, recording on a field microphone. This exchange of work for information was essential to us in maintaining a sense of relational accountability (Wilson, 2008) between farmers and researchers. Work time is irreplaceable during the growing season: by providing skilled help, we meant to justly compensate farmers for their expertise and build a relationship of mutual respect and utility.

TABLE 2 Categories of collective action

Category of collective action	Definition and examples
Community-based	Included local groups; community or regional agriculture organizations not governed by farmers; non-farming neighbours and community members lending support and knowledge
Farmer-based	Farmers sharing infrastructure and informal peer-to-peer support; agriculture organizations governed by farmers
Market-based	Formal and informal marketing co-operatives; farmers' markets; food hubs and other distribution actors

After a period where participants could add additional comments or clarifications to their transcribed interview, we coded transcripts inductively according to constructivist GTM and noted emerging themes for analysis. This followed an inductive process, moving from axial coding of initial ideas to theoretical coding of a typology of collective action. Each round of coding proceeded from specific items to more general themes to potential theory (Birks & Mills, 2015; Urquhart, 2013), thereby building theory that was based entirely on interview participants' experiences rather than through existing literature (Suddaby, 2006). From the initial set of codes, we highlighted forms of collective action which clustered around common themes and generated a typology of collective action for the region. Collective action within the interview material could be

classified into three sections: community-based, farmer-based and market-based (see Table 2). Where examples are useful, and to convey local voices and expertise, we present transcripts from interviews below.

3 | RESULTS

Participants volunteered multiple categories of collective action that impacted both their individual farms and their relationship with other areas of the food system such as food distribution, storage, and sales.

3.1 | Types of collective action

We grouped expressions of collective action according to emerging categories and found that collective action in the region is rooted in surrounding communities; on farms; and within the markets where food is distributed and sold. A summary of these expressions is available in Table 3.

3.1.1 | Community-based

Community-based collective action refers to actions or institutions organized by non-farmer community members which support

small-scale vegetable production in the Maritimes. Many of these are informal associations, bound by support from neighbours and community. Farmers seek out advice and knowledge about local climate and soil conditions by community members from older generations. They also benefit from close neighbourly contact, receiving help in other specialized tasks such as veterinary medicine or farm tool repairs:

A family friend is our large animal vet, and we go over and watch hockey at their house, you know. Anytime anyone is sick or injured on a weekend I can call them and say, I've got this in my fridge, is this what I should be using? Or he'll come out in the middle of the night if we need him. [...] He gives really great advice in terms of livestock.

Farmer, New Brunswick (NB-013)

A lot of our knowledge on the historical climate trends or weather events has come from other people that we are asking those questions to. Our first-hand experience is really limited, still, and the two growing seasons that we've had here have been very different from each other.

Farmer, Nova Scotia (NS-024)

One informal expression of community-based collective action was a regional seed-breeding group which seeks to isolate locally adapted,

TABLE 3 Categories and expressions of collective action

Category	Expression	Definition and examples
Community-based	Community food advocacy groups	Organizations which engage food policy at the local and community levels and dialogue with policymakers and government
	Seed-saving groups	Community groups breeding and producing locally adaptive and resilient varieties
	Community or regional agriculture organizations	Organizations led by non-farmers which work with producers to develop marketing, promote peer-to-peer knowledge-sharing, facilitate infrastructure sharing and provide access to government support
	Neighbour and community support	People who are physically proximate to farms and who form networks of practical support (helping with large farm tasks; specialist services such as electrical work; etc.)
	Knowledge-sharing from neighbours	Neighbours around farms who provide local historical knowledge of climate conditions, soil conditions, etc.
Farm-based	Peer-to-peer knowledge-sharing	Farmers sharing knowledge amongst themselves re: practices, new technologies, etc.
	Customer-sharing	Farmers redirecting customers to other small producers if demand exceeds supply
	Equipment/infrastructure sharing	Farmers sharing equipment or infrastructure (e.g. storage) with each other to avoid additional costs
	Farming organizations	Farmer-governed organizations which lobby government with a unified political voice, and provide a support network for beginning farmers
Market-based	Formal co-operatives	Regional co-operatives made up of farmers which provide multiple support streams, including marketing; advertising; extension; etc.
	Informal co-operatives	Individual farms which have formal or informal collective selling agreements, exchange information and infrastructure and provide support in times of need
	Farmers' markets	Farmers who come together to independently start markets in communities, with the objective to create niche markets for products
	Distribution-based collaboration	Food hubs, which aggregate produce from multiple farms and redistribute to food-impooverished areas

resilient seed varieties for collective use, and therefore indirectly support small-scale agriculture.

Participants also noted the importance of community-led agriculture organizations, which aim to bridge gaps in government support for agriculture. These organizations often liaise with governance institutions such as Departments of Agriculture and extension agents on behalf of farmers.

The government has a great information package—I shouldn't say it's great; it's good. I think it needs another element. It tells you [that the agriculture industry is there] are there, but it doesn't necessarily tell you how to get into [it].

Q: So it provides information that still makes it necessary for an organization like SPADE [the Sunrise Partnership for Agricultural Development and Education, New Brunswick] to exist.

A: SPADE [helps] link the organizations that are doing that. There are 5 or 6 organizations that are all tackling little parts of that how to become a farmer chain, but there are still gaps.

Farmer, New Brunswick (NB-013)

3.1.2 | Farm-based

Farm-based collective action emerges through formal and informal interactions between farmers which aim to support on-farm production, financial resilience and knowledge in the community.

Respondents described some formal, regional, farmer-led non-governmental organizations that aim to build community between farmers and advocate on their behalf to government:

As a general farm voice, you have the Agricultural Alliance, the NFU [National Farmers' Union]. And government has been pretty receptive because [... they're] strong associations now compared to maybe how it was 10, 15 years ago. So the government will listen.

Government worker, New Brunswick (NB-011)

Networks within the farming community provide support on farms and between farmers by sharing knowledge about useful practices and techniques.

It's hard during the season, but in the winter, [farmers in the region] always try to get together and talk about what systems have been working or not, what the problems are. [Others are] very helpful for that kind of discussion too. I've definitely found the community here to be helpful and welcoming.

Farmer, Nova Scotia (NS-019)

Farmers also share infrastructure such as equipment and storage space; this pooling of resources helps reduce overhead costs on individual farms. These collaborations also make it possible to use certain types of equipment which would otherwise have been too expensive or complicated to be worth the investment, given the comparatively low volume of production for small farms.

We don't have a round baler, so we pay someone to come in and do our baling. We didn't used to have a hay-mower, we now share one with the neighbor [...]. We find it cheaper than having our own baler [...] We don't have to own all this equipment, [...] we couldn't justify owning it for the small volumes that we're doing. Those are efficiencies that we have.

Farmer, Nova Scotia (NS-013)

For smaller-scale producers in the Maritimes, the demand for product occasionally outweighs the capacity to supply it. Some farmers spoke about sending customers to other small farmers in the region, rather than turning potential buyers away entirely, in order to keep the demand in the region.

Often the biggest issue is that we don't have enough of what people want. [...] Usually people around here are really good at saying, I don't have any piglets, go talk to this person. We'll pass around our customers to other people.

Farmer, New Brunswick (NB-013)

3.1.3 | Market-based collective action

Market-based collective action refers to actions taken by farmers, distributors and retailers to improve or stabilize their market streams. These include forming formal or informal co-operatives; creating or gaining control of farmers' markets; and creating collaborative distribution hubs (also known as food hubs). They are distinct from community- or farm-based collective action in that they specifically focus on increasing income or financial stability for those involved.

Formal market-based collective action is principally organized around marketing co-operatives, which are led by farmers and aim to pool resources, improve farms' profitability and better manage the market for local producers. Co-operatives are often highly diversified: the largest regional co-op in our sample was formed as a horticultural co-op but has now expanded to include farmer's market, as well as controlling several advertising streams for the region. Informal co-operatives, on the other hand, exist as non-incorporated alliances of farmers who work together at market, selling collaboratively to increase their table presence and attract more customers than they would alone.

Farmers spoke of the financial and social benefits that co-operatives have provided for their farms. They found that going to market as a co-op is financially beneficial to everyone involved: it

creates a 'catch-all' market for surplus produce and frees up capacity by reducing the time each farmer had to spend at market.

Last year, at [the market], we would just have brought strawberries. We would have made [...] \$1200 last year. But we decided to bring vegetables and all, and officially integrated that cooperation by incorporating as a co-operative with three other farms, what did it bring us? \$5000 in vegetables plus \$1200, \$1300 in strawberries. That's a substantial gain for a first year. And it happened without us really planning for it. We hadn't planted with going to [that market] in mind.

Farmer, New Brunswick (NB-001)

Participants also identified co-ops as opportunities for cross-scale collaboration. One mid-scale apple producer took on packaging responsibilities for a number of smaller-scale producers, allowing apples to be sold to regional grocery stores which would otherwise have been out of the reach of small-scale producers:

One of the producers [...] said, we're ready to take the risk and be the aggregator, so they invested in a packing line. [...] [the producer] takes everybody's apples in the region and is able to offer Sobey's [a grocery store chain in the region] the price and the quantity that they need for their market. [...] [A smaller orchard] sells its apples to [the larger orchard], which bags them and sells them to Sobey's. Which means that those two [could collaborate]—[the smaller orchard] said, the [financial burden of the] packing line doesn't interest us, but it [is] a service [we] need. With the co-operative that makes sure that networking is strong and that those kinds of people can get together... the co-operative didn't do anything except just be there.

Co-operative executive director, New Brunswick (NB-010)

Co-operatives also create a network of producers and distributors who can share knowledge and provide support in times of need.

Because of my [health concerns], I have been relieved of market duty. This is another benefit of the Co-op, that we help each other out if somebody is having a bad year—the co-op can kind of come together to be there [and support them financially or with extra labour]. And then hopefully next year I can be more organised and do my bit.

Farmer, New Brunswick (NB-005)

Opportunities have emerged for provincial governments to collaborate directly with co-operatives in the Maritimes: in one particularly successful instance, the government of New Brunswick took over a programme offered by a regional co-operative whereby farmers had hired a pest specialist to inspect members' orchards, making the service available to all fruit growers in the area.

I know that at the Ministry of Agriculture, the co-op is well-seen, and often used as an example, a source of inspiration for their own programmes, officially or no [...] [The government] was like, [the pest specialist service is one] we want to offer, and the co-op said, OK, take it. We don't need to run it to survive. The objective is for farms to keep going.

Co-operative executive director, New Brunswick (NB-010)

Other forms of market-based collective action include the creation and control of farmers' markets, whether through co-ops or other means; building distribution networks which work exclusively within the small-scale production niche; and the creation of food hubs, which aggregate produce from local or regional farmers for regional sale. All of these multi-scale institutions were perceived as providing additional security in sales for producers by creating a diversity of markets which might accept produce with a higher degree of flexibility than contracts to commercial sellers.

Back in the day, where they would do apple co-ops [...] there is a reason why they did that: because in masses, they were able to compete together with larger companies [...]. I think that, as market farms, rather than competing with one another, working collaboratively, [...] still having your own kind of thing, but together—I think we can actually go further forward faster and meet a demand [more easily].

Farmer, Prince Edward Island (PEI-005)

3.2 | Impacts of collective action

Many participants suggested that collective action provides systemic benefits beyond the support of individual farm operations.

Co-operatives, collaborative selling and sharing customers all contribute to the creation and maintenance of niches in the market—subsets of the market especially suited to small-scale producers. As well as facilitating a stable space in the market, niches encourage producers to collaborate in distribution and to unite politically in the face of a globalized food system.

In the big scheme of providing food, you have to find your own small place. And you can't change things, because [your strength comes from] how you decide where you fit.

Farmer, New Brunswick (NB-002)

Participants noted that networks, peer support and regional agricultural organizations help build communal knowledge and reduce on-farm overhead costs by generating possible collaborations between farmers. Farmers highlighted the importance of building knowledge in the community to disseminate ideas and help innovate farm practices, given the lack of capacity of some government departments to provide agricultural extension support. In particular, farmers noted that these relationships increased the diversity of crops and infrastructure

on farms, as well as in the number of markets they accessed for produce sales. Infrastructure changes allow producers to build efficiencies into the farm system. Sharing knowledge, equipment and storage infrastructure reduces individual farm overhead costs. Selling at multiple markets, meanwhile, provides a financial safety net in case of economic shocks.

I want to diversify markets because that's more resilient, safer, and more stable, but that takes time and that takes energy. So then you go back to the co-op model. We kind of get the best of both worlds. [...] Diversity of markets means that if something goes under, something goes wrong, [...], then you have other markets to fall back on.

Farmer, New Brunswick (NB-005)

Cooperation also gave a more general hope for success, no matter what future emerges. As the same farmer succinctly put it:

If we can do that—if we can find like-minded people who share vision and [...] work together in whatever capacity [we] can, then I think we can kind of get through almost anything.

Farmer, New Brunswick (NB-005)

3.3 | Relating collective action to climate resilience

Participants described ways in which the systems-level impacts of collective action may help farms and the broader food system increase their capacity to adapt to climate change. They drew connections between financial adaptability and a farm's capacity to respond to future shocks, including those brought on by climate change.

For me, building a financially viable business that has flexibility in it is also part of that because then I can grow and shrink as I have to. I don't know how [the future] will play out. I feel like I have to keep that flexibility. And I think that's part of mitigating for climate change too.

Farmer, Nova Scotia (NS-019)

For some, maintaining financial resilience is an important facet of sustaining relative independence in a future where government funding may not be as accessible.

Even as we need more support from government, I think that maybe there's going to be less just because the pot is going to be shrinking and it's going to be spent more in terms of disaster response. Part of resilience for a farm means having a certain amount of economic independence.

Farmer, Nova Scotia (NS-016)

Participants were also quick to point out the importance of a supportive network of practitioners and community members in mitigating risk, increasing collective knowledge in the farming community and providing help in a crisis. They noted that co-operatives and other organizations are a useful source of human and social capital.

Having a supportive community is key to helping you get through any kind of crisis that you're going to face on the farm.

Farmer, Nova Scotia (NS-019)

I think that, for me, in any change, whether it be climate change, or in markets, in society [...] one of the most important things is that people can get together to face challenges that those changes bring. The role of the [co-op] in those situations is important, because it's like the glue that keeps people together to go further, to take the next step... [The co-op] is the gel that keeps all those small-scale players independent, but in collaboration.

Co-operative executive director, New Brunswick (NB-010)

Many forms of collective action in the region also interact with governance institutions. Regional organizations, community advocacy groups and farmers' organizations were all mentioned as important advocates for farmers with governments. Farmers often suggested that the time-intensive nature of their work prevents them from engaging in extensive government consultation; collaborative organizations were reported as useful because they let farmers share concerns and present a united voice on issues without requiring farmers' constant presence. Participants mentioned that certain ideas or projects which had originated in collective action settings were taken on by government once they had proven viable:

[The distribution hub] first [...] started around a roundtable discussion, back in January 2017 where there was government, there was [a major caterer] at the table, there were farmers, there was [...] a diverse mix of [community food organizations], the Farmers' Union; they were all at the table and they said [...] they needed something to connect the dots for logistics, for distribution, for aggregation, for storage. So [our organization] was developed, and funding was secured in August from [the larger cooperative in south-eastern New Brunswick and the provincial government].

Co-operative executive director, New Brunswick (NB-016)

4 | DISCUSSION

We set out to examine how collective action emerges in land-based food systems, how it affects the resilience of food system actors and how it can contribute to the broader goals of climate change

adaptation for the food system. Our data suggest that collective action can emerge from seemingly heterogeneous groups in the food system due to the existence of a community of shared concern, and build adaptive capacity and resilience in both individual farms and the food system more generally.

4.1 | Heterogeneous groups, shared concerns

The actors who participated in our study come from heterogeneous backgrounds, and the collective action we noted emerges from three overlapping but separate areas—farms, communities and markets. Their interests are varied and sometimes contradictory. Farmers, for example, want to sell at as high a price as feasible, while retailers and distributors want to buy at lower prices. Following Olson (1971)'s initial expression of collective action theory would suggest that such a group might find it difficult for actors to coordinate in order to serve everybody's interests; this 'group size paradox' remains a central strain of collective action theory (Pecorino, 2015).

Our results go counter to the logic of classical collective action theory: farmers across the Maritimes are coordinating with distributors in order to maintain a share of the market. Meanwhile, consumers and civil society are collaborating with farmers in order to ensure succession of the profession and access to a specific quality and sourcing of food, rather than simply accepting lower food prices from a global marketplace. What motivates food system actors to lay aside self-interest for the sake of a common goal?

One explanation may lie in the existence of a community of shared concern for agricultural resilience in the Maritime food system. Pelling (2011) develops the concept of *shadow community* as a natural, informal unit of adaptive action which unites actors with shared concerns and values. These communities transcend formal organizational boundaries; they are based in trust, shared concern and ongoing engagement. Our study's participants often spoke of being united against larger forces—in some cases, climate change; in other cases, globalized market forces. They share both financial interests (maintaining solvency) and non-economic concerns (continuing to farm at the same scale, using certain practices). They ascribe value to spaces where they can speak informally with their peers. Moreover, many of the forms of collective action in which they participate are informal, and require mutual trust and reciprocity in order to be maintained. Anecdotally, it is clear to us—as former farm workers and embedded regional researchers—that the Maritime farming community is as well-connected as it may be geographically disparate: reputation, trust and a shared sense of community are essential to the maintenance of knowledge and aid networks among producers, retailers and other food system actors. During data collection, some farmers and even government officials were initially reluctant to participate in an interview until the researcher had explained that they had previously worked for half a decade as a farm worker and had roots in the farming community

across the Maritimes region. Without the close social networks to support them, adaptive processes in the region would be difficult, if not impossible.

The fact that co-operatives, knowledge-sharing, and producer support all aim to build resilience in the food system speaks to the social nature of community resilience. It resonates with the suggestion within resilience theory that both social-ecological systems and social psychology are at work in self-organizing for strong community resilience (Berkes & Ross, 2013). Following Darnhofer et al. (2016), our data also suggest that resilience in the land-based food system is built on the relationships which connect individuals, institutions and ecological systems, rather than exclusively on mechanistic understandings of farm components such as soil health or irrigation infrastructure. Our insights lend weight to Ostrom (2000, 2010b)'s response to classical collective action theory: individuals *can* be willing to coordinate and achieve the benefits of collective action so long as there exists a sufficient platform of reputation, trust and reciprocity. Though the actors in our participant sample are diverse, they all value the local small-farm based food system's continued existence; thus, the unifying driver of collective action.

4.2 | How does collective action affect food system actors?

Our data show immediate benefits of collective action for small-scale producers and distributors, as well as higher-level impacts which map closely onto the drivers of resilience and adaptive capacity to regional environmental change.

Figure 4 represents the flow of impacts and interactions between different forms of collective action in the Maritime food system described here. Producers noted that collective action is often immediately beneficial to them: for example, sharing infrastructure can reduce overhead costs on-farm and increase sales, which improves a farm's financial stability. Having spaces where farmers can confer, such as regional farming organization meetings, creates a supportive community through which farmers can exchange knowledge; provide support; and vent frustrations. These spaces become communities of practice, exchange and regulation which can help individual farms and farmers during a crisis.

These effects are beneficial, but they also point to more sustained and complex impacts. In the case of the Maritime food system, the immediate impacts of collective action (higher sales for farmers; increased diversity; a unified voice for farmers at a provincial, regional or federal level) directly affect food system processes—namely, the creation and stabilization of market niches; mitigation of on-farm risks and vulnerability; recognition and legitimacy in the eyes of government; and a strengthened community of knowledge and practice.

How do these structures mitigate climate-related risks for the food system? The cumulative impacts of collective action in the

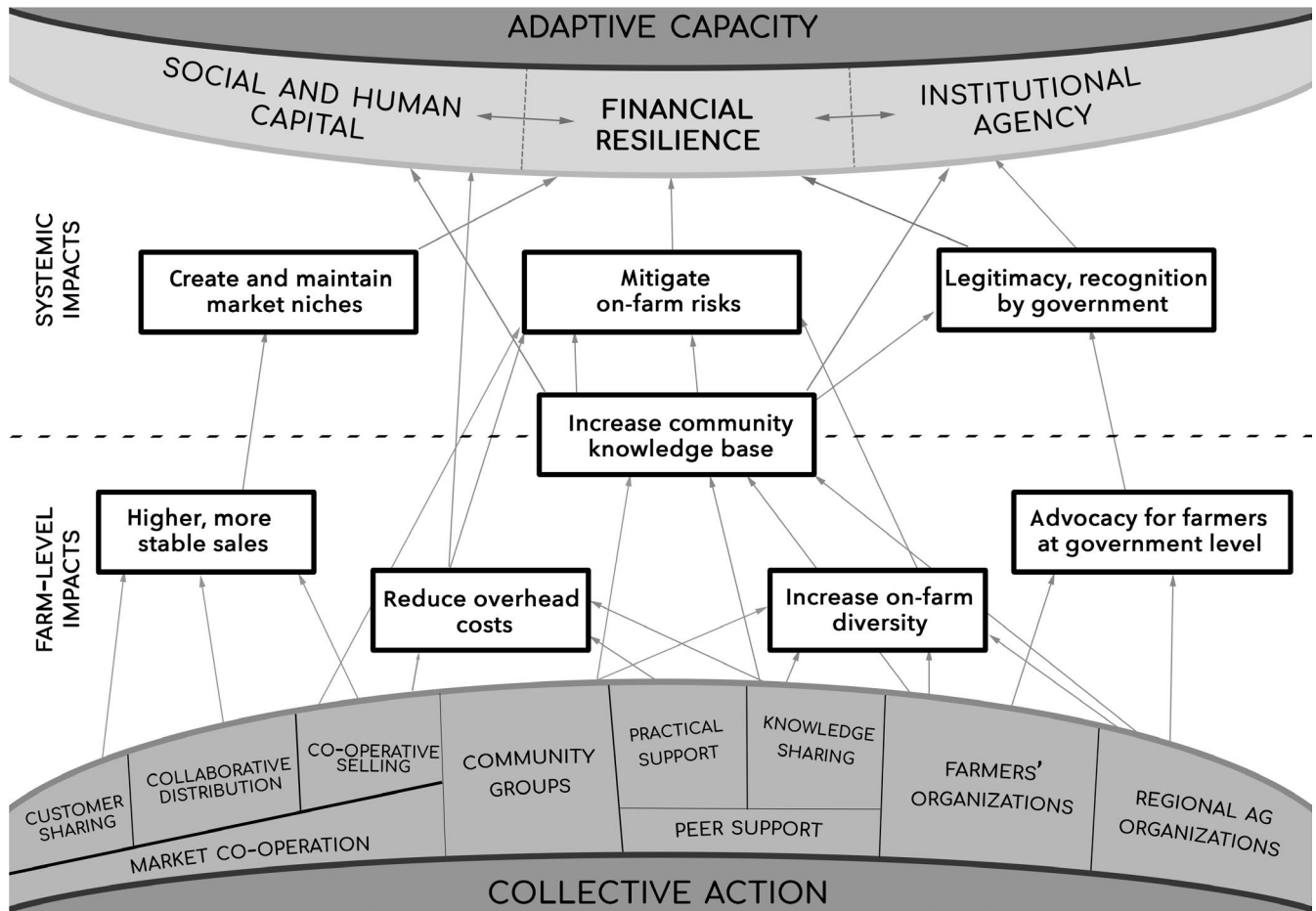


FIGURE 4 Collective action can build adaptive capacity in the food system

Maritimes' land-based food system map closely onto the established drivers of adaptive capacity that are required for successful resilience to climate shocks and adaptation to climate change. Adaptive capacity in systems relies on social, human and financial capital (Adger, 2003; Christmann et al., 2015; Paul, Weinthal, Bellemare, & Jeuland, 2016), as well as sufficient institutional agency between actors and governance structures (Adger et al., 2011; Clapp & Scott, 2018; Delaney, Chesterman, Crane, Tamás, & Ericksen, 2014; van Bers et al., 2016). Social and human capital in the region are built and maintained through socialized learning, informal discussions and networks of reciprocity and trust (Adger, 2003; Wynne-Jones, 2017), as well as by creating spaces for deliberation and organization. The latter is facilitated by co-operatives and food hubs: while neither types of organization we interviewed specifically identified as 'bridging organizations', they fulfil similar functions as those explored by Berkes (2009) in that they provide spaces for otherwise disparate actors to evolve within institutional structures. Financial resilience for small-scale producers in the Maritimes emerges because shared markets and stabilized niches buffer enterprises from larger global forces, and because farmer networks create opportunities to reduce overhead costs and outsource otherwise expensive distribution networks—a finding which reinforces the social nature of financial

resilience as well as its economic basis (McManus et al., 2012). Institutional agency, meanwhile, comes out of the initial community of shared concern (Pelling, 2011) around the livelihoods and culture of farmers, distributors and civil society in a small-scale land-based food system in the Maritimes; solidifies into formal or informal institutions such as regional co-operatives; and creates the possibility for dialogue between provincial governance and a heterogeneous group of producers and distributors where none was before.

Collective action in the Maritimes land-based food system may act as a 'meta-driver' of adaptive capacity to climate change: although none of the actions we noted stem from direct or exclusive concerns about the impacts of climatic instability, their communal and cumulative impacts create the kinds of conditions which will enable the system to adapt to a variety of shocks. Though farmers are concerned about the impacts of climate change, these worries can fade into the background when more pressing destabilizing factors emerge: international markets, supply chains and labour and succession issues remain urgent and take up a farmer's capacity to plan ahead. Collective action as we document it provides an avenue to address a variety of shocks; farmers can choose to buy into collective action for economic purposes and find benefits that ultimately help them shrug off climate shocks. The

multi-purpose nature of collective action is its strength: adaptation, after all, is more likely to fail if it is limited to singular objectives such as mitigating impacts on production, rather than if it attempts to generate resilience and adaptive capacity across a system (IPCC, 2018a).

4.3 | Policy implications of collective action

As we noted above, there are already concerns about top-down adaptation policy for agriculture, whether in the Maritimes or elsewhere (Ayer, 1997; Ostrom, 2010a; Soubry, 2017). Creating food adaptation policy in Canada typically involves a period of consultation where farmers and other food systems actors are asked to provide opinions, which are synthesized into policy recommendations (House of Commons of Canada, 2018; Senate of Canada, 2018). Yet these processes can often be biased towards those who have the time, inclination and financial capacity to act as witnesses. Governments have a tendency of accepting suggestions at a surface level while maintaining the status quo—in the case of Canada, a neoliberally minded, export-based market economy—in agriculture and food systems rather than moving towards any radical or even necessary changes (Beilin, Sysak, & Hill, 2012; Laforge, Anderson, & McLachlan, 2017).

Farmers can be reluctant to adopt suggestions from governments they mistrust or apply for grants that add to their administrative burdens (Soubry, 2017; Stock, Er, et al., 2014). Laforge et al. point out that government processes often ‘reinforce unequal power relations by restricting (containing), often through the direct enforcement of limitations through regulations, or diluting (co-opting) emerging grassroots alternatives through technologies of governmentality’ (2017, p. 674). Co-opting can be particularly damaging to collective action when governments support programmes which pursue dominant trajectories rather than more transformative approaches (Laforge et al., 2017). Moreover, governments are notoriously, dangerously slow to action, considering the rate at which impacts of climate change are affecting livelihoods (IPCC, 2018a). Waiting for top-down adaptation policy to be filtered through the levels of governance, industry and local implementation maximizes climate risks for everyone involved, especially vulnerable populations such as rural workers (Hallegatte et al., 2016; Ostrom, 2014). Considering the present paucity of adaptation policy in the Maritimes, how can collective action play into the creation of successful adaptation strategies for the food system?

We could consider expressions of collective action from farmers and food system actors as endogenous adaptation techniques, or *desire lines*, for food systems adaptation. Desire lines, we mentioned above, emerge out of a reaction to an imposed environment: they are the ‘manifestation of a common will’, a straightforward path through a landscape otherwise difficult to penetrate. In their most successful cases, the adaptation is adopted by planners and designers: mud paths are paved, clearing the way for a

greater number of (satisfied) users (see Figure 5). The concept need not be restricted to architecture and urban planning: Smith and Walters suggest that ‘expanding [the concept] from its current limited scope is a useful tool for imagining how dominant forms of exclusion and social control in public spaces might be resisted’.

Under what conditions do desire lines morph into collection action and, ultimately, policy response? Perhaps the most straightforward path requires a clear need from the grassroots to be met with open attention from institutions. In one particularly successful example discussed above (Section 3.1.3), the provincial government took on a pest management programme which had originally been created a farmer marketing co-operative to reduce specialist costs. This adoption was able to occur because it was mutually beneficial to both parties: on the farmers’ side, the service was clearly needed, useful and government adoption freed up the co-operative’s capacity; on the government side, there was no need to worry whether the programme would be adopted by producers, and no effort to be spent creating and testing the service. The collective design of the programme sidestepped the potential problem of government co-opting a service.

Collective action—much like an ideal form of good adaptation policy—emerges because it is needed; is adopted because a shared community of concern is willing to support it; and is sustained because it is effective. In contrast to the high-risk approach of top-down adaptation, and following Thorn, Thornton, and Helfgott (2015) and Mersha and van Laerhoven (2018), we suggest framing collective action as a desire line which reveals already successful, effective and accepted endogenous adaptation. Building adaptation policy with the innate needs and expertise of practitioners as a starting point, rather than with top-down guidance, could help create programmes which are immediately effective; enhance the adoption of any initiatives promoted towards farmers; and free up capacity in both the production community and in governance institutions to consider longer-term goals. This path has been taken up in other disciplines and fora, which have highlighted that supporting existing autonomous adaptation can be effective first-order policy when compared to top-down or planned adaptation (Ford, 2008; Pearce et al., 2015; Thornton & Manasfi, 2011). By following the desire lines of collective action rather than the planned path of policy, food system actors are already sending clear signals to policymakers about their needs and what methods might be most effective to address them; what remains is perhaps to develop the capacity of policymakers to take note.

We do not mean to suggest that collective action is a panacea to ineffective adaptation policy, nor that it is sufficient in all situations. Here, we describe how food system actors can support each other in short-term situations and urgent problems; but how can local-level collective action react when faced with the much larger project of transforming a food system into one which can adapt to climate change? Inevitably, there are limits to what collective action can achieve. Collective work is not always constructive; social capital, for example, can occasionally contribute to conflict or conservatism



FIGURE 5 Ohio State University walkways adapted from desire paths (Reddit, 2019)

within groups by identifying 'leader' organizations at the expense of other sub-groups (Bauermeister, 2016; Crespo, Réquier-Desjardins, & Vicente, 2014; Paul et al., 2016).

It may be that collective action is an effective, important tool in a broader ecosystem of adaptation governance, especially with regard to climate change. Ostrom describes these polycentric systems in the context of climate change as 'multiple governing authorities at differing scales rather than a monocentric unit' (Ostrom, 2010a, p. 552). Participants in a polycentric system can use the localized

knowledge and experience of collective action to mobilize significant resources from larger institutions, allowing investments to be directed towards knowledge-sharing, innovation and resource mobilization (Ostrom, 2010a, 2010b). Collective action in the region may only be truly effective when paired with broader institutional support, lending a polycentric dimension to food systems adaptation to climate change.

Though there is a clear place for government to show initiative in supporting some endogenous adaptation practices which have

emerged through collective action, we should remember that many of the actions have emerged from informal communities, and often in response to government failures. Further research may illuminate the place of governance institutions in supporting informal action. What is the place of government in recognizing collective action if that action emerges in spite of a governing body? How can governing institutions support climate adaptation without accidentally or intentionally co-opting or corrupting collective action to their own agendas, as Laforge et al. (2017) point out?

5 | CONCLUSIONS

We set out to understand how collective action emerges in the land-based food system, how it affects food systems actors and whether it can contribute to the broader goal of food systems adaptation to climate change, especially in a policy leadership vacuum. We found that collective action in the Maritime provinces of Eastern Canada emerges along three dimensions: communities, farms and markets. The participants we interviewed described the individual benefits of collective action processes in the region as well as their cumulative, more complex effects on the food system's stability. Our case study suggests that collective action emerges through heterogeneous communities of shared concern, and that it can help build adaptive capacity and resilience in land-based food systems.

We propose that sustained expressions of collective action be considered as desire lines for successful food systems adaptation policy: they act as signals indicating a useful, communally generated strategy to respond to multiple stressors. Considering that much adaptation policy remains top-down—a high-risk strategy—collective action can present systems which are already enthusiastically adopted by their participants; are necessarily effective at multiple levels; and reach across industries and concerns to solve challenges not solely related to climate change. Our results support government policymakers who seek to support food systems adaptation through policy that is both highly effective and adopted by practitioners. The research also deepens inquiries in food systems and adaptation research concerning the effectiveness of collective action in building sustainable climate adaptation practices.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHORS' CONTRIBUTIONS

B.S., K.S. and T.F.T. conceived the ideas and designed methodology; B.S. collected and analysed the data and led the writing of the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

DATA AVAILABILITY STATEMENT

In order to preserve participants' anonymity, transcribed interviews are stored on encrypted hard drives, and have not been made publicly available. If you would like to obtain data from this study, please contact the corresponding author.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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