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Community-Led Adaptation, Weather Extremes, and Health and Wellbeing

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ABSTRACT

Community-led action is of increasing interest for policy, local government, and the design of adaptation under a changing climate. Previous research has shown how community-led responses to climate impacts, such as flooding and heat, can be important in mitigating their ill health and wellbeing effects. But the evidence base on the character and nature of such actions by communities is at present scattered. In this paper, we review the international peer-reviewed evidence on the form, character, and challenges of community-led action for key climate-related risks facing many localities across world regions both now and in the future. We bring particular focus on the role that community-led responses play in supporting or mitigating health and wellbeing impacts, identifying common themes on their benefits in the face of climate-related risks, including: the use of localized knowledge for both planning and recovery from events; their importance for identifying and supporting vulnerable people; and the relevance of community-led action for advancing generalized resilience. We conclude that greater value could be placed on the unique knowledge, decision making, innovation, flexibility, and opportunities that community-led adaptation offers.

This article is categorized under:

Vulnerability and Adaptation to Climate Change > Institutions for Adaptation

Vulnerability and Adaptation to Climate Change > Values-Based Approach to Vulnerability and Adaptation

1 | Introduction

Human-induced climate change in most world regions increases the frequency and intensity of extreme weather events such as floods and heatwaves, with severe consequences for health and wellbeing (Hanlon et al. 2021). Alongside these increasing risks, cold is projected to persist throughout this century, continuing to pose severe risks to human health for communities globally (Curtis et al. 2017; Chalabi et al. 2016; Masselot et al. 2023; Ritchie 2024). We focus on these three weather risks—heat, flood, cold—as some of the more prominent weather risks faced around the world that have severe consequences for health and wellbeing (Ahern et al. 2005; Champagne et al. 2023; Ebi et al. 2021; Khavandi et al. 2024; Masselot et al. 2023; Milojevic et al. 2011). Though climate-change impact related health risks are commonly managed through formal, institution-led planning and response processes, bottom-up community-led actions are recognized as playing an increasingly important role (Climate Change Committee 2024; IFRC 2025; Mees et al. 2014; Rahman et al. 2023; UK Health Security Agency 2024;

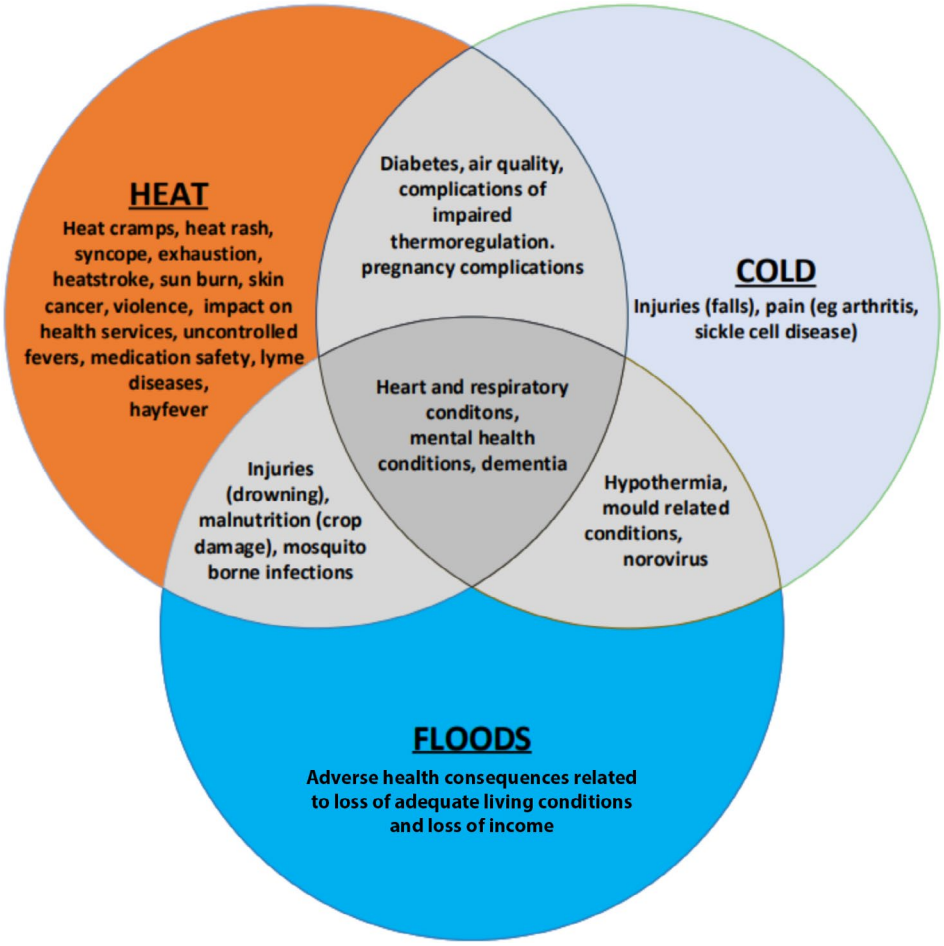

FIGURE 1 | Health consequences of flood, heat and cold weather extremes.

WHO 2025), not least because institutional fragmentation in governance arrangements has been noted for creating difficulties in incorporating health concerns into broader climate planning (Shimamoto and McCormick 2017).

Existing research shows how community-led action holds important possibilities for supporting health and wellbeing in extreme weather events of heat, cold, and floods, with local actors performing diverse roles (Gilbert et al. 2025; Simon et al. 2020; Wickes et al. 2015). For example, Wolf et al. (2010) show that support provided by individual families and carers do not on their own lead to effective action in response to heatwave health risks amongst older people. They argue that community groups are needed to counteract embedded ideas about heat and provide a route for delivery of better-informed support and advice on how to sustain good health. For flood risk, community-led actions have been shown to act as an important 'buffer' that helps to sustain wellbeing after flood events (Walker-Springett et al. 2017), with an active sense of belonging and relational capital important elements of community resilience that can ameliorate impacts on mental health (Quinn et al. 2020).

For action on cold, research has demonstrated that providing advice and support through organizations embedded in the community can be effective in breaking down barriers encountered by top-down approaches, specifically accessing those most at risk, marginalized or unable to interact with more distant institutions (Ramsden 2020, Chard and Walker 2016). There is also evidence for how community-led interventions ameliorate risk through using local and lay knowledge in ways that support wellbeing (Barr and Woodley 2019; Lane et al. 2011). Overall, there is evidence that the wide-ranging social consequences of floods, heat, and cold for health and wellbeing (see Figure 1) can be mitigated or ameliorated by community-led action. Yet this current evidence is scattered with little understanding of the nature of such forms of community-led action and how it might differ or where similarities exist across different types of weather risks.

With this wider context, the review addresses key questions about the nature of community-led adaptation across flood, heat and cold and the benefits it has been found to offer for health and wellbeing. In this, we give focus to research that can be characterized as addressing *community-led* adaptation to weather extremes, defined as those adaptations initiated by and primarily led by communities themselves in their varied forms (from communities of locality to communities of shared interest). This reflects, in part, an effort to acknowledge the widespread recognition that much of what is reported as "community-based adaptation" is often initiated externally to communities themselves and can sometimes have limited community involvement in decision-making (Rahman et al. 2023; Vincent 2023). Bringing focus more specifically onto research that reports on actions primarily initiated and

led by communities narrows the scope for our review and means we exclude literature examining projects that merely involve communities in some way. This is not to ignore or diminish the importance of synergies between state and communities, which can be both practical and political, for example through providing physical space and resources for communities to act and deliberate together, and through enabling democratic participation in civil society (Evans 1996). Rather, we wish to give focus to a body of research that has yet to receive detailed attention amid the wide-ranging and amorphous work addressing community and climate.

In the following sections, we examine the existing evidence for what it indicates about the nature of community-led adaptation related to preparing or recovering from extreme heat, cold, and flood-related risks and its benefits for health and wellbeing. Addressing each risk in turn, we document the character and form of such community-led action before moving to a cross-cutting discussion focused on common themes that have arisen from the review reflecting on: (1) the role of localized knowledge for both planning and recovery from events; (2) how community-led action is important in identifying and supporting vulnerabilities contributing to the effectiveness of anticipatory planning; and (3) the ways that community-led action can be revealing for understanding synergies between social capital and generalized resilience. In our discussion, we address each of these themes before moving to consider issues and characteristics that enable or constrain community-led adaptation. In concluding, we reflect on the extent of the existing literature on community-led adaptation and suggest possibilities for future research gaps and priorities.

2 | Methods and Approach

The review here provides a cumulative, comparative, and integrative analysis of diverse studies of community-led action for floods, heat, and cold around the world. We focus on what the evidence base reveals about the benefits of such action for wider public health aims of preventing health impacts and supporting improved wellbeing outcomes through responses to heat, cold, and flooding. By invoking the concept of wellbeing, we adopt a broader category for understanding the healthiness of people, taking into account how interventions affect social, cultural, and economic factors that are known to shape outcomes for both physical and psychological health (White 2017).

The review process used a range of search methods for peer-reviewed academic articles to ensure breadth and depth of coverage combining initial expert judgment, a systematic search using reference databases, snowballing from reference lists, and expert-led identification of relevant papers drawing on the knowledge and experience of the team. Before beginning our searches, we conducted two exercises to generate an appropriate list of keywords to be used, one on health and extreme weather via analysis of peer-reviewed papers and the second on community-led adaptations to extreme weather via gray literature. Results of these exercises to create key words are presented below, with the health and extreme weather rapid review results depicted in Figure 1 above (Liddell and Morris 2010; Macintyre et al. 2023; Obeagu and Obeagu 2024; Quinn et al. 2023; Vallianou et al. 2021).

TABLE 1 | Examples of community extreme weather adaptation interventions and relevance for cold, heat, and flood risks.

	Examples of community response
Heat	*Community events:* Information campaigns, drinking water distribution, sunscreen distribution
	Community first aid: Cool spaces, first aiders, defibrillator networks, outdoor application apps for casualty location, wildfire fighting volunteers and equipment
	Drowning/cold water shock prevention: Open water swimming safety training and information, river level communications, water safety and equipment
	Nature-based solutions for cooling and shade: Green walls and roofs, tree planting, restoring peat bogs, beaver reintroduction
Cold	*Financial assistance:* Fuel vouchers, financial advice, advocacy. access to grants
	Warm clothing provision: Distribution of clothing, knitting campaigns
	Homeless support: Warm food, sleeping bags, tents
	Supervision: Checking in on vulnerable neighbors, grocery deliveries
	Shelter: Temporary accommodation, community warm spaces
	Home adaptations: Boiler repairs and installation, insulating properties
	Energy production: Community Energy
Floods	*Community action:* Placing temporary barriers, communications, rescue of people and pets, relocation, clean up and repairs
	Nature-based solutions: Peatland restoration, slowing the flow, beaver reintroduction, urban nature restoration
	Adaptations to homes: Installing Non-return drainpipes, levees and walls around properties, window and door flood barriers, raising plug sockets, catch basin outside property, airbrick covers.

The sources searched for examples of community-led adaptations to weather risks are listed in Box 1. From this exercise to derive key words for community-led action in response to the different weather risks, we developed a typology of intervention forms. Table 1 below shows documented types of community-led actions across flood, heat, and cold risk that were commonly reported. This shows that community-led action spans anticipatory action, advocacy with government and other stakeholders,

BOX 1 | Sources for Review of Non-Peer Reviewed Documented Community-Led Adaptations to Climate-Related Extreme Weather Events.

- UK and European government reports.
- UK national media—newspapers, TV, radio news.
- Community newsletters on these topics.
- Websites: Funders (e.g. for UK: National Lottery, Community Foundations), community organizations working on issues of heat, cold and floods.
- Social media: Snowballing via social media platforms by following these and allowing algorithms to suggest other relevant material.

and emergency response, where social networks come to the fore (Aldrich and Meyer 2015). Full details of this rapid review are available in a report (Cronin de Chavez et al. 2026).

This scoping work on both the health impacts of weather risks and the types of community-led action was then used to inform the development of search terms for our review of the academic peer-reviewed literature. For the systematic search, keyword searches were undertaken through PubMed, GreenFile and Google Scholar databases (see Supporting Information). Limits included Title and Abstract only of articles in English and Spanish, and the date range 2000–2024. The resulting 2160 abstracts were managed using Rayyan review software. 260 duplicates were removed and a further 1219 were excluded for lacking a link to climate adaptations and human health (Box 2). 681 abstracts were then double reviewed by two authors (Cronin de Chavez and Walker). Rayyan software was used in multiple ways to ensure rigor in the process including: (1) to see where agreement had been reached on papers to include or exclude; (2) to add notes to each record if needed; (3) to identify when discussion was required to decide jointly on a paper; and (4) to further refine the boundaries to find useful papers for our review.

Despite adopting a rigorous approach grounded in systemic review methods and informed by an extensive piece of analysis to determine search terms and snowballing from gray literature (Box 1), the review may still be partial. We excluded studies where community was used as a synonym for specific localities and where the research described action that was led and organized by local authorities, health services, and other state-led organizations (and hence not community-led by our definition) (Box 2). The selection from this first search yielded 55 articles. We then undertook expert elicitation within the team and wider networks as well as snowballing from the articles already identified, finding a further seven articles. The decision tree to guide selection is shown in Figure 2.

We then reviewed the full-text versions of these 62 articles to arrive at a subset of 32 key papers; 12 on community-led adaptations to cold, four on heat, and 16 on floods. A further four papers and one key piece of gray literature on heat were added during the review process, expanding to include studies that reported on less direct forms of community-led action for this risk because of the very low numbers found in our more restrictive search. A PRISMA diagram to show the results across the different stages of the search is shown in Figure 3 below.

The author team reviewed the remaining articles in detail creating summaries of the case studies, key arguments, and findings with focus on links to health and wellbeing (see Supporting Information S1). A thematic analysis was then conducted of these summaries and a consensus drawn within the team on the following themes: (a) *Types* of community-led adaptation—reactive, responsive and preventative adaptations; (b) *Character* of community-led adaptations; (c) *Role* of community members and their beliefs and knowledge; (d) *Forms of community collaboration* with other stakeholders, local authorities; and (e) *Duration and Timing* of adaptations. These codes were subsequently discussed amongst the project team through analysis meetings in which key messages and insights were developed.

In the following, we discuss the outcomes of the analysis structured around responses to the different weather risks—first discussing the evidence for community-led actions for heat, then cold, then floods. In this, we address what different studies reveal about the nature of community-led actions and how they shape health and wellbeing. Following our treatment of each risk (heat, cold, and floods), we move to a cross-cutting discussion reflecting on key themes and bringing further focus on what the literature reveals about the characteristics of community-led adaptation.

3 | Community-Led Adaptations for Health and Wellbeing Across Heat, Cold, and Flood

3.1 | Heat-Related Community-Led Adaptation

Extreme heat represents a direct threat to wellbeing and health for vulnerable populations—notably for elderly populations and in dense urban areas—and is expected to increase with climate change heightening these risks (Derakhshan et al. 2024; Stone et al. 2010). There are limited studies on community-led actions related to heat extremes. Only four papers met our selection criteria for community-led action on the direct impacts of heat. However, four further studies and one key piece of gray literature were added through expert elicitation and review processes. These tended to focus more on indirect forms of action, such as communities facilitating individual and behavioral shifts through promoting social networks. The total number of articles on heat included in the review was eight with one supplementary piece of gray literature.

The documented evidence on community-led action for heat reveals that interventions often have a largely *responsive* character, helping people to cope with and stay in good health during heatwaves. These actions include community volunteers in Japan visiting the homes of vulnerable residents to check on their safety and provide advice and support (Boeckmann 2016), and similar volunteer groups in South Australia (Williams et al. 2013). Within their broader

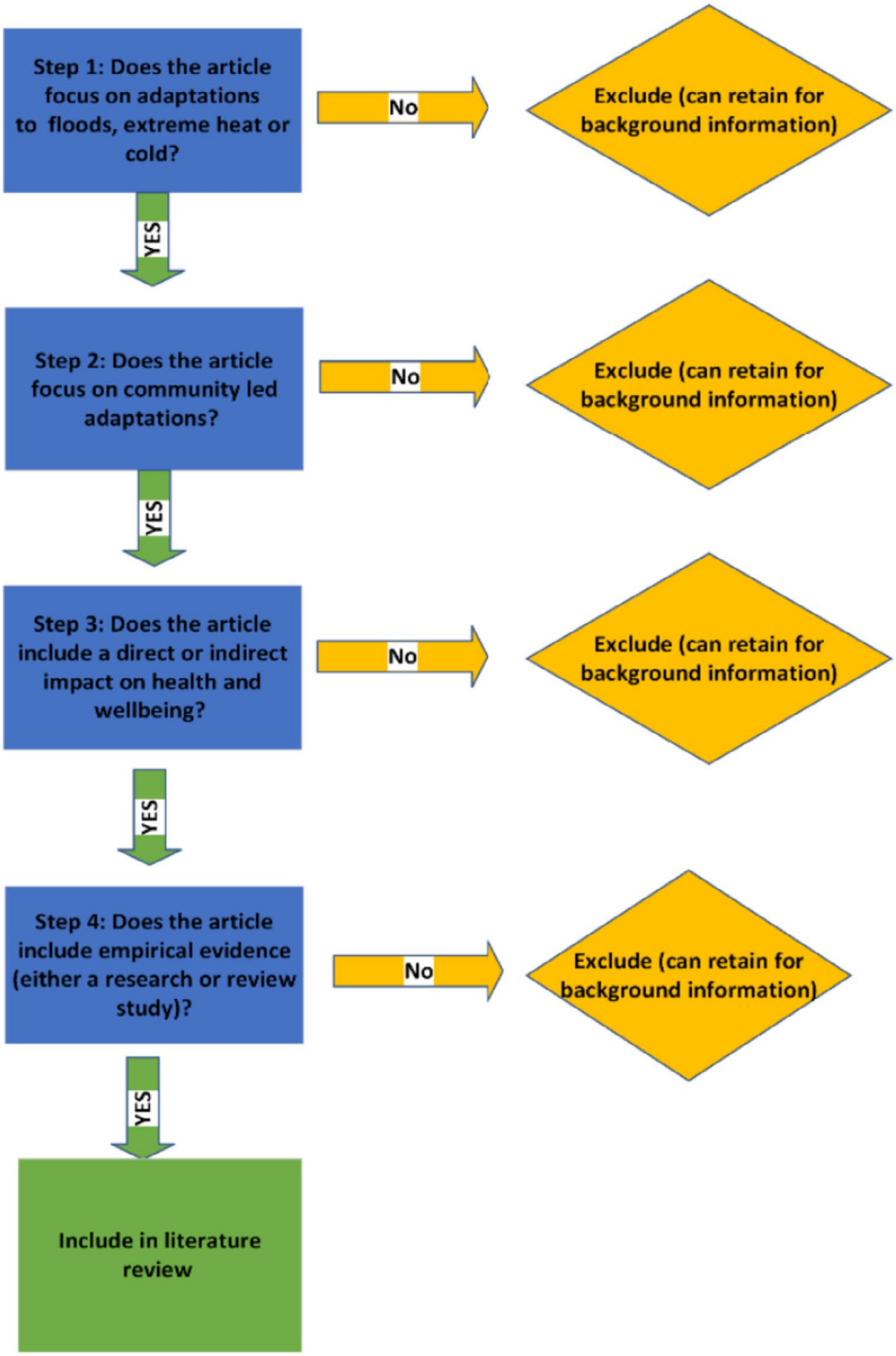

FIGURE 2 | Decision tree for included studies on community-led actions on heat, cold, and flood.

review of responses to heat risks in cities in the USA, White-Newsome et al. (2014) document several community-led schemes for heat adaptation. These include postal delivery workers alerting nearby community organizations when mail has not been picked up as a way of identifying people to be checked on for their health during a heatwave, and local community organizations undertaking outreach to homeless people who are particularly at risk from extreme heat. Whilst the responsive actions in these cases were enacted during heatwaves, they also entailed proactive pre-planning by communities to be ready and prepared to act effectively, with local non-governmental actors (including faith groups and local environmental groups) also involved in programs of public communication about heat risks. These forms of action had important implications for health and wellbeing by reducing the risks of serious negative health outcomes, particularly for those most vulnerable.

Community-led action that works to address the underlying factors that lead to health and wellbeing impacts from heat risks is less common within the documented examples we found, but Guardaro et al. (2020) offer an example of such

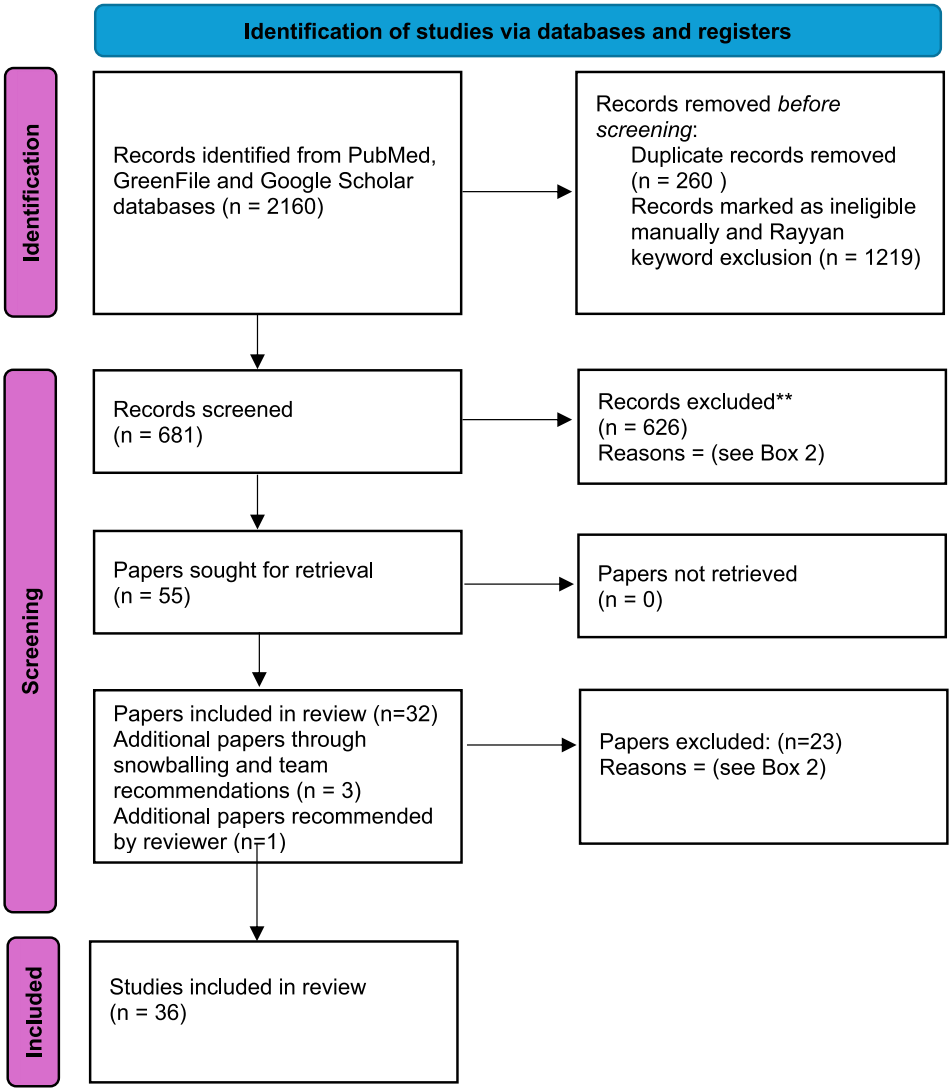

FIGURE 3 | PRISMA diagram of formal search process for community-led action on heat, colds, and flood risks. PRISMA template. *Source:* Page et al. (2021).

BOX 2 | Exclusion Criteria for Articles on Community-Led Adaptations to Heat, Cold, and Flood Risk.

- Opinion articles, conference abstracts, protocols
- Method studies: not empirical research or reviews
- Epidemiological prevalence and physiology studies
- Individual behavioral adaptations
- Tangential topics such as food culture, plastic pollution, built environment factors
- Studies on definitions of extreme weather or adaptations
- Vulnerability assessments: not adaptation
- Studies on biological adaptation of non-human life (marine life, fungi, bacteria, insects, plants)
- Non-relevant meanings of climate (e.g. social, cellular, political)

forms of response. They undertook action research to generate *proactive and preventative* community-led adaptation planning, including actions to reduce vulnerabilities. They piloted and evaluated a community engagement methodology in three of the "hottest and highest need" neighborhoods in Phoenix, USA. The aim was "to develop a methodology to engage hard-to-reach vulnerable populations to co-create locally contextual and culturally appropriate urban heat interventions to increase community resilience" (Guardaro et al. 2020). They developed an expert and local stakeholder co-designed action plan for improved resilience before and during heat events. Evaluating this process, they emphasized how its outcomes went beyond standard recommendations for adding more shade, cool roofs, and materials, to include more structural questions about how vulnerability was related to poverty and inequality. In this instance, then, community-led action played an important role in surfacing connections to wider underlying factors that shape heat vulnerabilities.

Across the documented assessments of community-led action for heat risk, it is explicitly or implicitly seen as having characteristics that can be beneficial in mitigating the health and wellbeing impacts of heat extremes. The local and situated knowledge that communities have about where they live and how best to communicate with and reach out to diverse populations is repeatedly emphasized as crucial for supporting health and wellbeing. In Phoenix, this included disseminating knowledge about how people traditionally manage living with heat in a desert environment and how inequalities in access to public services and infrastructure (such as drinking water and public cooling centers) are experienced (Guardaro et al. 2020). Communities are also seen to bring capacity in terms of the number of volunteers that can be mobilized during heatwaves, along with the social networks, trusted relationships and language skills that can break down barriers to providing health and wellbeing support, including encouraging residents to make use of designated cooling centers (White-Newsome et al. 2014).

Most instances of community-led action for heat in the papers we reviewed involved some form of collaboration with local government or government agencies, often in providing resources, coordination, or specialist expertise but sometimes going further to entail joint leadership. Across the many examples of urban heat adaptations in the US reviewed by White-Newsome et al. (2014) most were partnerships of some form; some were led primarily by city authorities or federal agencies, while others were led by community groups and NGOs. Though these forms of community-led response are shown to offer benefits for supporting health and wellbeing in the face of heat risks, Boeckmann (2016) sounds a note of caution. In his study in Japan, interviewees argued that if too much responsibility for health protection was pushed onto community organizations, this can become regressive and disempowering if it becomes a substitute for state action and is not properly funded or supported. Such critical analysis suggests an important need to balance responsibility and action between communities and governing institutions (Guardaro et al. 2020; Turek-Hankins et al. 2021).

While within the available literature the benefits of community-led action on heat are evident, the small number of instances of literature documenting and examining such forms of action suggests that there may remain a greater focus on individual action and responses planned and implemented through health agencies (Turek-Hankins et al. 2021). Some work suggests that community-led action is likely to have been diminished through ongoing forms of austerity along with the provision of public space (parks, swimming pools), negatively affecting preparedness for heat risks (Guardaro, Hondula, Ortiz, and Redman 2022). In their study of the Netherlands, Mees et al. (2014) propose that the absence of documented community-led heat actions may be partly to do with confused landscapes of responsibility for heat risk. These analyzes infer that there may simply be less community-led work in response to heat than other risk areas, offering a potential reason for the lack of literature documenting such work. More broadly, this lack of published evidence on the agency and decision-making of communities has been noted in global systematic reviews of heat adaptation. Turek-Hankins et al. (2021), for example, identify a bias in that adaptations documented in urban settings in the Global North tend to look at infrastructure type adaptations, where those in the Global South are more often about communities and individuals. They suggest, therefore, that the lack of literature may partly reflect wider challenges in documenting community-led adaptation owing to the barriers Global South communities find in participating in research and publication processes, such as requirements for ethical approval, publication costs, and other demands relating to academic conventions.

However, the limited documentation of community-led adaptations for heat in the peer-reviewed articles can be supplemented with reference to gray literature. Though we did not extend our review to include gray literature systematically, given the few academic published accounts found, it is worth reflecting on the evidence from one of the more significant reports addressing community responses to heat. The Adaptation Research Alliance's (2024) review of evidence and their subsequent publication the *Community-driven Heat Solutions Compendium* provides an extensive overview of community-driven solutions to heat adaptation. This heat compendium is aimed at policymakers, funders, and communities and they categorize heat adaptation solutions into: (1) Nature-based solutions; (2) behavioral, lifestyle and traditional knowledge solutions; (3) infrastructure and design solutions; (4) technology and innovation solutions; and (5) advocacy and capacity building solutions.

Though much of the work cited by the Cornu et al. (2024) is across individual, community, and state action at a community level, rather than more explicitly emphasizing community-led action, it shares some important examples and insights adding to those we articulate here. For example, health-related responses documented in the report include water storage and distribution; tree planting for shade and wetland restoration for cooling; community knowledge for cooler housing designs; provision of cooling centers; and communication of heatwave warnings (Cornu et al. 2024). This review suggests similar responsive forms of action from community groups to those documented in the academic literature along with other preventative actions, such as the tree planting. This report indicates that there are, in effect, two common community-led forms of action that are overlooked or have yet to given as much attention in academic literature: (1) longer-term action and advocacy by local communities for green urban environments (as a key common-owned, held, or commons-managed resource); and (2) community-led work focused on building social capital by connecting family, friends and local knowledge, and building trust for interventions (Aldrich et al. 2016; Guardaro, Hondula, Ortiz, and Redman 2022; Guardaro, Hondula, and Redman 2022; Sultana et al. 2025, Wolf et al. 2010). Though such actions may not primarily be intended for heat adaptation (Sousa-Silva and Zanocco 2024), they offer important routes to mitigating negative health and wellbeing impacts in heat events and can also support positive climate justice by giving particular focus to marginalized populations (Juhola et al. 2022). In sum, though the literature on community-led heat adaptation for health and wellbeing is not as extensive as that addressing other weather risks, it nevertheless indicates an important role for these forms of action in responding to climate impacts.

3.2 | Cold-Related Community-Led Adaptation

Cold risks represent an ongoing issue for many parts of the world in contexts of climate change with projections indicating that this will continue to represent a significant threat to health in winter months until late in the century (Masselot et al. 2023; Ritchie 2024). The responses to cold risk are also often bound up with those related to heat and to some extent flooding focusing, as they often do, on changes to the built environment. For example, efforts to retrofit homes to protect against cold have been shown to increase heat risk if not carried out in ways that support both heating and cooling (Zahiri and Gupta 2023). Bringing focus on community-led responses to cold risk, our search generated 12 papers on cold containing examples of community-led adaptations, ranging from the provision of energy advice and making homes more energy efficient to community-organized or owned energy supply such as solar power.

Community-led interventions to address the challenge of keeping homes warm are prevalent within the literature across Europe. For instance, in Spain (Parreño-Rodriguez et al. 2023), Germany (Hanke and Guyet 2023), Greece (Konstantopoulos et al. 2023) and the UK (Lawler et al. 2023; Martiskainen et al. 2018; Nolden et al. 2022; Reeves 2016), studies document such types of community-led response, including things like energy cafes where people can go for advice on keeping warm and support for energy bills and debt.

Provision of energy advice for households can be considered both preventative and reactive for vulnerability to cold and involves several specific types of intervention. These include a mixture of financial, behavioral, material, and coping strategies (Nolden et al. 2022). Financial approaches are often reactive to previous high bills or costs, with strategies such as switching supplier or querying bills (Martiskainen et al. 2018). In contrast, behavioral interventions, such as advising warmer clothing and ways to reduce energy use, are in effect preventative in supporting people's abilities to keep warm and avoid ill health effects of cold weather (Nolden et al. 2022; Reeves 2016). Physical and material interventions, such as shares in solar photovoltaic or insulation, work in a similar way in that they have the potential to reduce exposure to the ill health and wellbeing effects of cold risk in the future (Hanke and Guyet 2023; Parreño-Rodriguez et al. 2023).

The literature addressing community-led energy advice initiatives as well as home energy interventions shows that they have the potential to increase social learning about how to manage and reduce energy demand, helping to prevent negative health and wellbeing impacts from cold. For example, Reeves (2016) studied 12 cases of cold interventions across the UK and identified four of these as community-led. These included a local sustainability group in the rural West Midlands conducting a range of interventions, such as thermal imaging and home energy advice visits, with positive implications for the energy literacy of those involved (Reeves 2016). More broadly, their research highlights the value of community-led responses for cold risk in a range of ways including, supporting signposting to wider services and agencies; using networks to enable vulnerable people to access services; aiding outreach activities and acting as "community champions;" and filling gaps in wider institutional support. These diverse forms of action enabled people engaged through the interventions to better manage cold risk, supporting their health and wellbeing and reducing negative impacts.

Other examples such as those presented by Martiskainen et al. (2018) show that community-led action can be particularly critical for vulnerable populations. They evaluated community-led Energy Cafés that were acting as short-term initiatives, run by volunteers in a pop-up shop format with grant money support. They explain how such forms of response from community groups offer routes to provide tailored and trusted support in a safe environment (Martiskainen et al. 2018), translating into prevention of health and wellbeing risks from cold homes. However, studies also highlight issues in the abilities of community-led responses to secure funding to offer a sustainable service and extend the reach of their activities (Reeves 2016). For this reason, studies show that community groups addressing cold homes often (as in the above examples) work synergistically with government and other actors. Most commonly, this involves working with health professionals and local government (Parreño-Rodriguez et al. 2023; Lawler et al. 2023; Reeves 2016; Rugkåsa et al. 2007), networks of other community energy groups (Parreño-Rodriguez et al. 2023; Nolden et al. 2022; Goedkoop et al. 2022), and charities or voluntary sector actors (Reeves 2016; Rugkåsa et al. 2007).

Though the studies reviewed often did not focus specifically on improvements in health and wellbeing outcomes, there were many documented benefits of community-led action on cold arising from these papers. For example, studies highlighted how their particular roles in building trust (Lawler et al. 2023; Ramsden 2020; Rugkåsa et al. 2007) and providing access to resources (Nolden et al. 2022) often had positive implications for supporting those most vulnerable to the ill health effects of cold. The literature also documents a few holistic energy poverty interventions that seek to build social fabric, tackle health and social inequalities, and address local and national structural factors (Lawler et al. 2023; Conlon et al. 2011). These studies suggested the importance of multi-scalar partnerships encompassing the local, regional and national levels across domains such as energy, housing, health, benefits and employment for addressing cold risk.

Overall, from our review of the peer reviewed literature on community-led responses to cold risk, there are multiple and clear benefits identified as arising from these forms of action, including how they can provide crucial support for those most vulnerable and unlikely to access more formal responses. However, it also highlights how most community-led interventions for cold tend to be focused on the short-term. This is perhaps reflective of the seasonal nature of the problem in most world regions but also the cycles of available funding required to support such action. Limited and insufficient funding has been identified as a problem in many community-led interventions more generally (Lawler et al. 2023; Konstantopoulos et al. 2023; Ramsden 2020; Reeves 2016)—a trend reflected in the literature across the different risks examined here.

3.3 | Flood-Related Community-Led Adaptation

Floods represent one of the most significant risks posed by climate change for many global places (IPCC 2023). Its health and

wellbeing impacts are well established and include risks of death, injury, and disease outbreaks like gastroenteritis, along with serious mental health issues, such as post-traumatic stress disorder, anxiety, and depression (Walker-Springett et al. 2017; Alderman et al. 2012). Community-led adaptations to floods in the 16 papers identified by our review included diverse forms of response that in different ways support the mitigation of such health and wellbeing impacts. The studies discussed immediate responses such as alerting and moving people and belongings, and preventative actions such as enabling property-level resilience, keeping belongings at higher levels, and preparing food and other essential resources. We also found evidence for broader preventative forms of community-led action, including for natural flood management interventions such as restoring wetlands, and initiatives to re/build flood-resilient housing (Peh et al. 2014).

Many studies highlight that it is often the community that is the first responder in the immediate event of a flood before any emergency services, NGOs, or authorities can arrive (Aksa and Afrian 2022; Walker-Springett et al. 2017). This informal approach has been characterized as autonomic adaptation, emerging from the local community, as opposed to planned adaptation, arising from governing institutions (Harwitasari and van Ast 2011). However, research also highlights how communities can go beyond initial responsive actions, engaging in longer-term forms of support. For example, in a study of Indonesian coastal communities, after helping with evacuations, community members lent others money for repairs and helped each other with rebuilding (Aksa and Afrian 2022).

Other longer-term actions found in the papers reviewed included the development of flood action groups, often set up in the aftermath of a flood (Garvey and Paavola 2022). One such group in North Yorkshire, UK, provided support during floods by moving people and possessions, arranging temporary accommodation, shopping for those in need, and helping to look for lost possessions, as well as undertaking minor repairs (Simm 2016). Another group in Nepal worked to provide first-response care for people in the immediate period following floods (Devkota et al. 2014). Research highlights how these early and longer-term actions are important in mitigating some of the worst health and wellbeing effects of floods, including diminishing negative impacts that arise from people feeling isolated and distanced from their community following flooding events (Butler et al. 2018).

Detailing more anticipatory action, in Indonesia Marfai et al. (2015) found community-led actions that supported adaptation to floods, including building small dikes and raising the level of housing, as well as developing "communal work systems... to clean the rivers and drainage channels" around settlements (p. 1140). They also report how communities organized to support rebuilding after floods by collecting materials to be reused and obtaining loans and financing to buy new materials and hire workers to support faster builds. Another study, this time in Brazil, also reports such forms of preventative community-led action, including building walls around shops, raising stock and furniture off the ground, and building elevated housing (De Andrade and Szlafsztein 2020).

In the UK, communities were documented as central to promoting nature-oriented proactive solutions to flood management (Garvey and Paavola 2022), most often in partnership with private and public sector partners. The Ryedale Flood Resilience Group and the Pickering Flood Defense Forum generated evidence to promote nature-based solutions and worked with a range of actors such as local landowners. The flood groups got involved in re-meandering a river, building leaky dams, and creating ponds to slow the flow (Garvey and Paavola 2022). Aside from benefits for public use of nature and increased biodiversity, the popularity of nature-based solutions has facilitated community access to alternative funding, as communities can secure financing to implement smaller scale works that may not otherwise reach UK local authority thresholds for contracting (Simm 2016). These more responsive forms of community-led action are significant then for supporting health and wellbeing in terms of the prevented impacts and the wider benefits that can be derived from approaches like nature-based solutions, for example through access to blue and green spaces (White et al. 2021).

Many studies strongly identify the need to respect and account for local knowledge in responses to floods suggesting that this can mitigate negative health and wellbeing impacts (Barr and Woodley 2019; Dwirahmadi et al. 2019; Fabiyi and Oloukoi 2013; Mashi et al. 2020). The papers reviewed show how community-led actions often foreground and prioritize cultural beliefs, knowledge, and needs, as well as feeding important information into processes for predicting flood risks. Despite this, studies suggest that within flood adaptation local knowledge is often disregarded and characterized as secondary to other forms of knowledge or even, in some cases, as crude and uncivilized. For example, Fabiyi and Oloukoi (2013 p17) discuss how important indigenous knowledge about flooding in Nigeria remains undocumented and undervalued because it is "oral, holistic, and culturally buried under taboos." Similarly, in the UK, Barr and Woodley (2019) discuss the oppositional discourse of "scientific" versus "lay" knowledge, and how this framing, which also often implies a hierarchy, can be disempowering for community-led action. This aspect of the literature highlights how community-led adaptation and action can often be better attuned to local knowledge in adaptation to floods than wider forms of response.

All these studies offer evidence for the value of community-led action in preventing or mitigating some of the worst health and wellbeing impacts of floods by reducing exposure to flood waters and enabling repair following events, as well as by providing responses that can support mental wellbeing, for example by engaging local knowledge systems and building on local connections. The research discussed here highlights both the direct forms of community-led action to prevent floods or mitigate their impacts, but it also brings to light the ways that such forms of adaptation response can often enhance precisely the forms of connection and attentiveness to local knowledge that have been shown to support mental wellbeing in contexts of flood (Butler et al. 2018; Quinn et al. 2020). However, research on community responses to flooding also highlights how though representativeness and inclusivity can be thought of as integral to the concept of community-led adaptation, communities can also be exclusionary or restrictive in nature. Garvey and Paavola (2022) found that in the UK, community flood groups were often composed of middle-class, retired individuals with high levels of education. Marginalized groups were often inadequately

represented, despite a well-documented social gradient suggesting poorer populations face the greatest risks from flooding in the UK (Walker and Burningham 2011). In this way, the literature highlighted the importance of not valorizing community-led action as inherently inclusive and supportive of health, and of being attentive to the ways that such forms of response can still reproduce injustices.

4 | Discussion: Benefits and Constraints of Community-Led Adaptation

The evidence base on community-led adaptation for heat, cold, and flood provides insight into a wide range of actions as well as particular attributes that such work can sometimes offer in contrast to other forms of state or institution led responses. In this final section we discuss crosscutting insights from the literature relating to the benefits of community-led adaptation for health and wellbeing and consider whether the characteristics of the risks shape the nature of such action. We then move to reflect on the constraints or limits of community-led action and where wider change might be needed to more fully realize the benefits reported in the literature reviewed here.

Across the different weather extremes we examined there were emergent themes evident in community-led actions, with responses taking common forms and having similar virtues in terms of their implications for health and wellbeing. The papers reviewed highlight: (1) the relevance of *localized knowledge* for supporting health and wellbeing; (2) how community-led action helps to *identify and support vulnerabilities*, contributing to the effectiveness of anticipatory planning; and (3) the ways that community-led action can be revealing for considering the links between *social capital and generalized resilience*. These themes arise across the literature on the different weather risks reviewed and point to the relevance and importance of community-led adaptation in supporting health and wellbeing.

On the benefits of *localized knowledge*, the literature reviewed here highlights how community-led action often involves balancing local and more formalized knowledge systems, with trust and credibility as key issues. Local community leaders and intermediaries, for example, play roles in building trust (Guardaro et al. 2020; Lawler et al. 2023; Ramsden 2020; Rugkåsa et al. 2007; Williams et al. 2013), communicating between communities and health or local authorities (Boeckmann 2016; Lawler et al. 2023), and sometimes shaping and evaluating interventions (Lacey-Barnacle 2020; Ramsden 2020). In a study of pro-active community-led action on flooding in England, Garvey and Paavola (2022) demonstrate how local knowledge was used as evidence for natural flood management. Social learning, citizen science, and harnessing of social media facilitated the incorporation of local knowledge of where and why flooding occurred, which was added to flood maps by local residents. The use of such local knowledge led to greater community acceptance, ownership, and control in future floods with important implications for health and wellbeing (Barr and Woodley 2019; Fabiyi and Oloukoi 2013; Mashi et al. 2020). Similar examples and evidence for the importance of community-led action in valuing, incorporating, or amalgamating local knowledge were evident within multiple papers across the different risks. This highlights how locally held knowledge of the environment and traditional adaptations should neither be overlooked nor undervalued.

In terms of *identifying and supporting vulnerabilities*, the reviewed literature suggests that community-led action has the potential to address entrenched dimensions of climate justice, including epistemic injustices over how different knowledge systems are valued and integrated into adaptation processes (Barr and Woodley 2019; Fabiyi and Oloukoi 2013). Clearly, the most marginalized groups in society will often face disproportionate health impacts of extremes of weather and have the least capacity to prepare or respond (Taylor 2014; UKHSA). The evidence suggests that community-led action can be vital in both identifying those that are vulnerable and supporting those people to mitigate the health and wellbeing consequences of weather extremes. However, given the importance of wider structural conditions in causing vulnerabilities, it is also evident that some community-led adaptations can only make marginal differences, rather than being able to ameliorate the underlying casual factors. It is important, then, to highlight that the positives of community-led action for health and wellbeing must be met with wider shifts in support and responses that tackle the broader systemic issues people are facing. On this point, there is evidence of the benefits of community-led adaptation planning for bringing to light connections to wider underlying factors that shape vulnerabilities (Guardaro et al. 2020) and developing proposals that address them. This suggests that community-led work can be important in initiating such wider shifts in broader institutions and governance.

On the links between *social capital and generalized resilience*, the benefits of support for community-led adaptations reviewed here appear to be threefold. First, preparing for and responding to these extremes of weather depends, in part, on the resilience capacity within local communities. This capacity is developed through precisely the forms of local organizing, sharing of resources and information, and reciprocal action that community-led adaptation is evidenced as supporting within the papers reviewed here. This type of work offers routes to enhancing identity, voice, and self-esteem of community members and ultimately their wellbeing, offering routes to achieving wider institutional goals for resilience (Heath 2025; Mortreux et al. 2023). Second, it is by recognizing and respecting local knowledge that governing institutions can learn more about what works and how, as well as which communities need more support. Third, there are multiple economic and health benefits to autonomous and resilient communities, which will require less support in the long term. One key lesson from all the documented community-led actions is the synergy between community and local-scale formal government. This reveals that community resilience does not develop in a vacuum, instead it depends on wider structural conditions that often require intervention from governing institutions to create supportive conditions (Catney et al. 2014; Newman and Dale 2005).

Reflecting on the nature of the responses across heat, cold and flood, there are some distinct patterns and characteristics of the community-led actions documented in the papers reviewed. Some of the risks appeared to be dominated by more responsive forms of action, while others more frequently saw significant

longer-term preparatory and preventative actions. Responses to cold risk, for example, involve a range of financial, material and behavioral interventions to support health and wellbeing, but most of these actions focused on low-cost interventions like advice aimed at short-term mitigation of a chronic problem over the winter months (Lawler et al. 2023; Ramsden 2020). In contrast, actions by communities on flood risk more commonly emphasized longer-term concerns, including material preparation prior to events, as well as during and through post-flood responses (Aksa and Afrian 2022; Marfai et al. 2015; Devkota et al. 2014). For example, the adoption of nature-based solutions for flood risk involves actions over many years and even decades, representing a long-term endeavor requiring structural change such as land management practices (Short et al. 2021). Heat interventions discussed in the published literature reviewed here also tended to focus on acute events, with largely responsive measures reported as the focus of community-led action supporting behavioral adaptations by individuals (Boeckmann 2016; White-Newsome et al. 2014). However, there were also examples and evidence for the engagement of communities in more proactive planning, such as reducing urban heat effects through provision of green space (Cornu et al. 2024) or developing approaches that go beyond technical and infrastructural changes to consider steps required to address deeper underlying issues that shape vulnerabilities (Guardaro et al. 2020).

The evidence reviewed also revealed common challenges for community-led adaptation. One commonality limiting the scope and extent of interventions across extremes of weather is available funding with issues reported in studies on cold (Lawler et al. 2023; Konstantopoulos et al. 2023), flood (Barr and Woodley 2019), and heat (Guardaro et al. 2020; White-Newsome et al. 2014). Studies found further challenges for community-led action in the ways that they can intersect with government programs. For example, in relation to flood, government-led relocation programs were found to have the potential to undermine community resilience by splitting communities up and fracturing social networks that shape abilities to work collectively in the face of flood events (Abu et al. 2024; Fabiyi and Oloukoi 2013). These studies thus highlight the ways that government action can sometimes undermine social relations and connections that are often important to health and wellbeing outcomes within flood adaptation processes. This means that while community-led action to cope with weather-related risks is widespread and there is evidence for its importance in supporting health and wellbeing, there are current limitations that are important to address for fuller health and wellbeing benefits to be realized.

5 | Conclusions

This paper examines the evidence on community-led adaptation to extremes of weather across heat, cold, and floods. The body of knowledge reviewed here suggests that, although the specific nature of community-led action is not well documented in peer-reviewed studies, there are tangible benefits to supporting and engaging with community-led action. We have found that while there is documented evidence of community-led adaptations across heat, cold, and floods, they have not been given as much attention in the published academic literature as might be expected given their apparent prevalence across global contexts. The paucity of identifiable papers on community-led action for heat, for example, contrasted with the multiple documented examples of such action within the key piece of gray literature included in our review.

This is surprising given the scale of the risks and the importance attributed to "understanding the perceptions, coping capacities, and adaptation strategies held by local communities" (Marfai et al. 2015 p. 1129) within many research traditions. Despite this wider concern with the role and relevance of community in adaptation, our narrow focus here on studies that document and discuss responses led by communities, rather than those merely involving or based within them, has revealed a more limited picture of the level of engagement with such work. This is important because it means there is less understanding of the place of such forms of response within the wider adaptation landscape than might be expected.

The review here thus suggests some important research gaps and priorities. These include a recognition and clear distinction between community-led action and the use of community that simply signals communities as populations living in the same place and experiencing the same climate risks. This belies recognition of the level of attention *community-led* responses are attracting in the literature. A second area of research is more formalized treatment of the benefits and ancillary benefits of community-led action. Though the research reviewed here suggests these are legion, they are yet to be formalized in a viable framework. A third issue concerns questions of internal and external governance of community-led action. Communities are by their nature, exclusive groups, and the ability to draw boundaries or exclude interests, while often necessary, means that some community-led actions may inadvertently exclude the most vulnerable. Better understanding how community-led action addresses existing inequalities is thus key to evaluating its sustainability and effectiveness.

A final area relates to the nature of research methods for examining and evaluating community-led action. Many community-led interventions are explicit about goals for just and democratic community formations. Some traditional, hierarchical and extractive methods may not be fit for that purpose (Ford et al. 2016; Sartorius et al. 2024). From this review, action research and co-production methods that bring community actors into the research, policy, and evaluation design would seem to be more effective, appropriate, and more likely to uncover the dynamics of action and the potential for leverage.

Author Contributions

Anna Cronin de Chavez: conceptualization (equal), investigation (equal), methodology (equal), writing – original draft (equal), writing – review and editing (equal). **Lee Towers:** investigation (equal), writing – original draft (equal), writing – review and editing (equal). **Gordon Walker:** conceptualization (equal), investigation (equal), writing – original draft (equal), writing – review and editing (equal). **Patricia Nicole Albers:** investigation (equal), methodology (equal), writing – original draft (equal), writing – review and editing (equal). **Catherine Butler:** conceptualization (equal), investigation (equal), writing – original draft (equal), writing – review and editing (equal). **W. Neil Adger:** conceptualization (equal), funding acquisition (equal), investigation (equal), methodology (equal), writing – original draft (equal), writing – review and editing (equal). **Matthew Cotton:** investigation (equal),

writing – original draft (equal), writing – review and editing (equal). **Emma Bland:** conceptualization (equal), writing – review and editing (equal). **Frank de Vocht:** writing – review and editing (equal).

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Related WIREs Articles

Community-based adaptation: a review of past and future challenges.

Community-based adaptation research in the Canadian Arctic.

Participation and co-production in climate adaptation: Scope and limits identified from a meta-method review of research with European coastal communities.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Table A1:** Articles on community led adaptations to heat, cold and flood extreme events.