

Research article

Exploring the interconnections between health, climate crisis, food insecurity and institutional neglect in Alta Verapaz region, Guatemala

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ABSTRACT

Introduction: Rural Indigenous communities in Alta Verapaz, Guatemala face escalating and multifaceted health risks due to recurrent extreme climate events. This article focuses on the deepening crisis of chronic food insecurity and malnutrition, driven both by acute shortages during climate shocks and the long-term degradation of local food systems. These harms are further compounded by entrenched structural inequalities and limited access to government emergency response systems and public institutions more broadly.

Methods: This study draws on participatory action research conducted with 16 Maya Q'eqchi' communities and civil society partners. Data were collected through participatory mapping, group dialogues, and institutional analysis, and were analyzed using thematic methods grounded in the social determination of health framework.

Results: The study identifies two central concerns: the intensification of food insecurity driven by both climate change and the expansion of monoculture agriculture, and the inadequate institutional response to these interrelated crises. Community members reported crop loss, declining soil fertility, toxic contamination following floods, and ongoing encroachment on their habitats. National policy analysis reveals that, although the emergency response system appears adequate in design, its implementation is hindered by limited capacity and chronic under-resourcing at the community level.

Conclusion: The interplay of climate shocks, food system pressures, and institutional failure requires a rights-based, multilevel approach to health and climate justice. Public investment, decentralized emergency planning, and recognition of Indigenous knowledge are critical parts of addressing structural drivers of vulnerability. Community-led strategies must be supported by responsive, well-resourced public institutions.

1. Introduction

In a Special Report on Climate Change and Health for COP29 [1], the World Health Organization (WHO) emphasizes that “health, well-being and equity must be at the heart of climate action.” In the context of Latin America and the Caribbean, the Pan American Health Organization (PAHO) further notes that the detrimental effects of climate change in the form of extreme weather events are frequently compounded by persistent structural challenges, including high levels of inequality and

limited access to public services and nutritious diets [2]. Addressing this challenge thus requires both immediate responses to extreme weather events, which disproportionately affect structurally disadvantaged communities, and the protection of biodiversity and natural ecosystems, which are essential to sustaining health, food security, and livelihoods [1]. These efforts cannot succeed without responsive public institutions capable of integrating short-term emergency relief with long-term strategies to confront underlying social and climate injustices.

In recent years, Guatemala has been among the countries most

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heavily impacted by extreme climate events, with increasingly volatile weather patterns alternating between severe storms and heatwaves. As part of Central America's so-called Northern Triangle—together with El Salvador and Honduras—where climate vulnerability intersects with entrenched socio-economic inequality and limited public investment, Guatemala is emerging as a critical site for exposure to climate risks and for understanding their structural drivers [3,4].¹ In addition, with the largest and most diverse Indigenous population in the region (approximately 41.4 % of the population identifies as Indigenous and >22 native languages are spoken nationwide), Guatemala provides a national context marked by ethnic diversity as well as by enduring legacies of marginalization [5].

This research addresses a pressing need for studies that examine both the impacts of climate-related extreme weather and the efficacy of emergency response systems affecting Indigenous communities in the Global South. Although scholarly attention to this issue has increased since the COVID-19 pandemic, most studies focus on Indigenous populations in high-income countries—such as First Nations communities in Canada [6,7] and Aboriginal communities in Australia [8,9]. Comparable research in the Global South remains limited [10]. At the same time, Rivera et al. note that, even as governments increasingly acknowledge the importance of emergency management systems, their effective coordination remains a persistent challenge in resource-scarce environments [11].

This paper draws on preliminary findings from Phase I of an ongoing Participatory Action Research (PAR) project conducted in partnership with 16 Maya Q'eqchi' communities in Alta Verapaz, Guatemala. The project explores the health and social impacts of extreme weather events on partner communities and their response to these crises. Developed in collaboration with Guatemalan civil society organizations—the *Centro de Estudios para la Equidad y Gobernanza en los Sistemas de Salud* (CEGSS)/*Red de Defensores y Defensoras Comunitarios por el Derecho a la Salud* (REDC-Salud), *Laboratorio de Datos GT*, together with university-based researchers in Canada and the United States, the project stems from community concerns regarding the government's inadequate response to problems caused by repeated heavy storms, flooding, and high temperatures. Research evidence is being used to co-create and implement multilevel strategies with affected communities to demand government accountability and action.²

Previous phase I research demonstrates that extreme weather events cause or exacerbate myriad health related problems in the 16 communities, for example direct harm to physical and mental health, disrupted access to health services, damaged housing, heightened short- and long-term food insecurity, and long-term disruptions to rural livelihoods. Findings also show that these consequences are amplified by the state's weak emergency response system [12]. This article discusses a specific subset of Phase I findings: partner communities' perceptions of how extreme weather affects their short- and longer-term food insecurity and livelihoods, the adequacy of emergency assistance received from the state to address these concerns, and community coping strategies. These specific findings highlight the urgent challenges they present for community partners, and serve as an entry point to explore important broader issues related to extreme weather and health equity in the context of the climate crisis in Guatemala.

In the following sections, the methodological and conceptual approach are reviewed, followed by an examination of the broader

historical, social, and environmental context of the research problem. The results subsequently presented draw on participatory fieldwork with affected communities, as well as national-level policy research and data analysis on Guatemala's emergency response system. These findings are then briefly discussed in relation to the social determination of health (SDET), concluding with brief policy and advocacy recommendations. Consistent with participatory action research methodology, this research is an iterative and interactive process that will continue to develop as subsequent phases of the work are completed. Further research findings will be discussed in follow up publications upon full project completion in 2026.

2. Materials and methods

The research team is diverse and interdisciplinary, including Indigenous researcher-practitioners from the Guatemalan civil society organization CEGSS, one of whom is Maya Q'eqchi' from Alta Verapaz, as well as eight Maya Q'eqchi community co-researchers from the affected areas. The co-researchers are Frontline Health Defenders (FHD) with the Guatemalan grassroots civil society health network, REDC-Salud, all of whom have extensive health rights advocacy experience.³ The team also includes a national policy analyst from Laboratorio de Datos GT in Guatemala and researchers based at universities in Toronto, Canada, and Washington, DC, USA.

2.1. Participatory research methods

The Participatory Action Research (PAR) approach operates at multiple levels. It engages community members, drawing on their lived experiences to shape both the research process and its outcomes [13]. In 2023, the CEGSS/REDC-Salud field team facilitated participatory mapping sessions in the Q'eqchi' language with partner communities across five municipalities in Alta Verapaz.⁴ To initiate the mapping process, the field team convened ten focus groups in partner communities. In some cases, due to logistics and geography, multiple communities grouped together in the same focus group session, with a total of 16 communities participating in the 10 focus groups. Community members discussed the impact of extreme weather on their communities, the state's emergency response, and their own community-based strategies used to cope with the repeated events. Two field team members, with assistance from two other Q'eqchi speakers from Alta Verapaz, transcribed and translated into Spanish the audio recordings from each session. Transcripts were then shared with the university-based research team members in North America for their collaboration with the data analysis process.

Braun & Clarke's approach to thematic analysis was used to analyze the transcripts [14,15]. This approach, now commonly referred to as Reflexive Thematic Analysis [14] involved becoming familiar with the data, then generating codes and assigning code labels to "segments of data with analytically interesting idea, concept or meaning" (pg.53). Codes and further subcodes were then reviewed, developed and refined [15]. MAXQDA software was used to help organize the data. The team drew theoretically on a critical political economy tradition to inform the analytic process and looked for key patterns and connected meanings across the ten sessions to generate preliminary results. This analytic process was supported by the field team's use of the transcripts to construct individual community briefs, for use by the communities, which aggregated stories told in each session and which offered further insight into important patterns. In addition, field team members discussed, refined and validated the data in these briefs with community

¹ Notre Dame's Global Adaptation Initiative (ND-GAIN) combines data on climate vulnerability with indicators of a country's readiness to enhance resilience. The index shows that although the countries in question already rank in the lower-middle range for vulnerability, their scores worsen significantly when limited economic, governance and social readiness are considered.

² Phase II of this project, currently underway, focuses on co-designing community-engaged action strategies to advocate for more effective emergency response from the state, and documenting the learning from that action process.

³ CEGSS provides technical support and accompaniment to the REDC-Salud network. While the network has its own leadership and governance structure, its administration and finances are facilitated through CEGSS.

⁴ In total, the 16 partner communities include 1,992 families, approximately 9,960 individuals.

members during repeated visits over 12 months. They discussed insights gained through these visits with the rest of the research team, further supporting a collective analytic process.⁵

In addition to the 10 focus groups sessions to initiate the community mapping process, Laboratorio de Datos GT conducted a structural level study to map the institutional architecture of the country's national emergency response system, including an analysis of its pertinent budget expenditures from 2015–2023. Given the important role of municipalities in responding to emergencies, they also examined municipal expenditures from 2020–2022.

Research reliability was enhanced through consistent application of the same methods to gather data in each focus group and throughout the analysis of all ten sessions, – through multiple team members' engagement in the analysis process, reflexivity among team members through attention to positionality and ongoing conversation with one another across research sites– especially crucial given diverse social locations – and through triangulation of community-based focus group data with data from the Laboratorio de Datos' national structural study. Consistent with PAR methodology, research validity was strengthened through the team's prolonged, direct engagement with community members, including community partners' key role in validating the data during multiple meetings that took place after the initial community mapping focus groups sessions. Follow up meetings were held in 2023–2024 at each individual community level and also between representatives from the 16 communities to generate collective reflection. The team continues its engagement with the partner communities through the project's current Phase II (2024–2026).

2.2. Conceptual approach

Food insecurity is recognized by the WHO as an important social determinant of health (SDH), one of the “the non-medical factors that influence health outcomes.” Broadly, the social determinants of health are “the conditions in which people are born, grow, work, live, and age, and wider sets of forces and systems shaping the conditions of daily life” [16]. SDH help to understand health beyond a biomedical disease paradigm. However, for some, use of the language of SDH can lead to an analysis that highlights factors such as individuals' living and working conditions but sometimes obscures the importance of broader structural forces that shape health inequities [17]. To emphasize a multilevel analysis, the language of the social determination of health (SDET) is used in this paper, a term that can be traced to the Latin American social medicine/collective health movement [18,19]. SDET draws on a critical political economy tradition, recognizing how health outcomes are shaped not only by individual factors but also by systemic conditions, including the unequal distribution of power, resources, and services [20]. These inequities intersect with environmental stressors such as climate change, deforestation, and pollution, which compound the vulnerability of Indigenous communities. By integrating these conceptual tools, a holistic perspective on some of the complex challenges facing rural communities in Alta Verapaz in the context of the climate crisis is provided.

3. The setting

3.1. Historical context

Many of Guatemala's present challenges stem from its history,

beginning with the Spanish conquest between 1524 and 1530 which inaugurated a long history of racialized dispossession. Indigenous communities were subjected to colonial rule and stripped of their lands; many fled to remote areas, while others were enslaved. Throughout the colonial period, this expropriation and subjugation was legitimized through a racial ideology that affirmed the superiority of Spanish and Creole elites, thereby facilitating the Crown's consolidation and maintenance of political control [21]. A second defining period of dispossession and violence unfolded during the civil war and military rule between 1960 and 1996, which claimed over 200,000 lives and led to the large-scale displacement of peasant and Indigenous populations. At the root of the conflict was the struggle for a more equitable distribution of land, which had become increasingly concentrated in the hands of landholding elites oriented toward the export of agricultural commodities [22]. In the post-conflict period, this has deepened, with the expansion of the agricultural frontier and the encroachment on Indigenous and peasant communities by sugarcane and oil palm plantations, agroindustrial processing plants, and large-scale extractive megaprojects [23].

3.2. Geographic context

Guatemala is a high-risk region for multiple natural hazards. Despite possessing a diversity of ecosystems suitable for a wide range of subsistence and commercial crops, global climate change and localized anthropogenic activities have placed mounting stress on these ecosystems [24,25]. Climatic extremes have been particularly severe for riverine and mountainous communities, triggering recurrent floods, landslides, and droughts [26]. In Alta Verapaz, geographical isolation compounds these challenges. Many communities live in remote, high-risk areas with limited access to emergency aid and government resources [13].

3.3. Social context

These pressures are exacerbated by severe inequalities in access to resources and public services. Despite economic growth, Guatemala maintains some of the highest poverty and inequality rates in Latin America, with poverty reaching 83 % in Alta Verapaz. Public services remain chronically underfunded and inadequate [27], and are distant from most Indigenous communities. As Demetrio Cojtí observes [28], the discriminatory structure of Guatemala's public institutions ensures that Indigenous peoples bear the brunt of society's hardships while accessing few of its public goods, including education, healthcare, infrastructure, and meaningful participation in governance.

One of the most severe consequences of these inequities for long-term health is the persistent crisis of food insecurity and malnutrition, which disproportionately affects rural populations. According to the UN's Food and Agriculture Organization (FAO), Guatemala has the highest rate of chronic malnutrition in the region—and among the highest globally—with approximately 46.5 % of children under five years of age affected nationally, while rates in rural communities range between 53 % and 58 % [29]. In an already critical situation at the national level, Alta Verapaz is among the regions most affected by severe food insecurity and malnutrition. According to the *Integrated Food Security Phase Classification*, 75 % of the population in Alta Verapaz experienced some form of food insecurity, with 41 % reportedly in crisis or emergency conditions—the highest in the country [30,31].

4. Research findings (phase I: 2023–2024)

Phase I thematic data analysis generated preliminary findings that point to several important patterns across the 16 communities repeatedly affected by climate-driven emergencies, including findings related to physical health, mental health and wellbeing, access to health services, housing and shelter, strategic alliances, short -and- long term food

⁵ A series of key informant interviews with public officials at a municipal, department and national level will be integrated into the current project results in the subsequent phase of the project (2025-26). As well, the project applied the same methods with four community partners in the neighbouring department of Quiché in late 2024. This will serve as an important point of comparison later in the project.

insecurity and rural livelihoods, community coping strategies, and emergency response provisions from the state. The set of interrelated findings that identify community's perceptions of how extreme weather is affecting their short- and longer-term food insecurity and rural livelihoods, the adequacy of emergency assistance received from the state to address these concerns, and community coping strategies are addressed in this manuscript. These findings move beyond simple topic summaries and begin to draw connections between ideas, drawing also on concepts related to SDET to consider the structural dimensions.

The community mapping exercises provided critical insights into the far-reaching impacts of climate emergencies on health and well-being across the 16 partner communities in Alta Verapaz (Fig. 1). Floods and landslides are an annual occurrence, with some communities experiencing these events multiple times per rainy season, while others also endure droughts during the dry season. Most of these communities are located in remote, difficult-to-access areas, including four officially classified as "high risk" by the government, and one in a zone declared uninhabitable. Many are situated near rivers and waterways prone to flooding, while the region's mountainous terrain further increases vulnerability to landslides.

Among the consequences of these climate hazards on community members' health and well-being, food insecurity and rural livelihoods emerged as a particularly acute and recurring issue, with recent climate pressures intensifying its severity. These challenges can be understood in two interrelated dimensions: (1) short-term food shortages during extreme weather events and (2) the medium- and long-term decline in food production capacity due to the combined effects of global climate change and localized habitat encroachment. Additionally, community members consistently emphasized the weak institutional response to this crisis. This attention to both the micro and structural dimensions is conceptually consistent with the SDET approach that considers not only individual factors but also systemic conditions.

4.1. Food insecurity and rural livelihoods

4.1.1. Food insecurity

Food shortages are most severe during extreme weather events,

which often provoke the loss of crops, livestock, and stored food provisions. Community members report extended periods of hunger during these crises, which also contribute to acute emotional distress [31]. In some instances, entire communities have been engulfed by floods and landslides, cutting off evacuation routes and blocking access to food supplies in neighboring areas. While some communities have received limited food assistance from the government or charitable organizations, others report significant delays or mismanagement in delivery. In at least one case, provisions were mistakenly delivered to the wrong community, while in another, aid was dropped into floodwaters by helicopter, rendering it partially unusable [32]. The absence or insufficiency of food aid forces communities to rely on their own resourcefulness or mutual aid networks with neighboring villages. Even when emergency food provisions are available, they offer only temporary relief—sometimes lasting just a few days [33].

4.1.2. Rural livelihoods

Climate emergencies have also contributed to the long-term degradation of arable land. Recurrent floods have eroded riverbanks, causing portions of farmland to be partially or entirely lost to encroaching rivers or fragmented by shifting watercourses [34]. Sediment deposition from floodwaters has reduced soil fertility, leading to declining crop yields—a problem exacerbated by extreme heat and drought during the dry season. These changes have forced many families to abandon affected plots, invest limited funds in fertilizers, or resign themselves to significantly reduced outputs [35].

Compounding these challenges, the financial strain caused by declining food production, rising expenditures on fertilizers to counter soil degradation, and limited rural employment opportunities has trapped many families in cycles of debt and migration, further eroding community cohesion and the material basis for well-being. As one community member described:

"When the community is flooded, everything is lost, and many of us must borrow money from the bank in order to plant. And if a hurricane comes and everything we planted is lost? We have to pay the debt at the bank; the bank does not forgive what we owe. That is why many people from the community are migrating." [33]

Weak State Emergency Response to Extreme Weather Events in Alta Verapaz Partner Communities

A recurring theme is the limited on-the-ground presence and support from public officials during and after extreme weather events. This is especially true of representatives connected to the government's emergency response system, which has created significant challenges for coordination and the provision of basic necessities, including emergency food provisions, during extreme weather events. This institutional neglect has contributed to a growing erosion of community trust in Guatemala's National Disaster Reduction Coordinating Agency (Coordinadora Nacional para la Reducción de Desastres – CONRED) and municipal authorities.

Some of the systemic failures underlying these localized experiences are detailed in a study of CONRED conducted by Laboratorio de Datos for this project. The findings identify critical weaknesses in both CONRED's implementation and institutional design [36]. An analysis of relevant budget allocations and expenditures from 2015–2023 reveals additional challenges [37]. Key findings are presented and considered in the context of findings from the focus groups with the 16 community partners.

Since its establishment in 1996, the CONRED system has developed an institutional framework that, on paper, appears to be a fairly robust, multi-tiered, and inter-ministerial structure, operating under the broader disaster risk reduction policy framework, *Política Nacional para la Reducción de Riesgos a Desastres de Guatemala* (PNRRD). However, significant implementation failures have resulted in uneven service delivery, disproportionately affecting geographically isolated,

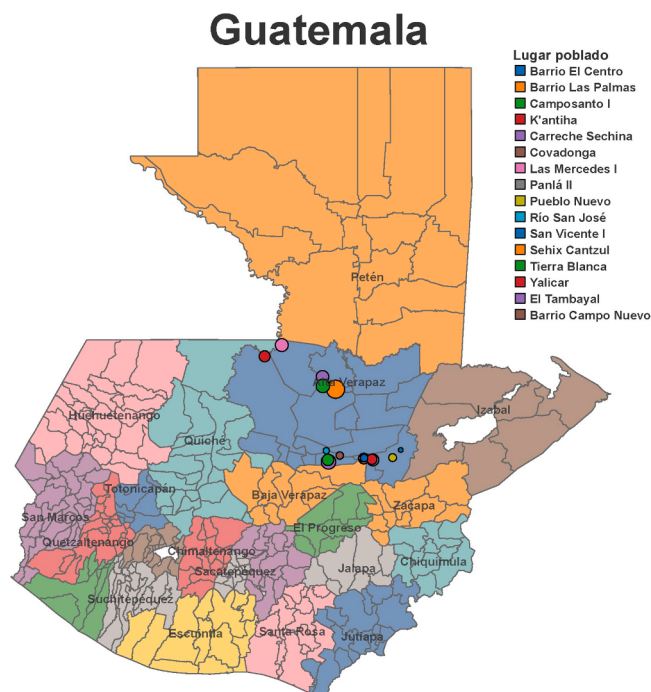


Fig. 1. Map of project locations in Alta Verapaz, Guatemala. (Source: Laboratorio de Datos GT, 2024).

predominantly Indigenous rural communities. For example, while some partner communities in Alta Verapaz acknowledged receiving limited assistance—such as small emergency food provisions or basic emergency shelter materials—others reported never having received so much as a visit or emergency contact information. In many cases where CONRED representatives were present, their role was limited to providing basic training for volunteers or distributing rudimentary emergency supplies. Some communities were given instructions for reporting flooding to CONRED, yet despite carefully documenting and relaying events, assistance was not forthcoming [38].

A key factor contributing to the system's poor articulation with local communities is the centralization of resources and response capacities at higher levels of governance. While CONRED is formally structured as a multi-tiered system—with response activation mechanisms at local, municipal, departmental, regional, and national levels—capabilities and resource allocation authority remain concentrated at the upper tiers of government. Municipal authorities, the entities closest to affected communities, are underfunded, lack clear emergency response protocols, and operate with limited transparency in reporting expenditures, leading to cases of misallocation or failure in budget execution [39]. Meanwhile, CONRED's role at the local level has been largely reduced to information gathering and damage assessment, while community-level coordinating units, composed primarily of volunteers, are responsible for issuing alerts and organizing evacuations, largely on their own initiative with community resources. Furthermore, critical provisions such as emergency food aid are stored at regional or departmental levels and require a tiered approval process—from municipal to departmental or regional authorities—before they can be disbursed. Similarly, distribution of international aid, including food, requires national-level approval, frequently resulting in delays or prioritization of assistance to high-visibility areas [32].

4.2. Community coping strategies

In the absence of institutional support, communities in Alta Verapaz have mobilized their own response efforts, relying on mutual aid from neighboring villages for food and assistance during and after emergencies, as well as some support from civil society organizations [33,34,40]. Rehabilitation of land and acquisition of resources to replant lost crops are problems communities primarily resolve on their own either individually or through collective efforts. While these efforts underscore the resilience of these communities, the continued failure of public institutions to provide adequate support systems, despite the existence of relevant public policies, reinforces existing discriminatory social structures. This deprives Indigenous populations of the conditions necessary for their health and well-being, including their right to food, and undermines their trust in public institutions.

5. Discussion

A common thread connecting the findings presented here on extreme weather, food insecurity, and the weakness of the national emergency response system to meet the needs of remote communities is the broader deterioration of the state's institutional capacity to provide basic services. This conclusion is reflected in the erosion of the budget allocated to CONRED over the past decade [41], and further demonstrated by Guatemala's persistently low public social spending in the areas of public health and education [28]. The past decade of political and economic turmoil has compounded poor investment in the public sector, further weakening state health and social institutions [42]. A new national government took power in early 2024 with a promise to reinvest in public services. However, it remains unclear the extent to which these commitments will result in concrete changes within public institutions like CONRED to improve its effectiveness in reaching rural Indigenous communities.

Achieving positive health outcomes in the context of extreme

weather events requires more than formal guarantees of individual rights. Consistent with the SDET approach it necessitates addressing the underlying structural drivers and social processes that amplify food insecurity and negatively impact people's health and education. The community partners in Alta Verapaz face intersecting social injustices—including poverty, income inequality, limited public services, and limited healthcare access—that exacerbate the impacts of anthropogenic environmental pressures.

Another consistent theme concerns the growing role of environmental stressors in shaping migration dynamics. While recent studies on emigration from the Northern Triangle caution against drawing overly direct causal links between climate change and mobility [43–45], they consistently find environmental factors increasingly act as “threat multipliers,” exacerbating both internal displacement and cross-border “survival migration” [46–50].

Guatemala's long history of injustice indicates that the marginalization of Indigenous communities—evident in biased public spending and restricted access to the country's economic, political, and symbolic resources—are not incidental, but rather the product of deep-seated inequalities embedded in public institutions. These inequalities are reflected in persistently low socioeconomic indicators associated with Indigenous identity and in the minimal representation of Indigenous peoples within government [39,41,51].

Beyond failing to meet fundamental needs, state institutions also disregard the contributions of Guatemala's rural Indigenous communities, which constitute over 40 % of the country's population, and whose traditional knowledge and relationship with nature have long proven effective in mitigating environmental hazards [52]. This disregard is evident not only in the poorly coordinated emergency response system at the community level but also in the lack of institutional support for sustaining ancestral food production and knowledge systems.

The World Health Organization (WHO) has recently emphasized that Indigenous food systems are not only essential for community health but also play a crucial role in environmental stewardship, helping to protect biodiversity from the expansion of unsustainable agricultural practices [1].

5.1. Next steps

This article draws on findings from Phase I of the project that yielded a series of short and longer-term recommendations, which community partners and team members are pushing public officials to adopt through a series of action strategies underway in Phase II of the project. Thus far, in response, CEGSS and REDC-Salud have been collaborating with partner communities to share Phase I results through meetings with government officials at a municipal and department level, to press for more responsive emergency prevention and response related to extreme weather events. Community representatives and team members presented research results and a series of proposals, or “demands” to mayors and other municipal officials in the five municipalities in Alta Verapaz where the project is located. Additionally, CEGSS/REDC-Salud has supported the formation of five “Advocacy Committees” (ACs), one per municipality. Each AC is comprised of members elected from each community. The ACs have been presenting the communities' positions to different government sectors in various forums. For instance, AC members met with the Governor of Alta Verapaz and officials from various government sectors at the departmental level to present Phase I research findings and the key issues that need to be addressed and some project team members, have met with national-level officials to share findings and begin an advocacy dialogue. The Phase II action component of the project is being documented for analysis and discussion. Short and longer-term policy proposals and other recommendations will be reported in future publications.

6. Conclusion

Impacts of recurring extreme weather events on rural and predominantly Indigenous communities demand urgent attention. It is equally critical to address the long-term processes of ecological deterioration while concurrently strengthening public institutions. Repeated flooding and intense heat undermine community health resilience, food security, exacerbate psychological distress and weaken social cohesion. Addressing these issues necessitates a comprehensive approach that integrates immediate relief efforts with systemic, long-term strategies and a collective commitment to broad, sustained change, led by the voices of those most affected.

Disclaimer

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.joclim.2025.100603](https://doi.org/10.1016/j.joclim.2025.100603).

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