Ontario Climate Risk: Workshop Report

Land Acknowledgement:
We wish to acknowledge the land where the Ontario Climate Risk Workshop was held (currently known as Toronto). For thousands of years it has been the traditional land of the Huron-Wendat, the Seneca, and the Mississaugas of the Credit. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

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TORONTO CLIMATE OBSERVATORY

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Report Contributors

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Introduction

Despite having the country's largest economy, population, and number of universities with world-class expertise on the topic, Ontario lacks a hub for sharing information and best practices and fostering connections between those working to address climate risk. There is a need for rigorous inquiry into localized climate impacts, including the potential for increased frequency and intensity of heatwaves, disruptions in water availability, and impacts on the Great Lakes region ecosystems. The significant expertise amongst academics and other researchers across the region regarding the complex dynamics between these factors will be necessary for devising effective and equitable mitigation and adaptation strategies. Identifying and addressing these gaps in our knowledge is paramount for developing region-specific strategies to mitigate and adapt to climate change, thereby contributing to the overall resilience and sustainability of Ontario's communities.

In this context, the Ontario Climate Risk Workshop, held on October 30-31, 2024, brought together participants from academia, public and private sectors, non-governmental organizations, Indigenous leaders, elected officials, and representatives of the general public to share knowledge, discuss existing initiatives, and co-create a research agenda for addressing climate risk in the province. The event was structured around eight thematic sessions, each of which is documented in this report. Within each session, participants examined and discussed existing resources and barriers relevant to addressing climate risks associated with the respective theme.

These proceedings provide an overview of the discussions for each session and were co-developed by our research team along with the respective session leads.

Rodrigo Costa and Robert Soden
Ontario Climate Risk Workshop Chairs

Climate Risk and Communities in Ontario

Taneea S Agrawaal[a], Sanaa Bhutani[a], Christopher Allsop[b], Scott Connell Puillandre[b], Anne Gloger[c], Kim Slater[b]

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Fence coming down. Photo by East Scarborough Storefront.

BACKGROUND BRIEFING

Connected Communities: Advancing whole of society approaches to addressing climate risk

The UN has estimated that 65% of the Sustainable Development Goals (SDGs) will not be achieved unless they are embedded at the local level and that achieving the SDG goals requires whole-of-society efforts to create strategies in which no one is left behind. In the recent UN Pact for the Future, there is a renewed commitment to "fostering synergies between science and technology and traditional, local, Afrodescendent and Indigenous knowledge, systems, practices and capacities" (United Nations, 2024). Community-engaged research is critical to this endeavour. Community-engaged research recognizes the value of local knowledge in seeking solutions to some of our most intractable problems. However, leveraging individual perspectives and voices to inform the actions of policy makers and other systems-level players only goes partway: there is also transformational potential for researchers and the act of researching itself to advance community-centred climate mitigation and adaptation strategies. Exploring these possibilities is the focus of this session.

Climate risk and geographic marginalization in Ontario

The SDGs are often viewed as individual and even siloed issue areas; in communities, however, they play out together in complex and nuanced ways. In Ontario, like in other places, we are experiencing more frequent and severe weather events, i.e.,

increased flooding, heatwaves, and extreme weather patterns. The more severe these climate events are, the more the ongoing stresses of poverty, food insecurity, isolation and despair are exacerbated, and the less likely it is that individuals and communities will be able to recover from extreme weather events (CREW, 2024).

Climate risks are highest among Ontario's most vulnerable populations and will continue to amplify existing disparities and inequities. Climate vulnerability is experienced most acutely by equity-deserving groups: communities that experience significant collective barriers in participating in society due to attitudinal, historic, social and environmental barriers based on age, ethnicity, disability, economic status, gender, religion, nationality, race, sexual orientation and transgender status, etc. Equity-deserving groups are those that face discrimination or barriers to equal access, opportunities and resources, and actively seek social justice and reparation (Climate and Equity Lab, 2024). People from equity-deserving groups in Ontario increasingly live in specific geographic areas where housing is less unaffordable but opportunities are fewer (Hulchanski, 2018); often, these are places where cultural support systems have norms and worldviews inconsistent with academia.

Communities have been marginalized and made vulnerable by mainstream systems, nowhere is this more evident than in the marginalization of Indigenous Nations (Wale and Huson, 2024). Neither communities nor Nations are, however, passive recipients of policy-level change; they are dynamic places where traditional, new, and ongoing collaborative solutions to local and systemic issues are being developed and implemented. These local-level initiatives are critical to systems-level change. Bonds of trust within communities can bind community members and local organizations together, which means that they have unique and effective ways of mobilizing collective knowledge and wisdom, ensuring dissemination of accurate and locally-relevant information, helping to combat misinformation, motivating people to roll up their sleeves and fight for a better world, and ensuring that information travels both to and from communities and local authorities (CREW, 2024). Reciprocity is the key.

Yet even the best community-engaged research will often engage communities only as individuals with individual opinions about what system-level actors should do to keep them safe from risks like those associated with climate change. These approaches often lack reciprocity and may exacerbate the risks through extractivism and further marginalization (Wale and Huson, 2024)

There are, however, researchers and community development practitioners in various places who are redefining ways of thinking about working with and in communities: ways that leverage the act of researching as well as research results, so that community-identified priorities and collaborative community-based strategies to

address those priorities are supported, and fueled as key drivers of systemic change. (Visionary Communities, 2024).

Beyond Consultation: Communities as Active Players in Low Carbon Resilience Strategies

While there are many advantages to community-engaged research that include individual residents in meaningful and participatory data collection, academia is typically structured in ways that centre 'knowledge-first' orientations rather than process-oriented ones (Miller, 2013). Knowledge-first orientations privilege conference presentations, papers in scholarly journals and other research outputs (Stoecker, 2009), often to the exclusion of adding value to community efforts designed to address the issues being researched.

Community groups hold more than knowledge about the challenges they face; community-engaged research typically acknowledges this and, therefore, seeks to engage residents in expressing ideas for solutions. However, localized, whole-of-society frameworks can go further. There are frameworks emerging, like the Connected Community Approach, which suggest that the act of researching itself has the potential to strengthen the social fabric of a community (Poland et al., 2021). Actions that strengthen social fabric contribute to the underlying conditions that make it possible for people living or working in a given community to be drivers of and actors in local change efforts. These conditions include:

- a sense of belonging, inclusion and agency
- regular and meaningful opportunities to learn across cultures and difference
- seamless access to supports needed to thrive
- effective entry points to meaningful civic participation and the confidence to advocate for what they need
- trust in one another, organizations and institutions
- respect for and capacity to steward the land that in turn nurtures them

Social fabric requires local 'relational infrastructure'. When this relational infrastructure is weaker, people can be less likely to participate in climate initiatives, public consultations, or adaptation programs. In turn, a lack of participation or engagement can limit the efficacy of support networks and mutual aid, the relevance of systems-level strategies, and the capacity for collective action in the face of a climate emergency (Climate and Equity Lab, 2024). The need for reciprocity and relational infrastructure will be foundational if mainstream society is to learn from communities and from the deep knowledge of Indigenous Nations about mitigating

climate risk, fostering a sense of responsibility and care for the environment, and supporting community resilience (Wale and Huson, 2024).

In this age of polarization, strong social fabric and social networks of support cannot be taken for granted: a whole-of-society strategy requires us to ask ourselves: when we engage with and in communities, what value do we add to those communities? How are we strengthening or weakening local efforts and the relational infrastructure that makes them possible?

Cross-Sector Multiple Strategies Grounded in Community

The 17 SDGs, which can and often are viewed as stand alone, even siloed agendas, play out in an interconnected way in communities. Breaking down silos is an act of decolonization: Aboriginal Housing Management Association (AHMA) stresses this by proclaiming that “one size does NOT fit all: policies, programs, emergency planning [and risk narratives] should not be done in silos, or ignore the distinct strengths, vulnerabilities, and needs of [differing] communities” (2023). Risk narratives should include place-based knowledge and experience, targeting the specific needs, values, and priorities of each community (Wales and Huson, 2024).

Unfortunately, the idea of 'community work' i.e., providing support so that localized strategies, plans and actions can thrive, is often either seen as a 'nice to have' extra that is outside of the important work of true climate action, or downloaded onto the backs of under-resourced, overworked and ill-equipped social service organizations (Poland et al., 2021). In Ontario, these organizations are typically funded to help individuals cope with the impacts of ongoing stresses related to poverty and marginalization and acute shocks brought on by climate change. As individual needs increase, these organizations become increasingly stretched meeting individual survival needs, which has an inverse relationship to their capacity to support proactive climate strategies, plans, and actions.

In a pre-pandemic study, the Toronto Environmental Alliance looked at the relationship between community hubs and climate change efforts, and found that residents and hub staff were only able to turn their attention to prevention and mitigation strategies if they had dedicated, context-specific support. They found that dedicated time and space, an ongoing commitment to shared decision-making and mutual learning from all partners (including researchers) was necessary to ensure equitable, inclusive, and meaningful participation towards shared climate goals (Mah et al., 2018).

Local actors are positioned to play a central role in building healthy, equitable, and resilient low-carbon communities, but they must be equipped with the necessary resources and support to undertake this work together with other civil society partners, institutions and government. Environmental organizations, institutions and researchers can play a key role in collaborating with local actors to catalyze community climate action. However, this requires a willingness to replace conventional strategies, which aim to get community members to contribute to climate goals of systems-level actors, with approaches that centre community priorities, support local initiatives, and add value to what's happening on the ground.

There are frameworks and approaches that support researchers, institutions and municipal actors to centre communities and contribute to the local social fabric. These are methodologies that support researchers to contribute to cross-sector, multiple-scale climate solutions grounded in communities. One such framework is the Connected Community Approach, which was developed in a deep collaboration between community members, researchers, and practitioners. CCA and its 10 Keys provide helpful guidance for environmental actors who wish to engage in authentic community-building processes (Yoon et al., 2021). Using CCA and other related frameworks can support academics to simultaneously advance their own research priorities and strengthen strategies, plans and actions of communities they are associated with. In CCA, this type of approach is referred to as "working at multiple scales".

Working at multiple scales means strengthening the local social fabric and building connective tissue between local priorities and actions and municipal-regional climate mitigation and adaptation policies and strategies. Skills to work at multiple scales can advance researchers' capacities to contribute to whole-of-society locally relevant responses to climate risk in Ontario and elsewhere.

The Role of Research in Community-Centred Strategies

Researchers can play a unique role in breaking down silos, strengthening community social fabric, and building the connective tissue between policy-level strategies, plans and actions and the communities they impact. Playing this role effectively is perhaps a key to the kinds of transformational change a whole-of-society approach demands.

> "While there has been much discussion and debate about the need to better engage with, respond to, and include diverse communities in (sustainability) research, as well as acknowledgement of the many systemic barriers to doing so (in terms of organizational cultures and incentive structures, particularly within academia), guidance on how to

> operationalize such work is varied and field-specific, and the bandwidth (and prior training) of academics for this work remains constrained (Beaulieu, Breton and Brouselle, 2018; Bell and Lewis, 2022). At issue is not only the need for new understandings and practices, and incentive structures (signalling the need for both attitudinal and educational as well as structural change within academia) (see for example Wittmayer and Schapke, 2014), but also the need for credible trusted intermediaries with deep roots in community as skillful brokers between the worlds of academic research and those of (especially, marginalized) communities (Levcoe & Cutler, 2018)" (Poland et al., 2021).

In the Connected Community Approach, for example, connective tissue is seen as created only when academics, institutions or governments commit to:

- Actively removing barriers to opportunity
- Engaging in concerted and intentional processes to decolonize their practices and develop anti-racist strategies, plans and actions
- Prioritizing their own capacity building to enable them to collaborate effectively across mandates and scales
- Investing in mechanisms so that residents and professionals can design solutions together
- Grounding strategies, programs, research and funding intended to benefit the community in the local context.

There are projects underway which seek to build on the strengths of community-engaged research to position researchers as active agents of change in this space. The facilitators of the "Connected Communities: Advancing whole of society approaches to addressing climate risk" session at the 2024 Beatrice and Arthur Minden Symposium, for example are deeply involved in the Visionary Communities project in which researchers and community development practitioners are co-developing methodologies that integrate the best of Community Engaged Research, Transdisciplinary Knowledge Co-production and the Connected Community Approach as a means of simultaneously addressing issues of equity, geographic marginalization and climate risk in Ontario.

Challenges and Opportunities

Among the challenges of implementing a whole-of-society approach to climate risk that is grounded in community is a tension between the urgency of the climate crisis and the time it takes to build community-based relational infrastructure: as a society, we have not prioritized either the social fabric of communities or the connective

tissue between communities and climate solutions taking place at a systems level, so, with the effects of colonisation and other forms of marginalization constantly at play, we are often starting from a deficit position. Added to this very real challenge are the cultural, attitudinal and structural differences between what has been defined as climate risk mitigation (typically related to technology and hard infrastructure) and what we see as community work. There are differences in worldviews, and the language and knowledge base used in academia and that used at the community level and especially by Indigenous Nations. Critically, a further significant challenge lies in the under-resourcing of the very intermediaries that are positioned to support local social fabric and connective tissue between systemic change and community-led climate mitigation and adaptation efforts.

But there are opportunities too. Some of those opportunities lie in the role of research and the act of researching and its potential to bridge across worldviews, silos and scales and ground solutions in a community context. These opportunities and what it would take to operationalize them are the subject of exploration in the "Connected Communities: Advancing whole of society approaches to addressing climate risk" session at the 2024 Beatrice and Arthur Minden Symposium.

Fence coming down. Photo by East Scarborough Storefront.

OUTCOMES FROM THE SESSION

Session Overview

This session, led by Anne Gloger, Executive Director at Catalysts' Circle and Community Partner at Visionary Communities, explored the criticality of centering communities in climate risk mitigation and climate resilience work. Community-engaged research recognizes the value of local knowledge in seeking solutions to some of our most intractable problems. However, leveraging individual perspectives and voices to inform the actions of policy makers and other systems-level players only goes partway: there is also transformational potential for researchers and the act of researching itself to advance community-centred climate mitigation and adaptation strategies. Exploring these possibilities was a key goal of this session.

Anne's work as a community development practitioner for the past 30 years, and her current work with Visionary Communities and Catalysts' Circle, guided the core themes of this session that centered around connecting communities with large systems like policy, institutions, and research — that often tend to dictate socio-economic outcomes for communities. A related theme explored in this session revolved around the risks of (re)producing inequities and vulnerabilities in the design and implementation of climate solutions that do not appropriately and equitably engage communities. Other core themes included the importance of collaborative, whole-of-society approaches to climate adaptation, cultivating and nurturing community-university partnerships, and ensuring knowledge sharing and trust building between researchers and communities, with the help of intermediary organizations.

Anne's presentation was followed by three short presentations by the graduate students Janna Radi Mohamed, Majd Al-Shihabi, and Mahassen Ramadan, who were involved in the Visionary Communities project. After each presentation, participants were presented with questions to reflect on and discuss in smaller groups at their respective tables.

Overall, the session emphasized the urgency of integrating communities into climate planning in Ontario, where diverse vulnerabilities and local expertise underscore the need for nuanced, community-centered strategies.

Contextualizing the conversation

The session was framed through an initial presentation by Anne Gloger, exploring some key arguments around the need for centering communities in climate work and building foundational relationship- and trust-based networks to advance this work. These included:

Gaps in how system-level players view communities

Anne emphasized that through her work, she has repeatedly witnessed systemic fragmentation in communities, where system-level players have diverging or incompatible ideas of how they want to involve communities, with little consideration of community agency. She highlighted four ways in which communities are primarily viewed by system-level players in the current paradigm:

- Sites of intervention where vulnerable people live
- Sites for doing "good work" or "charity"
- Sites where nice-to-have changes happen far from "real" climate action
- Sites for observation and study.

The limitations of such top-down approaches were discussed, highlighting the fact that without meaningful grassroots engagement, climate policies risk being ineffective and worsening social inequities. If communities are not equitably and meaningfully engaged, there is a risk of not only deepening and (re)producing inequities and vulnerabilities, there is also the risk of not getting community momentum and buy-in, thereby weakening the effectiveness of the solution.

Localizing solutions and whole-of-society approaches are essential

It was acknowledged that the UN estimates that 65% of the Sustainable Development Goals (SDGs) will not be achieved unless they are embedded at the local level and that achieving the SDGs require whole-of-society efforts to create strategies in which no one is left behind.

Anne emphasized the need for local strategies, plans and actions to be included in the development and implementation of climate policy, strategies and actions: without it, there is increased risk of losing key expertise, critical to the relevance of policy impacts at the local level. Examples include the East Scarborough Storefront, which focuses on strengthening the social fabric of the community, which was illustrated in the story of the "sky-o-swale"- a green roof structure co-designed by local youth and made out of repurposed materials — and further illustrated through stories of the co-creation of an Eco Food Hub kitchen and community gardens.

She also highlighted that in her work with Catalysts' Circle, their goal is to ground research in local and place-based contexts, invest in knowledge translation, particularly in terms of vocabulary and terminology, and strategically leverage local intermediaries.

Whole-of-society approaches were emphasized for their ability to address systemic barriers that hinder the ability of communities to play active roles in transformative change.

It was also highlighted that although climate urgency demands rapid action, sustainable outcomes require a slower, relationship-focused approach to build trust and ensure community-driven solutions: go slow to go fast.

Connected community approaches are critical for equitable solutions

The Connected Community Approach (which evolved over 25 years with and in communities) suggests that the act of researching itself has the potential to strengthen the social fabric of a community (Poland et al., 2021). Actions that strengthen social fabric contribute to the underlying conditions that make it possible for people living or working in a given community to be drivers of and actors in local change efforts. These conditions include:

- a sense of belonging, inclusion and agency
- regular and meaningful opportunities to learn across culture and difference
- seamless access to supports needed to thrive
- effective entry points to meaningful civic participation and the confidence to advocate for what they need
- trust in one another, organizations and institutions
- respect for and capacity to steward the land that in turn nurtures them

The Connected Community Approach, adapted for climate resilience, involves working with local intermediaries, learning from local knowledge, and fostering collaborative, strategic relationships.

These approaches are not without their challenges

Anne explored some challenges in operationalizing these lenses and approaches to climate risk and resilience work, which Catalysts' Circle is working to address, including:

- **Trust Deficit:** There's widespread distrust in experts and institutions due to perceived failures, requiring researchers to build credibility through genuine, non-extractive engagement.
- **Limited Localization Mechanisms:** Global climate strategies often lack tools for localized adaptation, leaving communities without actionable solutions relevant to them.
- **Communication Barriers:** The disconnect in language and goals between academia and communities creates obstacles in translating research into practical community actions.
- **Political and Funding Constraints:** Community-based projects frequently face challenges in obtaining long-term funding and political support, which is often directed at broader, less localized goals.

Session discussion

Presentation 1: Janna Radi Mohamed

Janna, who is an MHSc student at The Dalla Lana School of Public Health, University of Toronto, presented her research, which finds that communities are facing multiple stressors and levels of vulnerabilities that include, go beyond, and intersect with climate risk. She spoke about her work that looks to support local communities in synthesizing the barriers, opportunities, and tools required to build climate resilience. She acknowledged that her work with the Visionary Communities project in East Scarborough showed her that the expertise she had gained in public policy and climate was very different from the local knowledges harboured within communities. She emphasized that it was critical for her to understand the local context to be able to meaningfully do this work.

She elaborated on her work with Visionary Communities and emphasized that just looking at grey and academic literature and conducting interviews with community members was not enough. She emphasized that interpreting this data was not doable alone, and it was critical to have the community members involved to contextualize what the data means. Therefore, it was important to drop the ego as a researcher and validate findings with the communities.

She asked the tables to discuss 2 questions:

Would your research benefit from having a connection to grassroots or community action? Why or why not?

What do you know or would you want to know about local communities in order for your research to be as useful as possible on to the ground efforts?

In response, one participant said that she struggled with connection to grassroots community action because she didn't want to feel like she was "examining them" without their involvement. There was general agreement that conventional research methods of observation and data collection are extractive and treat communities as a 'petri dish', there to be studied. There was discussion about how a transdisciplinary lens requires that researchers work alongside community groups/organizations who are active agents of change in their own right.

Presentation 2: Mahassen Ramadan

Mahassen's presentation also focused on her work with Visionary Communities. She joined UofT for an MEd in Community Development and has also worked with the social justice department. She is now doing a PhD. She elaborated on her research, which looks at cultural representation and belongingness and the phenomenon of 'othering', and is aimed at building social resilience.

She spoke about her research, which looks at the following aspects of community engagement and resilience:

- Working at multiple scales
  - For example, community mapping and Community Speaks events
    - She emphasized that community events need to be scheduled to accommodate community residents and community advocates
    - Each community event has different purposes and may target different demographics in the community, for example, harvest events vs newcomers' events
    - In order to translate knowledge from events, she highlighted that it's important to attend community events in person and to debrief afterwards

- Learning at multiple scales
  - The goal is simultaneously to share knowledge and learn from communities

Mahassen asked the tables to discuss the following prompt:

What expertise do you have to offer to communities?

In response, one participant highlighted that their organization provides climate science information and brings climate education to high school students to alleviate as well as understand climate anxiety.

Another participant presented Curbcut, which provides support and expertise to put data into a spatial web-based tool for communities to easily use and understand for their local data needs.

There was a brief discussion about how we might work differently so that these kinds of knowledge might fuel what is already happening in communities.

Presentation 3: Majd Al-Shibab

Majd presented his work with Visionary Communities on participatory modelling for improved housing policy for Toronto. He talked about the need for human connection in participatory modelling and told the story of a community member he met at a local harvest festival. The interaction sparked a new and deeper understanding that led to his reimagining what participatory modelling might look like. These kinds of transformative moments were made possible because he was working with an intermediary, the East Scarborough Storefront. He emphasized that intermediaries also help frame research questions to be more thoughtful and meaningful.

This presentation had several key arguments and takeaways, including:

- Relationships are the heart of centering communities in climate work — it is critical to reflect on how to build those relationships, how to deeply listen to communities and the local priorities they are trying to advance, and how to leverage intermediaries and community centres in doing so.
- A critical barrier in doing this work is community distrust/mistrust about the knowledge that "experts" bring in — therefore, it is critical to acknowledge and understand different forms of knowledge and how they relate to the local context, as well as make connections across sectors and scales.
- Reciprocity in research and community work is essential. Communities are not just a data source — it is critical for researchers to think about how what they offer might be made meaningful to communities and to work in ways that do not build extractive relationships.
- Working with communities is a source of joy. Advancing community priorities with the community can be fun, and there's a lot of connection and joy to be had at communal gathering spaces such as community centers and events.

Research priorities and practical next steps

Strengthen Support for Localized Efforts: Develop policies and implementation strategies that support community driven projects and fund initiatives/

intermediaries that link local initiatives to larger systemic change efforts.

Prioritize Knowledge Translation and Trust-Building: Researchers should adapt language to local contexts, prioritize reciprocity in data-sharing, and employ intermediaries trusted within communities.

Leverage Existing Community Networks: Fund and engage intermediaries such as local libraries, health organizations, and community centers to facilitate Connected Communities, foster continuous community engagement, and bridge institutional gaps.

Incorporate Fun and Joy: To encourage long-term engagement, support community hubs that foster both climate action and community enjoyment, making them welcoming, multipurpose spaces.

Expand Policy and Funding for Grassroots Projects: Shift from treating community-led projects as isolated successes to exploring ways they can be integrated as elements of climate strategies.

Enhance Community Development/ Knowledge Translation Skills for Researchers: Prioritize training for researchers in effective, context-sensitive communication.

Support Intermediary Roles: Recognize intermediaries' critical role in fostering ongoing engagement and mutual understanding.

Incorporate Relationship and Trust Metrics in Project Planning: Ensure that projects prioritize trust-building and reciprocal engagement as essential components of climate resilience.

Examples/Case Studies

Green Roof Project (Sky-o-Swale): A youth-led initiative for a rooftop water filtration and harvesting system, using repurposed materials. This project addressed climate resilience through community-driven innovation.

Image: Alec Ring Architecture Inc.

Eco-Hub with Circular Systems: Community members transformed an abandoned police station into an eco-hub with composting and gardening, addressing food security and climate resilience while reducing isolation.

Food Sovereignty in Kingston-Galloway/Orton Park (KGO): Research found community-led kitchens and gardens addressing immediate food insecurity, with a move towards long-term food sovereignty supported by local organizations.

Harvest Event & Backpack Program: These local events, aimed at diverse community demographics, highlighted the role of intermediaries in fostering engagement and sharing knowledge relevant to community needs.

Other notes

Role of Intermediary Organizations

Local intermediaries, also known as community backbone organizations or integrators, serve as critical conduits for knowledge exchange, providing spaces for ongoing dialogue and enabling researchers to refine their questions and align them with community priorities.

Future Visioning Exercise

Participants imagined 10-year outcomes of community-centered climate work, emphasizing the importance of whole-society approaches where no community is left behind.

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Climate Risk and Agriculture and Food Systems in Ontario

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BACKGROUND BRIEFING

Vulnerability and adaptation to climate risks in Ontario agriculture and food system

Ontario's food and agriculture sector employs over 700,000 people (approximately 10.3% of provincial employment) and contributes approximately $45 billion to the provincial GDP (6.4% of total GDP) (Ontario Ministry of Agriculture, Food and Rural Affairs, 2022). Ontario is identified as Canada's top agri-food exporting province, with $19.6 billion in agri-food exports recorded in 2021 (Ontario Ministry of Agriculture, Food and Rural Affairs, 2022; Ontario Provincial Climate Change Impact Assessment Technical Report, 2023).

Ontario's agriculture and food sector is sensitive to regional climatic conditions, with changing temperature and precipitation patterns directly influencing productivity and other facets of the sector. While changing climate conditions may present potential opportunities for agriculture in Ontario (e.g., longer growing and grazing seasons), such benefits will likely be offset by negative impacts such as increased pests, water stress, and extreme weather risks, resulting in declining productivity, crop failure, and livestock fatalities. Several field crops and fruit and vegetable commodities (e.g., corn, cereals, soybeans, grapes, field vegetables) are expected to face 'very high' climate risk by the end of the century (Ontario Provincial Climate Change Impact Assessment Technical Report, 2023; Agriculture and Agri-Food Canada, 2020).



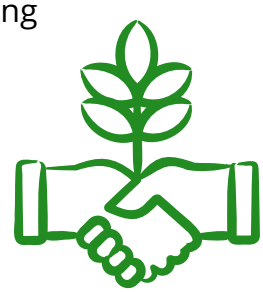
Climate change adaptation options for the agriculture sector

1. Adaptation Through Technological Development

Adaptation through technological development in agriculture involves several key innovations. Crop development, including new varieties, hybrids, and cultivars, can enhance tolerance to changing temperatures, moisture levels, and other climatic conditions through methods like conventional breeding, cloning, and genetic engineering (Smit and Skinner, 2002; Reid, 2007).

Additionally, advanced weather and climate information systems support farmers by providing accurate predictions that aid in decision-making for planting, spraying, and harvesting (Smit and Skinner, 2002). Resource management innovations, such as integrated drainage systems, efficient irrigation, and alternative tillage methods, also help manage water resources amid climate risks like droughts and floods (Smit and Skinner, 2002).

2. Adaptation Through Government Programs



Adaptation through government programs involves modifying existing subsidy and support programs, such as crop insurance, income stabilization, and ad hoc compensation, to influence farm-level risk management strategies (Smit and Skinner, 2002). Resource management policies that promote efficient land and water use can further support agricultural adaptation by accounting for changing climate conditions (Smit and Skinner, 2002).

The Ontario Federation of Agriculture (OFA) acknowledges climate change as a significant threat to Ontario's agricultural sector and advocates for policies and programs that support farmers in mitigating greenhouse gas emissions and adapting to climate impacts. The OFA emphasizes the importance of promoting beneficial management practices, investing in precision agriculture, and enhancing ecological goods and services. Additionally, the OFA opposes carbon pricing policies that increase production costs and underscore the necessity of government support for research, innovation, and resilience-building initiatives (Ontario Federation of Agriculture, 2023).

3. Adaptation Through Changes in Farming Practices

Adaptation through changes in farming practices involves strategies like diversification, where adjusting crop and livestock varieties to match environmental

variations and economic risks can boost resilience. This can include crop substitution and altering production intensity (Smit and Skinner, 2002). Modifying land use and topography by relocating production, adopting alternative fallow and tillage practices, and altering landforms can address challenges such as soil erosion and moisture deficiencies (Smit and Skinner, 2002).

Efficient irrigation practices help mitigate the risk of income loss from recurring droughts and changing moisture levels (Smit and Skinner, 2002). Agroforestry, which integrates trees into agricultural systems, can further enhance climate resilience by improving soil health, increasing biodiversity, mitigating extreme weather impacts, and providing alternative income streams while also sequestering carbon (Verchot et al., 2007; Garrity et al., 2010; Schroth et al., 2013).

4. Adaptation Through Farm Financial Management

Farmers can adapt to climate-related risks through several financial strategies. Purchasing crop insurance helps mitigate risks associated with climate-induced income loss (Smit and Skinner, 2002). Diversifying household income sources, such as engaging in off-farm employment, can also reduce vulnerability to climate-related financial challenges (Smit and Skinner, 2002). Additionally, participating in government-supported income stabilization programs provides a buffer against the economic impacts of climate variability, offering further financial protection (Smit and Skinner, 2002).

5. Community-Based Adaptation

Engaging local communities in adaptation planning ensures that strategies are context-specific and culturally appropriate. Community-based approaches emphasize traditional knowledge and participatory decision-making processes (Reid et al., 2009; Dodman and Mitlin, 2013; Ensor and Berger, 2009).

Impact of climate change on urban food systems: Case study in Toronto

Toronto's food system faces potential disruptions from climate change, primarily through extreme weather events such as flooding, heatwaves, and ice storms. These can disrupt the food supply chain, affecting everything from food processing facilities to distribution centers and retail outlets (Zeuli et al., 2018; City of Toronto, 2018).

The city's food system is highly dependent on critical infrastructure, including electricity, transportation, and fuel supply. Disruptions to these systems can significantly impact food availability and access. Toronto's reliance on external food sources and its "just-in-time" distribution model exacerbates these risks (Zeuli et al., 2018). Certain neighbourhoods in Toronto, particularly those with higher rates of food insecurity, are more vulnerable to climate-induced food disruptions. These areas often have fewer food retail options and higher concentrations of low-income residents (Zeuli et al., 2018; City of Toronto, 2018).

Building resilience within urban food systems involves a multi-faceted approach that includes **policy integration, infrastructure improvement, and community involvement**. It is suggested that local governments must play a pivotal role in supporting adaptive strategies, such as enhancing local food production through urban agriculture, investing in resilient infrastructure, and fostering community-based solutions like food co-ops and neighbourhood resilience plans. Innovative practices like vertical farming and rooftop gardens can contribute to reducing dependency on external food sources, thereby strengthening local food security. Collaborative efforts between public, private, and non-profit sectors are also vital for addressing climate-induced vulnerabilities and ensuring a coordinated response during emergencies (Zeuli et al., 2018; City of Toronto, 2018).

Social Justice and Equity in Food Systems

Historical Context and Structural Inequities

Structural inequities, rooted in racial, economic, and social disparities, significantly shape access to food. In urban areas, food deserts — neighborhoods with limited access to affordable and nutritious food — are disproportionately found in communities of color and low-income populations (Das and Ramaswami, 2022; Washington, 2020). These inequities are further compounded by climate change, which exacerbates vulnerabilities by disrupting food supply chains and increasing the cost of food.

The historical and ongoing impacts of colonialism have significantly shaped global food systems. Colonial practices disrupted Indigenous food systems, appropriated land, and imposed agricultural methods that prioritized monocultures and export-oriented production over local food sovereignty. This legacy persists today, as Indigenous and marginalized communities often face food insecurity and have limited access to land and resources necessary for sustainable food production (Chiblow, 2019; Tribaldos, 2022).

Moving Toward Equity and Justice in Food Systems

Indigenous Food Sovereignty:
Indigenous food sovereignty is a key concept in the movement toward equitable food systems. It emphasizes the right of Indigenous peoples to control their own food systems, including the production, distribution, and consumption of food. Chiblow (2019) discusses how Indigenous food sovereignty is intertwined with climate justice, as Indigenous communities are often on the front lines of climate change and have valuable knowledge and practices for sustainable food systems. Supporting Indigenous food sovereignty is essential for rectifying historical injustices and promoting ecological sustainability.

Equitable Food Policies:
Policies that promote equity in food systems are critical for addressing structural inequities. Hammelman (2019) explores the challenges of supporting social justice through food system governance, highlighting the need for policies that prioritize the needs and voices of marginalized communities. Equitable food policies should adress issues such as access to land, fair wages for food workers, and the availability of healthy food in underserved communities.

Collaborative Approaches to Food Justice:
Collaborative approaches that involve diverse stakeholders, including marginalized communities, are essential for achieving food justice. Cawley (2020) discusses the importance of collaboration in creating just local food systems, particularly in the context of climate change. By bringing together different perspectives and knowledge systems, collaborative approaches can develop more holistic and equitable solutions to food system challenges.

Community-Based Food Initiatives in Ontario

Initiatives in Eastern Ontario aim to ensure that all residents have access to healthy, culturally appropriate food produced through sustainable methods. This involves maximizing community self-reliance and promoting social justice (Hamm and Bellows, 2003; Andrée et al., 2015; Sustainable Food and Farming Futures Cluster, 2024).

The region hosts various community-based food initiatives, including food access programs, local food promotion, farmer cooperatives, integrated food and farming projects, and private distribution businesses. These initiatives address issues like food security, sustainable agriculture, and local economic development (Andrée et al., 2015). Programs like food banks and community food centers (CFCs) focus on providing food access to low-income communities.

They often emphasize community development and food skills education, aiming to empower individuals and reduce dependency on food charity (Saul and Curtis, 2013; Ballamingie and Walker, 2013). Initiatives such as Savour Ottawa and Kawartha Choice Farm Fresh promote local food consumption through marketing, branding, and educational campaigns. These projects seek to support local farmers and boost regional economies by encouraging consumers to buy locally (Ballamingie and Walker, 2013; Andrée et al., 2015; Just Food Ottawa, 2024).

Source: Acorn Creek Garden Farm/Savour Ottawa

Many initiatives are organized as cooperatives, promoting collective ownership and decision-making among farmers and consumers. These cooperatives often receive support from government programs and non-profit organizations, highlighting the importance of collaboration in building sustainable food systems (Ballamingie and Walker, 2013; Andrée et al., 2015).

Source: O'Brienview Farms/Kawartha Choice Farm Fresh

Challenges and Opportunities

Community-based food initiatives face challenges from neoliberal policies that prioritize large-scale, industrial agriculture. This includes regulatory barriers, limited funding, and market pressures that often disadvantage small-scale producers and local food systems (Andrée et al., 2015). However, it is argued that many alternative food movements, while opposing the dominant agri-food system, inadvertently reproduce neoliberal characteristics by emphasizing consumer choice, market solutions, and individual responsibility (Guthman, 2008). Community-based food initiatives in Ontario demonstrate potential for transformative change. By emphasizing collaboration, social justice, and ecological sustainability, these initiatives can challenge dominant food systems and promote more equitable and sustainable alternatives (Levkoe, 2011).

Photo by Karolina Grabowska/Pexels

OUTCOMES FROM THE SESSION

Session Overview

The “Climate Risk & Agriculture and Food Systems” session explored the current landscape, challenges, and future directions for agriculture and food systems in the face of climate change in Canada, with a particular emphasis on Southern Ontario. Led by Dr. Michael Classens from the School of the Environment at the University of Toronto, the session convened a group of researchers, community leaders, and practitioners to examine how climate change intersects with critical issues in the food system.

Central to the conversation were four interrelated core themes: food security, food justice, sustainable food systems, and the role of networks and collaborations. Discussions emphasized that food security and food justice involve not only the access and availability of food, but also fair distribution mechanisms that address the systemic inequities experienced by marginalized groups, including Indigenous communities, racialized individuals, and youth. Sustainable food systems were discussed in terms of their environmental, economic, and social dimensions. Network- and relationship-building were highlighted as essential for facilitating knowledge exchange, mobilizing resources, and coordinating cross-sectoral responses to complex climate and food-related challenges.

Several key focus areas emerged during the session. Multifaceted impacts of climate change on food systems were discussed — ranging from disrupted growing seasons to volatile supply chains — and the cascading effects these disruptions have on food availability and affordability. Marginalized communities disproportionately bear the burden of these impacts, reflecting the ongoing realities of food deserts, inequitable land access, and discriminatory planning policies. Food pricing was another central

concern, often tied to factors like transportation costs, fossil fuel dependency, and housing insecurity. The need for more robust, just, and context-specific food policies was highlighted, and the political and structural barriers to meaningful changes were discussed. Educational engagement — particularly with youth — was also flagged as a key avenue for transformation, as was the need for innovative, equity-centered models of governance and community resilience.

The session began with an overview of recent and ongoing work in the field, followed by a discussion of the most pressing challenges currently facing agriculture and food systems in Ontario. It concluded with suggestions for potential next steps to build more equitable and climate-resilient food futures.

Current Work and Projects

Several participants shared ongoing initiatives that address climate risks in agriculture and food systems:

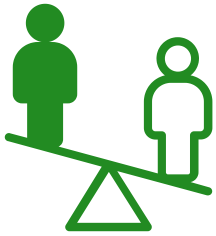
- **Michael Classens:** Jointly funded positions with United Way and University of Calgary to bridge academic and community efforts.
- **Marney Isaac:** Developing regionally adapted seed sources; long-term crop resilience projects; agroforestry and urban agriculture policy work.
- **Ashleigh Domingo:** Working on food sovereignty and food system sustainability through a phased approach and strength survey.
- **Kerry-Ann Charles:** Focused on land relationship planning, capacity-building for food sovereignty, and language change in planning discourse.
- **Ian Clarke:** Designing zero-heat rooftop greenhouses and sustainable dye products at OCAD University.
- **Rebecca Wallace:** Creating resilience hubs and networks prioritizing Black, Indigenous, and People of Color (BIPOC) communities through United Way partnerships.
- **David MacLeod:** Analyzing food-energy dependencies and municipal food system sustainability in Toronto.
- **Amanda Shankland:** Research on climate impacts on agriculture and postdoctoral work on transboundary basin resilience.
- **Sarah Elton:** Tracking food flows through the Ontario Food Terminal and exploring public-private infrastructure differences.

The session also brought attention to several other organizations actively working in this space. These include grassroots and community-based networks such as the Scarborough Food Network, Indigenous-led initiatives like the William Treaty organizations, and national-level players like Bioenterprise. Partnerships with entities like United Way and community land trusts further exemplify the importance of multi-sectoral collaboration.

Key Challenges Identified

The group identified several interconnected challenges affecting agriculture and food systems in Ontario and beyond. These challenges are rooted in broader structural and systemic issues and can be addressed with coordinated action, policy reform, and inclusive innovation.

Structural Inequities and Food Justice



Food injustice refers to the cultural and financial barriers that prevent fair and adequate access to food. The session emphasized that Indigenous Peoples, racialized communities, low-income populations, and youth face disproportionate food insecurity. There is a need to move away from a one-size-fits-all approach and instead recognize food as culturally embedded. Food deserts — areas where residents lack access to affordable, nutritious, and culturally appropriate food — are not simply the result of geography, but of structural inequalities. They are shaped by colonial land dispossession, exclusionary zoning policies, and market-driven planning that prioritizes profit over equitable food access.

Food Affordability

The affordability of food continues to be threatened by complex and often opaque factors such as global supply chain disruptions, fertilizer and fuel costs, and climate variability. These costs directly impact food prices and availability, particularly for those living paycheck to paycheck. In addition, the housing crisis further compounds food insecurity, as limited financial resources force individuals to choose between housing, food, and other necessities.

Fragmented and Inadequate Food Policy Frameworks

Participants noted a fragmentation of food policies across the country. There is a general lack of national coordination, and where policies exist, they are either too restrictive for small farmers or not effectively enforced. Many felt uninformed about developments in other regions and emphasized that the policy environment does not support just, sustainable, or sovereign food systems. A paradigm shift is needed to move beyond bureaucratic processes and toward transformative change backed by political will.

Food Sustainability

The current food system, heavily reliant on fossil fuels and industrial farming, was seen as unsustainable in the long term. Key concerns included the viability of local farming, the politicization of climate-friendly diets, and the declining biodiversity in the food supply. Participants discussed how GMOs and large seed companies disproportionately benefit industrial-scale farms, while small farmers struggle to survive in a system not designed to support them.

Limited Research on Emerging Risks and Technologies

The need for further research into the unintended consequences of emerging technologies in agriculture was highlighted in the session. Geoengineering techniques — such as solar radiation management and carbon dioxide removal — and weather modification methods like cloud seeding have been studied primarily for their roles in climate mitigation and precipitation control. However, their specific impacts on agriculture and food systems remain largely underexplored, particularly in relation to local ecosystems, long-term viability, and social equity. Existing studies tend to focus on technical feasibility or global climate models, with little attention paid to how these interventions intersect with food justice, small-scale farming, or community resilience. Participants emphasized the importance of understanding not only the scientific dimensions of these technologies, but also their social, cultural, and economic implications within diverse agricultural contexts.

Participants also raised concerns that existing insurance models and crop prediction tools often fail to serve the needs of smaller-scale or diverse farming operations. These tools are typically designed around industrial, monoculture-based systems, which can exclude or disadvantage farmers practicing agroecology, traditional farming, or localized food production. Moreover, dominant yield-maximizing models tend to prioritize short-term outputs over environmental sustainability, reinforcing extractive practices rather than supporting regenerative ones.

The Need for Inclusive, Just, and Contextual Innovation

There is a growing call for creative and equitable innovations in the food system. This includes not only new technologies but also new governance frameworks, funding models, and community-based strategies. Participants highlighted the need for localized, culturally rooted, and justice-oriented approaches that go beyond technical fixes and embrace systemic transformation.

Engaging Youth in Food Systems Education and Leadership

The lack of youth involvement in food systems was identified as a potential gap. Compared to past generations, today's youth have limited exposure to food production and land stewardship. Participants advocated for food education in schools, youth-centered agricultural programs, and leadership pathways that can nurture the next generation of food justice advocates.

Potential Solutions and Next Steps

Building on the identified challenges, participants proposed a range of actionable strategies aimed at transforming Ontario's food systems in the face of climate change. These strategies integrate community engagement, policy reform, interdisciplinary collaboration, and inclusive education to create resilient, equitable, and sustainable outcomes.

1. Cross-Sector and Multi-Level Collaboration for Systemic Change

Participants emphasized the importance of fostering partnerships that bridge gaps between academic institutions, communities, and government bodies. Examples include jointly funded positions, such as those supported by the United Way and the University of Calgary, which enable meaningful engagement across sectors. Vertical collaborations between municipal, provincial, and federal governments are critical to aligning policies, while horizontal collaborations — spanning cities, provinces, academic institutions, non-profits, and grassroots organizations — help generate creative solutions, pool resources, and share knowledge.

2. Integrated Policy Approaches to Improve Food Access and Affordability

Discussions underscored the need to frame food affordability not as an isolated issue, but one deeply connected to housing, transportation, and energy. Participants recommended integrated policy approaches that treat food and housing affordability as co-dependent, advocating for social safety nets and subsidies that ensure equitable access to nutritious, culturally relevant food. Reevaluating how affordability is measured and addressed could enable more effective interventions at both the local and national levels.

3. Reframing Food Standards to Reduce Waste and Support Sustainability

Challenging societal norms around food appearance was seen as a strategy for reducing food waste. Participants pointed to the retail rejection of 'imperfect' produce — like curly cucumbers — as a missed opportunity for both sustainability and equity. Efforts should be made to normalize aesthetic diversity in fruits and vegetables, re-educate consumers, and adjust store procurement practices. This not only prevents food waste but also supports farmers and improves affordability.

4. Empowering the Next Generation Through Food Literacy and Leadership

The role of education in shaping resilient food systems was emphasized. Participants advocated for integrating food literacy, climate education, and gardening programs into school curricula. Hands-on learning opportunities can reconnect youth with the land and foster awareness of food systems from a young age. Involving young people in community gardening, policy discussions, and advocacy efforts empowers them as future leaders and changemakers.

5. Making Food Systems Knowledge Public Through Inclusive Narratives

Effective public communication is essential for shifting perceptions and encouraging engagement. Participants highlighted the power of storytelling to make technical and localized knowledge accessible to a broader audience. By sharing lived experiences, best practices, and community narratives, stakeholders can bridge the gap between insular academic or institutional knowledge and public understanding. This also helps build support for new policies and practices grounded in justice and sustainability.

6. Centering Indigenous Knowledge and Leading Transformational Change

Participants stressed the importance of Indigenous-led approaches to food and land stewardship. This includes adopting land-relationship planning models that reflect Indigenous values and worldviews, rather than traditional land-use frameworks. Transformational change requires moving beyond tokenistic inclusion toward meaningful collaboration that recognizes Indigenous leadership, sovereignty, and knowledge systems. The shift also includes rethinking success metrics and governance structures to better reflect holistic and intergenerational well-being.

Conclusions

The session highlighted the need for integrated, just, and sustainable approaches to address climate risks in agriculture and food systems. It is emphasized that meaningful change requires moving beyond incremental reforms toward transformative action grounded in justice, collaboration, and ecological resilience.

Bringing together diverse perspectives — from community practitioners to academic researchers — was seen as essential to building food systems that are resilient, equitable, and sustainable. Strengthening partnerships, centering marginalized voices, and investing in education, particularly for youth, were identified as potential next steps in reimagining food futures in a changing climate.

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Image: World Refugee & Migration Council /Flickr/Texas Military Department.

Climate Risk and Mobility in Ontario

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BACKGROUND BRIEFING

Situating climate (im)mobilities in an Ontario and Canadian context

Climate (im)mobility refers to the movement or mobility choices of people in a world affected by climate change, including climate impacts and climate risks, as well as the structures that underpin these decisions. It encompasses a broader and more complex set of human movements than those traditionally captured by terms like "climate migration", which engages more narrowly with how climate affects migration systems. This concept recognizes that climate-driven mobility involves not just the displacement of populations due to environmental changes but also the decisions of and the agency with which individuals and communities seek opportunities and safe living conditions in the face of changing climates. Unlike the often narrow and sometimes stigmatizing narratives associated with "climate refugees," climate mobility encompasses a wide range of experiences, from voluntary to involuntary (forced) and migration to immobility, highlighting the agency, aspirations, and self-determination of those affected.

Moreover, the discourse around climate mobilities invites us to reconsider how we think about and respond to these movements not just as physical migrations but as an adaptation. It challenges the tendency to "other" those compelled to move, framing them as distant populations with problems that are not our own. This perspective can foster a more inclusive sense of global solidarity, encouraging us to see climate mobility not as a threat that must be guarded against or securitized but as a shared human experience that requires collective support and understanding. By reframing the conversation around climate mobility, we can counter divisive narratives and promote policies that address the root causes of climate-driven

movement while respecting the dignity and agency of those affected. In this way, climate mobility serves as a lens through which we can build empathy and foster a sense of global interconnectedness in the face of shared environmental challenges.

Understanding Climate Mobilities

Climate mobility operates at multiple scales (Rigaud et al., 2018; IDMC, 2021). It is dynamic, evolving with shifting environmental and socio-political landscapes (McLeman, 2019). Key characteristics of Climate Mobility are that it is:

1. **Place-based:** Rooted in specific geographical and cultural contexts
2. **Relational:** Influenced by connections between people, places, and institutions
3. **Multi-scalar:** Occurring at local, regional, national, and international levels
4. **Dynamic:** Constantly evolving in response to changing environmental and social conditions (McLeman, 2019; Schipper et al., 2014)
5. **Non-generalized:** (Im)mobility, whether voluntary or involuntary, due to lack of resources, infrastructure, or opportunity (Adger et al., 2015).

Key Issues in Climate Mobility

Complex Drivers

Climate mobility is influenced by a combination of environmental, economic, social, and political factors (Cattaneo et al., 2019).

Scale and Scope

Climate mobility includes various forms of movement, from temporary displacement to permanent relocation, occurring at local, national, and international levels (Rigaud et al., 2018).

Adaptation Strategy

Mobility can be a crucial strategy for climate adaptation, allowing individuals and communities to move away from areas prone to environmental risks, such as rising sea levels, floods, or droughts. By relocating, people can improve their chances of survival and secure better living conditions, access to resources, and economic opportunities. However, mobility as an adaptation strategy is not always feasible or desirable for everyone. For many, particularly those with limited financial resources, strong cultural ties to their land, or social obligations, moving may not be a viable option (McLeman, 2019). Immobility, whether voluntary or involuntary, often leaves people in harm's way without the capacity to adapt. Additionally, adaptation strategies can be implemented as mechanisms of co-option. This happens when the concept of adaptation is used by external actors, such as governments or

corporations, to justify forced relocations or shifts in land use that disproportionately benefit those in power while marginalizing vulnerable communities. For example, large-scale development projects, often branded as climate-resilient, can displace local populations in the name of adaptation, stripping them of their land and livelihoods. In such instances, the agency of affected communities is undermined, and adaptation strategies become tools for exploitation rather than genuine resilience-building.

Co-option of adaptation

Co-option of adaptation can lead to maladaptation, where the strategy intended to protect communities instead exacerbates inequality and vulnerability, trapping people in cycles of poverty and displacement. This calls for careful attention to who benefits from adaptation strategies, ensuring that they empower rather than marginalize vulnerable populations, and that those affected by climate risks are actively involved in decision-making processes.

Data and Knowledge Challenges

Limited data availability and methodological issues make it difficult to accurately predict and measure climate mobility (Gemenne, 2011), as well as to obtain appropriate localized and contextual information and knowledge.

Policy Gaps

More comprehensive policies, including support for those unable to move, are needed to address the complexities of climate mobility (Government of Canada, 2022).

What We Know

1. Climate Mobility Is Multi-Scalar and Diverse

Climate mobility in Ontario, as in the broader Canadian context, occurs at multiple scales:

- **Internal Migration:** Most climate-related movements happen within provincial borders, with people moving from high-risk rural or coastal areas to urban centers in search of safety and economic stability.

- **International Migration:** Canada is also a destination for climate migrants from other countries, including those affected by environmental degradation, drought, and sea-level rise. However, the majority of climate migration in Canada remains internal (Veronis and McLeman, 2014).

This mobility is shaped by both **voluntary** and **forced** movements. For instance, while some individuals proactively relocate to adapt to environmental changes, others are displaced by sudden events, such as floods or wildfires. Planned relocations, especially for vulnerable communities, are increasingly recognized as a strategy for climate adaptation, but they remain complex and often contentious.

2. Human Agency and Aspirations Play a Critical Role

Climate mobility is not solely driven by environmental factors. It also reflects the aspirations, agency, and choices of individuals and communities. While climate risks are often a catalyst for movement, decisions to relocate are influenced by multiple intersecting factors, including economic opportunities, social networks, and personal goals (McLeman, 2019).

Mobility can be a proactive strategy for improving livelihoods and securing better living conditions, but it is also constrained by structural inequalities. **Immobility** is a reality for many, especially those lacking the financial means, access to resources, or social support networks to move. Vulnerable populations, including low-income households, Indigenous communities, and rural residents, are disproportionately affected by forced immobility.

Gender also plays a significant role in shaping climate mobility decisions. Women are often disproportionately affected by climate change due to pre-existing social and economic inequalities (UN Women and UNDP, 2021). Limited access to resources, decision-making power, and economic opportunities makes it harder for women to move or adapt in the face of climate risks.

3. Complex Interactions Between Climate, Economy, and Governance

Climate mobility is rarely driven by environmental factors alone. Economic instability, social inequality, and weak governance structures compound the impacts of climate change, making migration decisions more complex (Cattaneo et al., 2019). In Ontario, regions that are economically dependent on climate-sensitive industries, such as agriculture, fisheries, and tourism, are especially vulnerable.

The globalized economy also plays a role in shaping climate mobility. Economic opportunities both locally and abroad, remittances from migrant workers, and access to international labor markets can drive migration decisions. For some, migration becomes a strategy to cope with declining local economic opportunities caused by climate impacts.

4. Climate Change Intensifies Environmental Stressors

Ontario is experiencing more frequent and severe weather events due to climate change. Increased flooding, heatwaves, and extreme weather patterns are already affecting many communities across the province. These environmental changes are linked to both sudden disasters, such as storms, and slow-onset impacts like rising temperatures and changing precipitation patterns.

What We Don't Know

1. Gaps in Understanding Internal Climate Mobility Patterns

While internal displacement due to climate change is becoming more common in Canada, there is limited research on how these patterns are unfolding in Ontario and their human cost. Much of the existing data focuses on general migration trends, without specifically addressing the role of environmental factors or the adaptation of populations.

2. Data Gaps on Immobility and Vulnerable Populations

Despite growing recognition of immobility as a critical aspect of climate change, research on this phenomenon remains sparse. Vulnerable populations often lack the resources or opportunities to move, leaving them exposed to increasing climate risks. The long-term impacts of this immobility, both in terms of economic resilience and health outcomes, are not well understood.

Further research is needed to identify the most affected communities and develop targeted policies to support them. This includes understanding how social, economic, and cultural factors interact with environmental stressors to shape decisions about staying or moving.

3. Insufficient Localized Risk and Adaptation Strategies

While tools like the **Ontario Climate Change Data Portal** provide important climate projections, there is still a significant gap in how these data are applied at the community level. Many local governments and policymakers lack the resources or expertise to integrate climate risk into long-term planning effectively. As a result, adaptation efforts are often reactive rather than proactive, focusing on disaster recovery rather than risk reduction.

Similarly, there is a lack of localized climate mobility modeling that could help predict where future climate migration might occur and what resources will be required to support affected populations.

Image: World Refugee & Migration Council/Flickr/Texas Military Department.

OUTCOMES FROM THE SESSION

Session Overview

This session, led by Elisabeth Gilmore and Yvonne Su, explored the nuances of movement and mobility choices, or lack thereof, that individuals and/or communities encounter in the face of a changing climate. Framed more inclusively than conventional, often restrictive understandings of migration systems, climate mobilities acknowledge the agency held and exercised by individuals and communities in seeking safe spaces to live and work, encompassing a wide range of experiences, from voluntary to involuntary (forced) and migration to immobility, highlighting the agency, aspirations, and self-determination of those affected.

Several core themes were explored in this session. Most critically, the re-framing of migration as mobility with multi-faceted and nuanced contexts was emphasized throughout the session. The session leads pushed against the simplification of climate migration and the narratives around “climate refugees” to emphasize the agency and personal dimensions that orchestrate flows of people and communities. Climate mobility as an act of adaptation and resilience-building was also highlighted, underscoring the importance of doing away with an “othering” of those who move and embracing more inclusive and empathetic frameworks.

The speakers also shared critical insights from both global and Canadian perspectives, highlighting case studies such as Lytton, BC, and Lake St. Martin First Nation, to illustrate the consequences of inadequate disaster preparedness and inequitable recovery. Discussions emphasized the importance of local knowledge, trust, and justice in climate adaptation and risk management. Through facilitated discussions, participants explored the complexity of migration decisions, the importance of agency, the limitations of current narratives, and the socio-political implications of climate adaptation. The session aimed to build a shared understanding of climate (im)mobilities and identify opportunities for more just and resilient policy frameworks in Ontario and Canada at large.

Contextualizing the conversation

The session was framed through presentations and discussions from Elisabeth Gilmore and Yvonne Su. Some of the core themes, ideas, and research that were presented included:

Key findings on climate migration from the IPCC

- Migration is a universal strategy that individuals and households undertake to improve well-being and livelihoods in response to economic uncertainty, political instability, and environmental change
- Climate conditions, events, and variability are important drivers of migration and displacement, with migration responses to specific climate hazards being strongly influenced by economic, social, political and demographic processes
- Specific climate events and conditions may cause migration to increase, decrease or flow in new directions, and the more agency migrants have (i.e., the degree of voluntary and freedom of movement), the greater the potential benefits for sending and receiving areas
- Most climate-related migration and displacement observed currently takes place within countries – that is, most of this migration is internal
- In many regions, the frequency and/or severity of floods, extreme storms and droughts is projected to increase in the coming decades, especially under high-emission scenarios, raising future risk of displacement in the most exposed areas\
- There is growing evidence about the future prospects of immobile populations: groups and individuals that are unable or unwilling to move away from areas highly exposed to climate hazards
- Mobility is most strongly about aspiration and people's agency – this means that immobility is also a choice that people can make

Differentiation of mobility types

Speakers emphasized the importance of understanding migration as influenced by interdependent factors, where climate is a driver among economic, social, political, and demographic influences. Distinctions between mobility, displacement, and immobility are essential for contextually responsive policies, as is acknowledging that they are diverse in terms of how they manifest — for example, mobility can be sudden, gradual, actual, or perceived. It is also important to rewire how we think about migration — not as "mass flows", but as individual people and households making decisions to diversify to reduce risk or increase access to opportunity.

Agency and narratives in climate migration

Speakers emphasized the importance of moving beyond the reductive "climate refugees" framing that dominates much of the media and policy discourse. This term often implies a lack of choice, portraying those who move due to climate impacts as passive victims of environmental forces. Such simplifications not only erase the complex motivations behind migration but also reinforce binary narratives of crisis and displacement. The speakers advocated for an approach that recognizes the agency, intentionality, and resilience of individuals and communities in the face of climate change. Migration is often a proactive strategy, a means for households to adapt, seek opportunities, and mitigate risk. Acknowledging the personal dimensions of these decisions means moving away from portrayals of "mass flows" and understanding migration as a series of individual and household-level choices influenced by interdependent economic, social, political, and environmental factors. This shift in narrative supports more empathetic, context-sensitive policy frameworks that respect dignity and autonomy, while addressing the realities and nuances of both mobility and immobility.

Climate migration as adaptation and resilience

Speakers emphasized a reframing of climate-induced movement as a legitimate and often necessary form of adaptation. Recognizing migration as an adaptive response acknowledges the agency of individuals and communities who move not only out of dire need but also as a means of securing safety, stability, and opportunity — a proactive rather than reactive choice. This approach calls for empathetic and inclusive policy frameworks that value the lived experiences of those affected, rather than stigmatizing or marginalizing them. The speakers highlighted the importance of embracing climate mobility as part of a broader resilience strategy — a key component of this shift is moving away from viewing climate migration as an “external crisis”. The tendency to “other” those who move due to climate-related disruptions obscures the shared vulnerabilities that exist across geographic and social boundaries. Speakers highlighted that internal climate mobility, such as displacement due to wildfires or floods, is already a pressing concern in Canadian communities, from Indigenous territories to rural towns. Emphasizing this shared experience can help build solidarity, reduce stigma, and support more holistic, justice-centered climate adaptation planning that includes everyone, regardless of whether they move or stay.

Social justice and systemic inequities

Speakers emphasized that climate adaptation strategies and disaster response efforts often fail to account for the unique needs and vulnerabilities of marginalized

populations, particularly Indigenous communities. These communities are frequently excluded from decision-making processes, resulting in top-down interventions that can lead to forced relocations or displacement. Adaptation measures, while intended to reduce risk, may inadvertently replicate or even exacerbate existing systemic inequities, especially when they overlook cultural, historical, and social contexts.

The concept of "disaster capitalism" was also raised as a pressing concern. In this phenomenon, governments and private interests exploit disaster-affected regions for economic gain, often at the expense of those who are most vulnerable. Profit-driven responses can displace marginalized populations permanently, stripping them not only of land but also of agency and dignity. The speakers called for policies that prioritize equity, community autonomy, and restorative justice in all phases of disaster management and climate adaptation.

Building localized knowledge and trust

The speakers acknowledged that trust between communities and governments is critical but often lacking, hindering effective climate risk management and response. Building reciprocal trust is essential for bolstering disaster preparedness and recovery. Further, the need for local, place-based, and contextualized knowledge was emphasized, which can then feed into community-based solutions and resilience strategies — for example, insurance models that focus on collective, not just individual, recovery. Local knowledge, particularly those rooted in Indigenous culture and ways of knowing, is an indispensable tool in climate risk preparedness, response, and resilience-building, in a manner that is equitable and does not further exacerbate existing inequities and injustices.

Building Back Better vs Building Back Bitter

The speakers highlighted the case of Lytton, BC, a village where 90% of structures burned down in a wildfire in 2021, a day after it recorded Canada's hottest ever temperature. It was acknowledged that many residents want to rebuild their homes but are still living in temporary accommodations. Lytton has not been rebuilt, and this example highlights the inequities in recovery from climate-induced disasters, with concerns about who benefits from rebuilding efforts and the financial burdens placed on vulnerable communities for recovery and resilience-building. Even with insurance, individuals are only entitled to what they lost in the fire, and this begs the question: who is responsible for "building back better", and for whom?

Session discussion

Three key guiding questions were posed by the speakers to the participants, with a 15-minute discussion around each question:

1. What are the key characteristics of climate (im)mobilities in Canada and in Ontario?

2. What are our key challenges and opportunities? How can we manage our losses?

3. What are knowledge needs and gaps required to inform our actions?

Characteristics of climate (im)mobilities in Canada and Ontario

- The discussion raised critical questions about who is responsible for managing climate impacts, with accountability often being shifted between different actors.
- This lack of clear responsibility is compounded by systemic siloing, where different actors and systems operate in isolation rather than collaboratively.
- As a result, individuals who are already experiencing the worst impacts of climate change are often overlooked, particularly migrant and temporary workers who may not be welcomed into communities, and are frequently left out of legal protections and rights frameworks. These conditions also extend to construction workers, who face increased exposure to extreme heat and may be forced to leave their jobs because their workplaces are unsafe, with little recourse or support.
- The current system often focuses narrowly on individual responsibility rather than emphasizing the need to protect and sustain the broader community.
- Participants highlighted how disaster response often prioritizes the protection of wealth and property over the preservation of social fabric and affordability.
- Displacement often leads to gentrification and the breakdown of community networks, particularly where support systems, language access, and social capital are already fragile.
- Participants noted that critical factors such as ableism, ageism, and health status are often excluded from planning frameworks, despite being major determinants of whether someone can remain in place during a crisis.
- This oversight is especially dangerous in situations like forest fire evacuations, where space constraints and resource scarcity intensify vulnerabilities. A key concern was the disconnect between large-scale logistical efforts and the on-the-ground realities of communities, which often lack the resources and capacity to respond proactively.

- Participants voiced a profound lack of trust in government institutions, contrasting with countries like Japan, where trust enables swift collective action. Many emphasized that these issues are not distant or abstract — climate risk touches all of us and requires a shift from viewing it as someone else's problem to recognizing it as a shared, universal challenge.

Key challenges and opportunities

Challenges

- **Misrepresentation of climate migration:**
  - Simplified narratives around "climate refugees" in media and policy often reduce a deeply complex and multifaceted phenomenon to a single, monolithic storyline of victimhood and displacement. These framings tend to emphasize crisis and emergency, portraying people solely as passive victims fleeing disaster, rather than recognizing the diverse motivations that shape decisions to move. In doing so, such narratives obscure the agency of migrants, many of whom make calculated, voluntary choices in pursuit of safety, opportunity, or adaptation in the face of climate impacts.
  - This reductionist framing can also reinforce harmful stereotypes and fuel exclusionary or securitized policy responses, especially in receiving countries. It fails to account for the socio-economic, cultural, and political drivers that interact with climate pressures to influence mobility. People move for reasons that are rarely solely environmental; decisions are shaped by livelihoods, family ties, governance, historical patterns of movement, and available resources. Recognizing this complexity is essential to developing more just, empathetic, and effective responses that uphold the dignity and rights of those on the move.

- **Systemic inequities in disaster response:**
  - Indigenous and rural communities often experience delayed, fragmented, or inadequate support when it comes to climate adaptation and disaster recovery, revealing deep-rooted systemic inequities. In these communities, responses are often under-resourced or slow to arrive, exacerbating the harms caused by climate-related events such as floods, wildfires, or extreme weather. The case of Lynn, BC, for example, highlighted how bureaucratic inertia and a lack of culturally appropriate planning can leave residents without timely assistance or clear pathways to rebuild. Similarly, the prolonged displacement and lack of adequate recovery for the Lake St. Martin First Nation following severe flooding exposed a pattern of neglect and inadequate coordination in responding to the specific needs of Indigenous communities.

- **Disaster Capitalism:**
  - Climate-driven relocation efforts are often co-opted for profit, with governments and corporations exploiting land left by displaced communities, which further disempowers vulnerable populations.
  - Post-disaster land and resource exploitation often displaces vulnerable communities rather than supporting genuine resilience.

- **Trust and community engagement gaps:**
  - Lack of trust in governments as well as lack of engagement with local populations in risk management and policy planning, particularly in emergency responses and adaptation efforts, is a critical challenge.
  - Top-down approaches often overlook localized knowledge and Indigenous frameworks, which hinders effective climate adaptation and risk communication, leaving communities feeling alienated.
  - Social ties, affordability, health disparities, and ageism all affect mobility and relocation decisions, constraining some groups' ability to adapt effectively.

- **Insurance and rebuilding barriers:**
  - Property-focused disaster insurance models fail to accommodate community-oriented rebuilding efforts and delay recovery in vulnerable areas, as seen in wildfire responses in Canada.
  - Current models prioritize property over communal structures and soft infrastructure, limiting resilience-building.

Opportunities

- Several key themes emerged around the need to improve labour laws, housing security, and shared responsibility in responding to climate-related risks.
- Participants emphasized the importance of access to accurate and holistic information, such as comprehensive flood maps for homeowners, to empower individuals and communities. Rather than seeing climate threats solely as crises, there is an opportunity to build stronger, more resilient communities through collective action and a sense of shared responsibility.
- There is an opportunity for governments to support grassroots and community-led initiatives, especially by recontextualizing local knowledge to inform climate adaptation efforts. This includes leveraging preexisting social networks — whether geographic or based on cultural or social affiliations — where trust is already established, and which can serve as natural hubs for distributing aid and shelter.
- Participants also emphasized the importance of personal networks in disaster response and the need to create opportunities for youth leadership through educational reforms, paid internships, and curriculum changes that foster innovative thinking.

- Participants emphasized that a shift from competition to collaboration is essential for building trust and long-term capacity, particularly by integrating Indigenous ways of knowing and deep local context into climate strategies. Understanding the unique characteristics and challenges of each place allows for a more nuanced and inclusive response to climate risks.
- Participants noted that challenges can be reframed as opportunities — for instance, local leadership during evacuations can preserve community agency if governments step in only to support, rather than override, local efforts.
- A broader conversation is also needed about accountability and communication: individuals need to be informed about risks, but decision-making must move beyond private property and consider community-wide resilience.
- Discussions around flood management, zoning, and insurance highlighted the need to reassess extractive development practices and prioritize community-level support, rather than focusing solely on individual emergency responses. This includes distinguishing between emergency and non-emergency planning, and asking why insurance isn't designed with collective wellbeing in mind.

Knowledge needs and gaps to inform action

- Participants identified community insurance and the broader challenge of navigating increasingly complex and inaccessible insurance systems as a key challenge. Many communities are left trying to figure out how insurance works in the face of rising premiums, exclusions, and evolving climate risks, often without adequate support or guidance.
- Compounding this is the notion that communities are suffering from a knowledge deficit, when in fact, what is often lacking is not information but action. People on the ground frequently know what needs to be done, but systemic barriers, institutional inertia, or the prioritization of economic models over social well-being can stall meaningful responses.
- Participants noted that over-reliance on cost-benefit analysis as a decision-making framework also contributes to inaction. This model often fails to account for non-monetary values such as ecosystem services, cultural continuity, and the strength of social infrastructure, all of which are crucial for building resilient communities. Social and cultural benefits, though harder to quantify, are no less critical in determining how people withstand and recover from climate-related disruptions.
- Addressing these issues requires moving beyond technocratic or transactional approaches and recognizing the mutual trust deficit that exists between governments and communities. While it is common to hear that people don't trust the government, what is less often acknowledged is that government systems also frequently do not trust communities to lead or inform local

responses. Building mutual trust — and fostering trust within communities themselves — is essential to shifting from knowledge accumulation to collective action.

Research priorities and next steps

- **Policy and Research Initiatives:**
  - **Localized resilience models:** Shift to community-focused models in disaster response and insurance, integrating Indigenous knowledge systems and prioritizing social and cultural metrics over economic cost-benefit.
  - **Canadian FEMA model:** Develop a national framework for climate adaptation similar to FEMA, tailored to Canada's social and geographical context. This would include updated risk communication strategies and contextual planning.
  - **Inclusive data collection:** Avoid reductive numerical metrics for migration by incorporating nuanced, qualitative data on migration/mobility decisions and the role of social capital.

- **Community-Driven Adaptation Efforts:**
  - **Empower Local Knowledge hubs:** Establish regional knowledge hubs for sharing localized risk information, building trust, and supporting community-driven adaptation planning.
  - **Collaborative governance models:** Foster participatory decision-making that centers community voices, especially Indigenous communities, and integrates them into risk management planning and evacuation processes.
  - **Resilience Education and Mentorship:** Embed climate resilience into public education to instill community-based adaptation skills and proactive risk management in younger generations. Enhance risk communication and public trust in climate action systems, using tailored education and engagement initiatives.
  - **Empowering localized decision-making:** Strengthen local agencies' autonomy in disaster preparedness and response, allowing communities to shape adaptation strategies.

- **Risk communication and trust-building:**
  - **Transparency in disaster responses:** Ensure open communication around disaster management decisions, like triaging, to foster trust and accountability, especially in vulnerable communities.
  - **Non-monetary value metrics:** Develop metrics for assessing social, cultural, and ecosystem benefits of adaptation strategies, such as social networks and mental health supports, to recognize the full impact of community-based resilience.

- Shift from property-centred insurance to **community-focused risk models**, emphasizing social infrastructure and cultural ecosystem valuation.

Examples, case studies, and data

- **Lynn, BC Wildfire (Canada)**: Indigenous and rural community heavily impacted by wildfires, facing prolonged displacement due to inadequate evacuation planning, insurance delays, and systemic inequities in rebuilding and the challenge of "building back better."
- **Lake St. Martin Super Flood (Canada):** In 2011, diverted floodwaters caused by government intervention displaced the Lake St. Martin First Nations. This "man-made" disaster underscored the systemic inequities in disaster response and resilience, with the government eventually settling a class-action lawsuit with the community in 2022 of $85.5 million, underscores the failure to prioritize Indigenous lives and assets in climate resilience strategies.
- **Philippines (Typhoon Lyn):** After a typhoon, land previously owned by evacuated communities was reclaimed by government and corporate interests post-evacuation, displacing vulnerable communities and illustrating how adaptation strategies can exploit disaster-impacted communities.
- **Quebec Wildfire Triage:** Rural communities experienced strategic fire diversion to protect urban areas, raising questions about whose lives and properties are prioritized in disaster responses.
- **Toronto, Ontario (Flood Management):** Zoning laws and infrastructure changes post-Hurricane Hazel serve as proactive measures to mitigate residential flooding risks.

Other notes

- **Background on Black's Framework (2011):** Environmental migration is influenced by a variety of factors, with migration forms (voluntary, involuntary, aspirational) that reflect different individual and community needs. Importance of viewing migration as agency-driven.
- **Importance of Contextualized Knowledge in Risk Planning:** Effective climate adaptation requires understanding specific local conditions, community structures, and topographical nuances to prevent displacement and enhance resilience equitably.
- **Challenges of Capitalism in Disaster Contexts:** Emphasis on how capitalist frameworks that prioritize property can exacerbate disparities in disaster response and resilience-building. A shift is needed towards collective models that emphasize community Assets and soft infrastructure.

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Climate Risk and Flooding in Ontario

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Image: National Observer/ xMississauga Fire and Emergency Services.

BACKGROUND BRIEFING

Ontario is Facing a Heightened Flooding Crisis

Floods have historically been among the most destructive and costly natural disasters in Canada, with Ontario facing increasing risks. The rising disaster impacts in Ontario are driven by shifting patterns of natural hazards, influenced by both climate change and changes in land use and land cover. Specifically, climate change is causing more intense and frequent precipitation events, while land use changes, such as deforestation and urban sprawl, are reducing the land's natural ability to absorb water.

In Southern Ontario, the economic costs of flooding are already substantial. The 2017 flooding of Lake Ontario, which saw the highest water levels in over a century, caused extensive damage and erosion along its shoreline. This event underscored the vulnerability of the Great Lakes region to extreme weather and climate variability, highlighting the need for improved flood forecasting and management strategies (Steinschneider et al., 2019). That same year, pluvial flooding in Toronto resulted in nearly $1 billion in damages, making it Ontario's most costly insured weather event to date (IBC, 2017; IBC, 2018).

Rapid urbanization in Southern Ontario, compounded by climate change, has exacerbated flood risks. The dense urban development has led to increased surface runoff, as natural absorption areas like forests and wetlands are replaced with impervious surfaces such as roads and buildings. These changes, combined with more frequent and severe rainfall events due to climate change, are overwhelming stormwater systems and leading to more frequent and severe flooding (Henstra et al., 2020).

Looking forward, flood frequencies in Southwestern Ontario are projected to increase significantly due to climate change. For instance, what were historically considered 100-year flood events are now expected to become 10- to 60-year events by the end of the 21st century, reflecting a substantial increase in flood frequency as climate change accelerates (Canada's Changing Climate Report, 2019).

Key Flood Risk Impact Areas

Flooding in Ontario presents critical risks, particularly to small businesses, natural habitats, and urban infrastructure. The spring floods of 2019 inundated areas across Ontario, Quebec, and New Brunswick, affecting 3,800 businesses, most of which were small enterprises with fewer than five employees. These small businesses, especially in retail and construction, are particularly vulnerable, with profit margins significantly below the national average, making them less resilient to prolonged disruptions (Statistics Canada, 2019).

The Ontario Risk Impact Assessment highlights several compounding factors that increase flood risks. These include the loss of natural habitats that serve as natural flood defenses, aging infrastructure that is not equipped to handle the intensity of contemporary extreme weather events, and the proliferation of impermeable surfaces in urban areas, which leads to increased runoff (Ontario Impact Assessment, 2023; Intact Centre, 2020). Additionally, climate change, rising property values, and the expansion of development into flood-prone areas further heighten these risks. The economic impact is substantial, especially given Ontario's status as Canada's economic hub, where disruptions in key areas like Toronto can have nationwide repercussions.

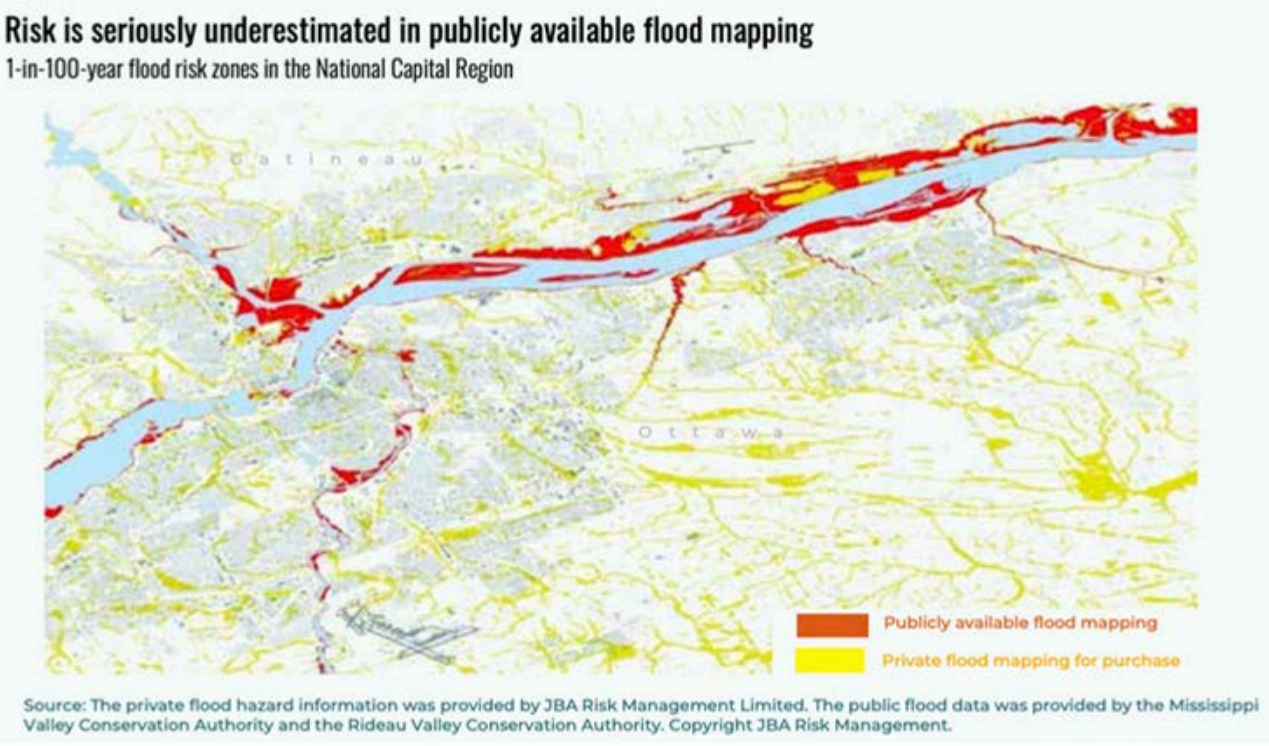
Key Challenges with Flood Risk Management

1. Incomplete and insufficient flood risk mapping

Canada's flood risk management is hampered by incomplete and outdated flood risk mapping. Experts do not fully understand which areas are at risk of flooding or the total value of property at risk, as Canada's flood maps are inconsistent and not comprehensive (Henstra et al., 2019).

The last national effort to create detailed floodplain maps ended in 1999, leaving many communities reliant on outdated information. Moreover, most flood maps available to the public are highly technical, depicting riverine floodplains with complex terms like "return periods" without explanation. While useful for experts, these maps do little to help citizens understand their flood risks or make informed decisions about flood preparedness (Henstra et al., 2019).

The lack of updated and accessible flood mapping is a significant barrier to effective flood risk management. Additionally, Islam et al. 2024 highlight that many dams and levees, critical components of flood management infrastructure, are also designed based on outdated flood risk data. This outdated information increases the vulnerability of these structures to extreme weather events, further compounding the risks associated with insufficient flood mapping.



2. Lack of clear accountability and responsibility

A critical challenge in Canada's flood risk management is the lack of clear accountability and responsibility among stakeholders. Recent policy shifts have attempted to place more responsibility for flood mitigation and recovery on homeowners. However, there is a significant gap between policy and public expectation, with many Canadians still looking to the government to take the lead in flood recovery efforts (Henstra et al., 2019).

Surveys reveal that property owners are often unprepared to take on the responsibility for flood risks. Many are reluctant to adopt property-level flood protection measures, reflecting a broader issue of limited public awareness and preparedness (Thistlethwaite et al., 2018).

This gap in responsibility is exacerbated by unclear roles and a lack of coordinated efforts among federal, provincial, and municipal governments, leading to fragmented flood risk management strategies. Islam et al. also point to the challenges in

managing these critical infrastructures. There is often unclear accountability for maintaining and upgrading dams and levees, particularly as climate change increases the frequency and severity of extreme weather events. This lack of clear responsibility undermines the resilience of these structures and, by extension, the communities they are meant to protect.

3. Barriers to flood insurance

Flood insurance is a crucial component of a comprehensive flood risk management strategy, yet there are significant barriers to its widespread adoption in Canada. Despite efforts to introduce flood insurance, many property owners are unwilling to pay for such coverage. This reluctance is partly due to a lack of understanding about flood insurance and a common expectation that the government will cover flood recovery costs (Thistlethwaite et al., 2020).

The limited uptake of flood insurance leaves many Canadians financially vulnerable to flood damage, increasing the burden on government disaster relief programs. Furthermore, Islam et al. (2024) underscore the need for insurance models that account for the evolving risks associated with climate change. As the frequency and severity of floods increase, the gap between insured losses and total economic losses is likely to widen, making the case for more robust and accessible flood insurance options even more critical.

Recommendations

Based on recent literature, several key recommendations emerge:

Shared Responsibility in Flood Risk Management: The study by Henstra et al. (2019) emphasizes the importance of a collaborative approach to flood risk management. This approach should involve homeowners, insurers, and government entities working together. Key actions include updating floodplain maps, investing in flood defenses, and enhancing public awareness and preparedness efforts (Henstra et al., 2019).

Private-Side Approaches to Reducing Flood Risk: Sandink et al. (2021) suggest that private-side measures, such as retrofitting homes with flood-resistant materials and implementing property-level flood defenses, can significantly reduce the risk of flood damage to buildings. These approaches are crucial for mitigating flood impacts in residential areas (Sandink et al., 2021).

Enhancing Climate Resilience of Flood Control Infrastructure: According to Islam et al. (2024), improving the climate resilience of dams and levees is critical to

safeguarding Southern Ontario from the increasing frequency and intensity of floods. This includes integrating resilience-based frameworks into the design and operation of these structures. Specific recommendations involve updating design flood estimation procedures to incorporate climate change projections and enhancing the maintenance of aging infrastructure.

Further reading

Policies and Programs for Flood Prevention and Mitigation in Southern Ontario

1. Integrated Stormwater Management (SWM) and Green Infrastructure:
Integrated Stormwater Management (SWM) policies have become central to urban flood risk mitigation in Southern Ontario. These policies promote the use of green infrastructure, retention basins, and improved drainage systems to manage stormwater and reduce vulnerability to floods. They also emphasize the importance of regional and municipal cooperation to address the impacts of climate change (Henstra et al., 2020).

2. National Disaster Mitigation and Flood Insurance Programs:
The National Disaster Mitigation Program (NDMP) launched by the Canadian government focuses on reducing flood risks through investments in flood mapping and facilitating private residential insurance for overland flooding. The program also includes a Task Force dedicated to exploring low-cost flood insurance and strategic relocation for residents in high-risk areas (Public Safety Canada, 2017).

3. Climate Risk and Resilience Assessments:
Infrastructure Ontario and other provincial bodies are integrating climate risk assessments into significant projects. These assessments help in building resilience against future flood risks by identifying vulnerabilities and implementing adaptation strategies across infrastructure, green spaces, and wetlands (Ontario Risk Assessment Report, 2023).

4. Enhanced Public Funding and Governance for Adaptation:
All levels of government are encouraged to scale up public funding for flood adaptation measures. This includes co-developing coordinated approaches with provincial, territorial, Indigenous, and municipal governments to enhance governance and transparency in managing climate change risks (Canadian Climate Change Institute, 2023).

Datasets and Assessment Frameworks

1. Canadian Hydrometric Data (Water Survey of Canada):
This dataset provides comprehensive historical and real-time data on river flow and water levels across Canada, which is critical for flood risk assessment and management. The data can be used to assess flood patterns, monitor water levels, and model potential flood scenarios.
Link: Canadian Hydrometric Data

2. Ontario Flood Hazard Identification and Mapping Program:
Managed by the Ontario Ministry of Natural Resources and Forestry, this program provides floodplain maps and risk assessments for various regions in Ontario. The data is used for land use planning, flood forecasting, and emergency preparedness.
Link: Ontario Flood Mapping and Risk Assessment

3. Infrastructure Canada's Climate Lens Assessment Framework 2020:
This framework aims to assess the climate impacts of infrastructure from both a greenhouse gas and resilience perspective, for stakeholders looking to incorporate climate impacts within their own assessment frameworks.
Link: Infrastructure Canada's Climate Lens Assessment Framework 2020

4. The Canadian Disaster Database
The Canadian Disaster Database (CDD) contains detailed disaster information on more than 1,000 natural, technological, and conflict events (excluding war) that have happened since 1900 at home or abroad and have directly affected Canadians.
Link: The Canadian Disaster Database

Case Studies

1. Flood Resilient Toronto - Tudhope, K., & Eng, P. (n.d.). Flood Resilient Toronto Working Group

a. Flood Resilient Toronto Working Group
b. https://www.toronto.ca/wp-content/uploads/2019/05/8e9a-2019-04-25_Flood-Resilient-Report.pdf

2. Toronto - Don River

a. Toronto Regional and Conservation Authority (TRCA) Don River Watershed
b. Bonnell, J. L. (2014). Reclaiming the Don: an environmental history of Toronto's Don River Valley. University of Toronto Press.

3. Use of a Climate Change Scenario Analysis Tool to Anticipate Various Futures Associated with Extreme Urban Flooding

a. Authors: Krantzberg, G., Chen, B., Sun, R., Li, W., & Cheng, K. Y.
b. Details: Focuses on the City of Hamilton's use of a scenario analysis tool to assess climate resilience and plan for frequent flooding events.
c. Publication: SSRN Electronic Journal, 2022
d. Link: Climate Change Scenario Analysis Tool

4. Atmospheric Circulation Amplifies Shift of Winter Streamflow in Southern Ontario

a. Authors: Champagne, O., Arain, M. A., & Coulibaly, P.
b. Details: Study on the impacts of atmospheric circulation on the temporal shift of streamflow and flood events in Southern Ontario.
c. Publication: Journal of Hydrology, 2019
d. Link: Winter Streamflow Shift

5. Increase of Flood Risk Due to Urbanisation: A Canadian Example

a. Authors: Nirupama, N., & Simonovic, S.
b. Details: Study on the elevated flood risk in the City of London, Ontario, due to urbanization in the Upper Thames River watershed.
c. Publication: Natural Hazards, 2007
d. Link: Increase of Flood Risk Due to Urbanisation

6. Is Flooding in Toronto a Concern?

a. Authors: Nirupama, N., Armenakis, C., & Montpetit, M.
b. Details: Overview of flooding occurrences in Toronto, with a focus on the 2013 flood and its implications for infrastructure resilience.
c. Publication: Natural Hazards, 2014
d. Link: Flooding in Toronto

7. Ontario's Great Lakes Flood History

a. Authors: Kreutzwiser, R., & Gabriel, A.
b. Details: Reconstruction of flood history along the shores of Ontario's Great Lakes and their connecting channels, focusing on the temporal and spatial distribution of flood events.
c. Publication: Journal of Great Lakes Research, 1992
d. Link: Ontario's Great Lakes Flood History

Image: National Observer/ x Mississauga Fire and Emergency Services

OUTCOMES FROM THE SESSION

Session Overview and the Start

The session opened with a stark reminder of Southern Ontario's growing flood vulnerability, as highlighted by the recent extreme flooding events that have exposed systemic vulnerabilities in regional flood preparedness. Three significant flood events were presented to frame the discussion: the July 2024 GTA storm that delivered over 100 mm of rainfall on saturated soils, resulting in widespread flash flooding, transit disruptions, and $940 million in damages; the 2013 Toronto flash flood where 126 mm of rain fell within two hours, overwhelming aging stormwater infrastructure; and the 2017 Lake Ontario floods that caused extensive shoreline erosion and economic losses due to record-high water levels.

These events collectively revealed several critical opportunities to strengthen current flood risk management approaches. For example, it was highlighted that several floodplain maps across the region, while extremely valuable for existing decision-making, need to be created or updated, particularly for pluvial and riverine flooding. Critically, few existing maps incorporate climate change projections or dynamic hydrologic modeling, which often leaves municipalities unprepared for intensifying extremes. Similarly, infrastructure evaluations, where they exist, should be updated to assess the performance of dams, levees, and stormwater systems under future climate scenarios. The region also requires consistent, coordinated data-sharing mechanisms. Improved coordination and cross-departmental collaboration amongst municipalities, conservation authorities, and other stakeholders can strengthen the effectiveness of planning and response. In parallel, flood planning processes should be adapted to intentionally engage with the perspectives and needs of vulnerable or at-risk populations, along with the integration of Indigenous knowledge systems or equity-based frameworks (Henstra et al., 2019; Canada's Changing Climate Report, 2019; Ontario Impact Assessment, 2023; Intact Centre, 2020).

The session transitioned to a structured review of leading literature and best practice recommendations across five focal areas: risk mapping and data sharing, infrastructure resilience, public communication, equity and inclusion, and policy and finance.

Improved Flood Risk Mapping and Data Sharing

The session emphasized the need to modernize flood risk mapping across Southern Ontario. The absence of up-to-date, accessible maps presents as a foundational barrier to risk assessment, public preparedness, and effective adaptation. Prior literature has called for the development of comprehensive, climate-informed floodplain maps that are regularly updated. The motivation for improved flood information sharing included four critical drivers: enhancing public safety and preparedness, supporting climate-resilient infrastructure design, informing cost-effective economic and insurance planning, and enabling more equitable assessments that direct resources to the most at-risk communities. To overcome these challenges, high-resolution modeling and improved inter-agency collaboration have been identified and recommended in prior literature as core enabling strategies. A regional data-sharing framework was proposed to strengthen coordination between municipalities, conservation authorities, and researchers, ensuring consistent and actionable data across jurisdictions (Henstra et al., 2019).

Infrastructure Upgrades and Nature-Based Solutions

Engineering and planning guidance recommend applying climate-adjusted intensity-duration-frequency curves and worst-case design scenarios to new and retrofitted infrastructure. A risk-informed approach to infrastructure investment was positioned as essential for long-term resilience. In addition to hard infrastructure upgrades, the session highlighted the value of nature-based solutions — including constructed wetlands, green roofs, and permeable surfaces — as effective, multifunctional strategies. Case studies, such as the Toronto Port Lands and Don Valley River restoration projects, demonstrate the successful application of green infrastructure in urban flood mitigation. The session overview also noted the need for consistent stormwater management rules across the region. A harmonized policy approach, modeled after the “Sponge City” concept, was presented as a pathway to distribute responsibility between public and private sectors and promote decentralized, adaptive stormwater storage (Islam et al., 2024; Ontario Provincial Climate Change Impact Assessment Technical Report, 2023; Canada’s Changing Climate Report, 2019).

Public Awareness and Communication

Risk communication strategies featured prominently in the session's review. The literature emphasized the role of storytelling, visualization tools, and interactive media in translating complex risk information into accessible formats. Tools such as the Climate Atlas were cited for their ability to support community engagement through location-specific, climate-informed narratives. The session also reviewed incentive-based programs that encourage household-level preparedness, including rebate programs, resilience certification schemes, and public education campaigns. These approaches were presented as cost-effective mechanisms to enhance community-level flood preparedness (Thistlethwaite et al., 2018).

Equity and Inclusion

The session addressed ongoing equity gaps in flood risk management in Southern Ontario. Existing planning processes often fail to engage or prioritize communities most exposed to flood hazards, including low-income neighborhoods and Indigenous populations.

> Literature reviewed in the session called for the integration of Indigenous worldviews and knowledge systems into flood planning frameworks, emphasizing the value of long-term, systems-based thinking.

Recommendations also included prioritizing infrastructure upgrades in vulnerable communities and ensuring equitable access to insurance products, emergency supports, and flood mitigation funding (Toronto's Current and Future Climate, 2024; Ontario Provincial Climate Change Impact Assessment Technical Report, 2023; Canada's Changing Climate Report, 2019).

Policy and Funding

The session concluded with a review of policy and financial mechanisms needed to support resilient flood management. A central recommendation involved increasing and coordinating funding across federal, provincial, municipal, and Indigenous governments. The literature supported co-developed strategies that emphasize transparency, shared governance, and long-term investment planning. The session also examined the growing need for sustainable and inclusive flood insurance models that reflect the realities of climate risk. By expanding insurance access and aligning products with future conditions, these models could reduce reliance on disaster relief programs and enhance household-level resilience (Thistlethwaite et al., 2020; Sandink et al., 2021).

Flood Mitigation

The session transitioned into an exploration of the evolving landscape of flood mitigation in Southern Ontario, with a focus on enhancing infrastructure resilience, integrating nature-based solutions, and reevaluating insurance frameworks. Participants' discussions emphasized the practical challenges of retrofitting existing systems, the role of local governance in shaping adaptive capacity, and the need to redefine what constitutes effective and equitable flood protection in a changing climate.

1. Critical Infrastructure Resilience

Prompt 1:
How can we enhance the resilience of critical infrastructure, such as dams, levees, and stormwater systems, in light of increasing flood risks?

Participants reflected on the limitations of existing infrastructure. Aging assets such as Toronto's sewer system have undergone upgrades in recent years, but many of the systems remain constrained by rigid designs — particularly legacy networks of tunnels and pipes that offer little room for adaptive responses. Others referenced Kitchener's Schneider's Creek renaturalization project as a departure from conventional engineering, where a concrete channel was removed and replaced with a naturalized streambed, re-establishing floodplain connectivity and allowing more dynamic flow control.

Challenges to modernizing infrastructure were discussed extensively. Municipal regulations were frequently cited as barriers to adaptive measures. For instance, Ottawa bylaws that prohibit tree planting near homes — ostensibly for safety reasons — were flagged as counterproductive, given the long-term benefits trees offer in stabilizing soils and managing runoff. Participants also noted that stormwater management standards vary widely between municipalities. Guidelines in Toronto differ markedly from those in London or Hamilton, creating a fragmented regulatory environment that impedes consistency and scalability.

Recommendations focused on adopting safe-to-fail design principles. Rather than attempting to prevent failure entirely, infrastructure should be designed to minimize collateral damage when failure occurs. Levees, for example, could be engineered to breach in controlled locations, thereby protecting downstream communities. Participants also emphasized the value of hybrid systems that blend traditional gray infrastructure, such as stormwater tunnels, with green interventions like rain gardens, bioswales, and permeable pavements.

The discussion also turned toward how infrastructure contributes to broader climate adaptation and mitigation goals. Participants questioned whether municipalities are tracking performance metrics beyond runoff reduction, such as carbon sequestration, cooling, and shading, and whether clear criteria for species selection guide tree-planting initiatives. Many noted inconsistencies in how different municipalities engage with developers, with no standardized guidance across jurisdictions.

2. Nature-Based Solutions

Prompt 2:
What role can nature-based solutions (e.g., wetlands restoration, green infrastructure) play in complementing traditional flood mitigation infrastructure in Ontario?

Participants widely supported the use of nature-based solutions to enhance and complement conventional flood mitigation efforts. Several pointed to successful examples already in place. Schneider's Creek in Kitchener was cited again, this time for its performance during the July 2024 storm, where the restored stream reduced peak flows by 30 percent. Others highlighted academic collaborations, such as the University of Waterloo's work on integrated watershed planning.

In discussing the value of green infrastructure, participants emphasized its ability to reverse past planning mistakes. Projects that de-hardened shorelines or replaced concrete drainage with natural features were viewed as not only beneficial for flood mitigation but also restorative in ecological and cultural terms. Asset management practices that incorporate climate-informed risk assessments were seen as critical for prioritizing these investments. Design approaches that allow water to pass through built environments — rather than block it entirely — were also discussed. Examples included building designs that permit controlled inundation in certain zones, as well as landscape planning that accommodates seasonal flooding without damage.

Despite broad agreement on the benefits of green infrastructure, participants identified persistent barriers to its implementation. Many have noted that developers continue to prioritize cost over environmental performance, often resisting requirements to incorporate rainwater treatment systems into new builds. Misaligned incentives, such as the lack of financial mechanisms to reward low-impact development, were seen as a recurring obstacle. Knowledge gaps were also identified, particularly regarding which tree and plant species are most effective in stabilizing soil, intercepting runoff, and withstanding future climate conditions.

The conversation then moved toward more systemic critiques. Several participants raised the issue of colonial-era infrastructure, built without Indigenous consent, which continues to alter hydrological systems and disrupt cultural practices. Schneider Creek's original concrete channel, for example, erased traditional fishing sites. Renaturalizing such spaces was viewed not only as a hydrological correction but also as a step toward restoring cultural relationships with the land. Participants also questioned the dominant paradigm of post-disaster rebuilding, critiquing the tendency to favor corporate reconstruction contracts over community-driven or Indigenous-led approaches. The group drew contrasts between Ontario's recent projects and the top-down post-Katrina levee reconstruction in New Orleans, which they viewed as a cautionary tale of inequitable recovery.

Finally, the group interrogated what is meant by "natural" in the context of restoration. Historically, Southern Ontario's rivers meandered through expansive wetlands that absorbed floodwaters like sponges. Returning to these conditions requires a reckoning with historical land-use changes, including agricultural drainage, urban sprawl, and channelization. Some participants suggested that "natural" need not mean strictly pre-colonial, but rather a hybrid approach that blends Indigenous stewardship, ecological principles, and urban constraints. In practice, this has involved replanting native species, such as silver maple and sedges, while also modifying watercourse paths to accommodate modern spatial realities.

3. Insurance and Incentives

Along with the prompts, insurance and other financial incentives also came up in the participants' discussions. For example, participants explored how insurance systems intersect with flood mitigation. A key issue was the failure of current insurance models to recognize or reward homeowner-level mitigation measures. Interventions such as rain gardens and tree planting, which can significantly reduce flood risk, are rarely reflected in premiums or eligibility criteria. Ottawa's tree planting restrictions were again referenced, illustrating how municipal rules can undermine long-term risk reduction.

One of the central concerns was equity. Participants noted that many existing financial incentives, such as grants for floodproofing, are often out of reach for marginalized communities. Without uniform green building requirements or targeted subsidies, lower-income residents bear the brunt of outdated infrastructure and higher risk. The discussion also highlighted an ongoing debate over whether flood insurance should even be available in high-risk areas. In literature and other broad discussions, arguments against insurance incentives reason that withholding coverage could lead to greater awareness and action. While those advocating for incentives warn that such policies risk deepening systemic inequities, particularly in

communities already underprotected and overexposed (Thistlethwaite, 2020; Ontario Climate Risk Impact Assessment, 2023).

Several potential reforms were discussed. Participants proposed tying insurance premiums directly to mitigation actions — for example, offering discounts for homeowners who install rain gardens or permeable driveways. Others suggested repealing bylaws that discourage climate-resilient landscaping, as well as the adoption of universal green development standards that mandate rainwater harvesting, permeable surfaces, and stormwater controls in all new construction. These changes were seen as necessary to democratize flood protection and establish a baseline of resilience across the province.

Floods Under Climate Change

The session discussions also explored how Ontario's flood management systems are grappling with the growing uncertainty and urgency of climate change. Participants engaged with two guiding prompts: first, how to better integrate climate projections into infrastructure planning; and second, how to design flood infrastructure that reflects future climate scenarios. Discussions highlighted both ongoing efforts and persistent barriers, while emphasizing the need for adaptive, inclusive, and scenario-based approaches.

Prompt 1:
How can we better integrate climate projections into Ontario's flood management infrastructure?

Participants began by reviewing how some municipalities have attempted to integrate climate data into infrastructure planning. Adjustments to design storms were noted as a common approach — for example, increasing buffer zones in stormwater models to reflect more intense and frequent precipitation events. Some referenced the use of tools like the Climate Atlas to visualize future rainfall patterns, noting its effectiveness in conveying complex data to the public. The platform's user-friendly interface and storytelling features stood out as strengths, particularly in engaging non-technical audiences.

Despite these emerging practices, several challenges surfaced. Political and technical barriers continue to slow progress. Municipalities face resource constraints and often push back against climate-informed mandates that require additional funding or staffing. At the same time, participants noted the absence of standardized

guidance from the province, which has left local governments without a clear roadmap for integrating projections into their planning frameworks. Participants also discussed the limitations of existing climate models. Regional models, such as WRF-Hydro for the Great Lakes, show declining snowpack and changes in soil moisture regimes; however, they often fail to provide the necessary resolution to inform specific infrastructure upgrades at the local scale. While precipitation projections can serve as a useful proxy for stormwater stress, participants noted that their applicability remains limited without more targeted hydrologic modelling. Finally, another gap lies in public accessibility and institutional uptake. Although tools like the Climate Atlas are available, participants observed that many municipalities are not using them. The group emphasized the importance of providing intuitive, interactive platforms that support both internal decision-making and public engagement.

To strengthen integration efforts, participants proposed a range of recommendations. Citizen science initiatives emerged as a promising strategy. Participants suggested school-based projects to ground-truth flood models, such as using local monitoring to validate runoff predictions along Schneider's Creek in Kitchener. Another idea involved developing interactive storytelling maps that communicate flood risk in tangible, place-based ways — for example, an "audio walk tour" of flood-prone neighborhoods designed to engage both residents and policymakers in experiential learning.

Prompt 2:
What are effective ways to incorporate future climate scenarios into infrastructure design?

Discussions then turned to the role of infrastructure design in preparing for future extremes. Participants again referenced Schneider's Creek renaturalization as a relevant example. Funded by Disaster Canada, the project replaced a rigid, concrete-lined channel with a re-naturalized stream corridor, allowing for more dynamic water flow and reducing peak runoff. The project was framed as a model of climate-adaptive design grounded in nature-based principles.

Participants highlighted significant barriers to broader implementation. Political resistance remains strong, particularly when proposed projects involve lengthy timelines or challenge established engineering norms. Many expressed concern about the reluctance to invest in long-term upgrades, as political cycles often favour short-term results. Existing infrastructure also limits flexibility. Tunnels, culverts, and

underground sewer systems, designed for historical conditions, cannot easily be adapted to handle projected increases in extreme precipitation.

Several clear recommendations emerged from the conversation. **Participants supported the adoption of a unified stormwater rule across Southern Ontario.** Regional standards could promote decentralized systems and distribute responsibility between public agencies and private developers. Scenario-based planning was another recurring theme. Rather than relying on a single forecast, participants advocated for adaptive frameworks that incorporate a range of climate futures. This included shifting investment toward safe-to-fail infrastructure, prioritizing strategic retrofits over large-scale reconstruction.

Overall, participants concluded with reflections on how to move forward within existing constraints. While high-resolution climate projections and large-scale infrastructure upgrades remain desirable, many advocates have called for using current tools and systems more effectively. Developing a range of plausible operating scenarios — rather than waiting for perfect data or billion-dollar designs — was seen as a pragmatic next step toward resilience.

Communities, Indigenous Knowledges and Flood Risk Impact

The final discussion examined how flood mitigation efforts can be made more inclusive of vulnerable communities and incorporate Indigenous knowledge systems. Guided by two prompts, participants reflected on the social dimensions of resilience, power dynamics in decision-making, and the risks of replicating existing inequities under the banner of climate adaptation. Discussions drew attention to the lived experience of communities most affected by flooding and the need for equitable, co-created approaches to risk management.

Prompt 1:
How can we ensure flood mitigation measures are inclusive and consider vulnerable communities?

Participants identified gentrification as a major unintended consequence of well-meaning green infrastructure projects. Efforts such as shoreline restoration or flood-resilient park construction often increase property values, placing pressure on low-income households through rising rents and displacement. This pattern risks turning adaptation investments into drivers of environmental gentrification. The group also

highlighted the persistence of extractive engagement practices. While consultations with marginalized communities have become more common, participants argued that these engagements too often remain superficial. Decisions are frequently made by external actors, with community voices treated as input rather than direction.

In response, participants emphasized the importance of co-designing flood mitigation strategies with affected communities. Rather than imposing predetermined solutions, projects should allow residents to define their priorities — for example, choosing between protecting buildings or allowing water to flow through specific areas. Empowering residents to shape outcomes fosters ownership, relevance, and long-term sustainability. To prevent displacement, participants discussed the need for policy tools, such as community land trusts and rent freezes, in neighbourhoods undergoing infrastructure upgrades. These measures can decouple resilience investments from speculative real estate pressure, helping to retain existing residents and protect cultural cohesion.

Access to resources also emerged as a key barrier. Participants called for simplified rebate programs to support household-level flood mitigation, including rain gardens, downspout disconnections, and backwater valves. Programs should be designed with minimal administrative burden and promoted through trusted local channels, such as community organizations and tenant groups, to ensure uptake in historically underserved areas. In terms of broader planning, participants emphasized the value of incorporating community input into asset management processes, ensuring that upgrades are prioritized based not only on technical models but also on local experiences and historical flood data.

Prompt 2:
How can Indigenous knowledge and perspectives be better integrated into flood risk management?

Participants named several limitations of current practices. Many described how Indigenous knowledge is often sought out for technical insights or historical data, but without reciprocity or real decision-making power. Such engagement, they argued, can reduce traditional knowledge systems to a supporting role, while leaving settler-led institutions in control of flood governance. The discussion contrasted two approaches to integration. One involved “handing over the reins,” acknowledging Indigenous sovereignty over land and water and enabling full control over planning and stewardship. The other emphasized bridging — creating equal partnerships

between Indigenous and non-Indigenous systems. Participants debated the limitations of the latter, warning that attempts at "bridging" may perpetuate subtle forms of control and dilute efforts toward true self-determination.

Participants also challenged the dominance of technical solutionism in Western flood planning. They criticized the tendency to reach for engineering fixes, such as levees or dams, rather than embracing relational understandings of water. Several participants referenced Indigenous frameworks that describe water as a living relative or "kin," not merely a hazard or resource. These perspectives offer fundamentally different starting points for flood resilience, rooted in respect, reciprocity, and long-term responsibility.

To realign resources and priorities, participants recommended redirecting research funding to Indigenous-led initiatives. Suggested projects included mapping ancestral floodways that had been erased by urban development or supporting cultural restoration of waterways through Indigenous planning frameworks. They also emphasized the importance of the person delivering the message in public communications. Trust in the messenger, participants noted, can shape how communities receive and respond to information — whether that message comes from government, scientists, or Indigenous leaders. In the context of financial incentives, participants called for insurance companies to take a more proactive role in enabling household resilience. They proposed that rebates for flood mitigation measures, such as elevation or relocation, be made available to Indigenous communities, both on- and off-reserve, and tied directly to community-identified needs.

The discussion touched upon several unresolved tensions. Some participants questioned whether current efforts toward integration, even when well-intentioned, risk reinforcing existing power structures. They emphasized that true equity must involve not just inclusion, but a shift in agency — toward Indigenous control over both land and water systems. Others reiterated that simply adding Indigenous voices to settler-led projects was not enough. They stressed the need to challenge the underlying assumptions of flood planning frameworks, particularly the belief that every natural process can or should be engineered. Participants also discussed opportunities to support collaborative innovation. The City of Toronto's climate collaboration platform was mentioned as a potential model. The platform invites researchers, municipal staff, and community groups to co-develop research agendas and projects, offering a structure that could be expanded or adapted for more meaningful Indigenous partnerships.

Recommendations

The session concluded with a forward-looking conversation on how Ontario can advance equitable, effective, and climate-informed flood risk management. Participants emphasized that moving from analysis to action requires institutional alignment, community trust, and strategic investment in both data systems and social infrastructure. They identified several interrelated pathways to strengthen preparedness and resilience in the face of escalating climate-driven flood risks.

1. Strengthening Knowledge-Sharing and Collaborative Platforms

Participants emphasized the importance of cross-sector collaboration in driving innovation. The City of Toronto's collaborative climate research platform was referenced as a promising model. The platform creates space for municipalities, researchers, and community groups to co-develop research priorities and align on pilot projects. Participants called for expanding this model across Ontario to facilitate more intentional partnerships between academia, Indigenous communities, local governments, and civil society. By connecting knowledge producers with practitioners and policymakers, this type of platform can ensure that research efforts are targeted, applied, and community-responsive. Participants also emphasized the importance of integrating climate risk into housing and infrastructure decision-making processes. This includes embedding flood risk considerations into property databases and zoning tools used by municipalities, developers, and residents. Doing so would enable planners and households to better understand their exposure and make informed decisions about investment, design, and protection.

2. Enhancing Public Awareness and Shared Accountability

Participants discussed the importance of public education in advancing flood risk reduction. Tools and guidance from institutions like the Intact Centre on Climate Adaptation were referenced as valuable resources for household preparedness. The group emphasized that while public-sector investment is necessary, reducing flood risk also requires greater accountability at the homeowner level. Participants recommended targeted communication strategies to inform residents about their level of flood exposure and available adaptation measures. They emphasized the importance of working through trusted local mediators, such as neighborhood organizations, tenant groups, and cultural associations, rather than relying solely on

formal government channels. Participants agreed that effective public outreach must reflect community language, values, and relationships — and must do more than distribute static risk maps.

3. Redefining and Protecting Critical Infrastructure

The session raised fundamental questions about how Ontario defines "critical infrastructure." Participants challenged narrow interpretations focused exclusively on major engineered assets such as dams or levees. Instead, they advocated for a more inclusive and ecological definition that acknowledges the importance of fish habitats, wetlands, and urban green spaces. For example, infrastructure that supports salmon migration or native aquatic systems plays a vital role in community resilience and ecological stability — yet remains excluded from many assessments. Participants called for proactive stress testing of infrastructure systems, using simulation models and available data to understand how existing assets perform under projected future scenarios. With data and mapping tools already available in many jurisdictions, participants emphasized the need to shift from reactive recovery to forward-looking resilience planning.

4. Advancing Comprehensive Mapping and Transparency

The conversation closed with a focus on mapping and risk communication. Participants reiterated that Ontario continues to lack a consistent, detailed flood map, particularly for urban areas vulnerable to pluvial flooding. In many cities, information about basement flooding remains fragmented, siloed within insurance data, and rarely shared publicly. Participants called for the development of comprehensive, publicly accessible urban flood risk maps, built on standardized methodologies and regularly updated with local input. They emphasized that improved mapping is not only a technical requirement but a prerequisite for equitable planning. Transparent flood risk data enables residents to make informed decisions, reduces the likelihood of post-disaster displacement, and supports fairer insurance frameworks. Without it, vulnerable households remain unaware of risks, unprotected from damages, and excluded from critical funding opportunities.

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Insurance and Financialization of Climate Risk in Ontario

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Image: The Globe and Mail.

BACKGROUND BRIEFING

Hazard exposures and associated losses are increasing

Canada's vulnerability to severe weather and its associated financial impacts has significantly increased over the years, with a notable increase in insured losses. Before 2009, the average annual insured losses from severe weather events were around $400 million. However, this figure has since surged to an average of $1.4 billion annually, with total insured and uninsured disaster losses projected to reach an annual average of $15.4 billion by 2030. These projections account only for direct financial disaster losses and do not consider the broader impacts on human and societal health and well-being (Public Safety Canada, 2022b).

The impact of extreme weather was particularly evident in 2022, which was the third most costly year on record for insured damages, totaling $3.1 billion from floods, storms, and cyclones (CBC News, 2023). Among these, flooding has emerged as Canada's most frequent and costly natural disaster in recent years, causing approximately $1.5 billion in damage to households, property, and infrastructure annually, with residential property owners bearing about 75% of uninsured losses each year (Public Safety Canada, 2022a).

Total insured and uninsured disaster losses projected to reach an annual average of $15.4 billion by 2030

This pattern is especially pronounced in Ontario, where flooding remains the most frequent and costly natural hazard in the province (Government of Canada, 2019). From 1983 to 2008, insurance

payouts for catastrophic events ranged between $250 million and $450 million annually, but this figure has increased significantly in recent years (Insurance Bureau of Canada, 2023b). A recent example is the flash flooding in Southern Ontario on July 16, 2024, where over 100 mm of rainfall within a few hours caused widespread damage, underscoring the region's vulnerability to extreme weather (Environment Canada, 2024).

Arising challenges for the insurance market

Rising insurance costs and the challenges associated with underinsurance have become increasingly significant issues in Canada due to the growing frequency and severity of natural disasters. Historically, only three disasters in Canada exceeded $500 million in losses (adjusted to 2014 dollars) before 1995. However, from 2013 to 2017, Canada experienced $16.4 billion in disaster losses, with insured losses from severe weather events averaging $1.4 billion annually since 2009, a significant increase from the $400 million average prior to that year (Public Safety Canada, 2022a). The severe weather events of recent years, such as the 2017 floods in eastern Ontario and the 2019 floods in southwestern Quebec, which caused over $200 million in insurable damages and displaced many residents, highlight this escalating trend (Lin et al., 2019). In 2022, Ontario alone contributed significantly to Canada’s total of $3.4 billion in insured catastrophic (CAT) losses due to extreme weather (Insurance Bureau of Canada, 2023a).

As extreme weather becomes more common, insurance companies are facing higher payouts, leading to increased premiums for consumers. This rise in costs has made insurance less affordable, particularly for those in high-risk areas (CBC News, 2023). For instance, home insurance rates in Ontario have increased by an average of 33% between April 1, 2018, and April 1, 2023 (Canadian Underwriter, 2023). This issue is compounded by the widening "protection gap" between insured and total economic losses, which reached a record $231 billion worldwide in 2020, with about 75% of potential global disaster losses remaining underinsured (Public Safety Canada, 2022a). Many residents in high-risk areas, unable to afford the high premiums or secure sufficient coverage, face significant financial losses and extended recovery times (CBC News, 2023). Flood insurance availability and affordability are vital for those living in flood-prone areas; however, the current market does not adequately cover these high-risk zones, creating a protection gap that undermines the effectiveness of flood insurance in managing flood risks (Public Safety Canada, 2022a).

The insurance industry also faces challenges in accurately pricing climate risks due to

a lack of historical data and difficulty in recognizing patterns. This can lead to the mispricing of insurance products, either overestimating or underestimating the actual risks (Insurance Institute of Canada, 2023). Additionally, insurers face growing pressure from regulators, investors, and society to address climate risks, including transitioning their investment and underwriting portfolios to achieve net-zero emissions by 2050, in line with broader societal efforts to combat climate change (Financial Services Regulatory Authority of Ontario, 2023).

Source: Curt Pickens/ Getty Images.

Arising challenges for low and moderate-income households

The growing vulnerability of Canadians to climate change and natural hazards highlights the urgent need for more effective and accessible insurance solutions. Insurance can serve as a crucial tool in providing predictable and comprehensive financial coverage for those affected by natural disasters (Public Safety Canada, 2022a). However, to make insurance more accessible, particularly for low and mid-income households, significant efforts are needed. These efforts include promoting greater financial literacy, building capacity within community organizations that support housing for vulnerable populations, and ensuring that national insurance solutions are adaptable to different regional and cultural contexts (Public Safety Canada, 2022a).

Low and mid-income households are particularly at risk due to their limited financial resources and inadequate insurance coverage. Often located in high-risk areas and living in poorly maintained buildings, these households face heightened vulnerability (CBC News, 2023). Climate change not only increases physical risks but also exacerbates health risks for these communities, exposing them to extreme heat, poor air quality, and waterborne diseases, while they often lack access to essential healthcare services (Canadian Climate Institute, 2022).

The economic impacts of climate change on low-income households are profound. In a high emissions scenario, these households could experience significant income losses, potentially up to 19% by the end of the century (Canadian Climate Institute, 2022). This potential for severe economic hardship highlights the urgent need for targeted interventions to support these vulnerable populations as climate change continues to intensify.

Risk mitigation and risk transfer programs

Flood protection efforts in Ontario have made significant advancements in recent years, demonstrating the province's commitment to enhancing resilience against natural disasters. Between 2018 and 2021, Ontario increased its spending on flood protection infrastructure by nearly 90%, reaching $2.5 billion — double the investment of any other province. This substantial investment underscores Ontario's proactive approach to mitigating flood risks and safeguarding its communities (Government of Ontario, 2022).

On a national level, Canada is developing the National Flood Insurance Program, designed to provide affordable flood insurance to homeowners, especially those in high-risk areas. This initiative, a collaboration between the federal government and the property and casualty (P&C) insurance industry, aims to reduce the financial burden of flooding, which is Canada's most common and costly natural disaster, causing around $1.5 billion in damage annually (Government of Canada, 2022). The program, expected to be operational by 2025, will cover over 1.5 million high-risk homeowners, making flood insurance more accessible and affordable while also reducing disaster costs for federal and provincial governments (Government of Canada, 2022).

At the provincial level, the Disaster Recovery Assistance for Ontarians (DRAO) program plays a crucial role in helping residents recover from natural disasters, such as flooding and tornadoes. This program provides financial assistance for cleanup, repairs, and essential property replacement, ensuring that affected residents receive the support they need to rebuild their lives. The DRAO program has been implemented in various regions, including Kirkland Lake, McGarry, and Chamberlain, demonstrating its importance in disaster recovery efforts (Government of Ontario, 2023).

In addition to these broader initiatives, local programs in Ontario focus on reducing specific flood-related risks. For instance, the Sanitary Backwater Valve Rebate Program in the Peel Region offers homeowners up to $700 in rebates for installing a sanitary backwater valve, which prevents wastewater from backing up into basements during heavy rainfall, thus mitigating basement flooding risks (Region of Peel, 2023). Similarly, the City of Toronto’s Basement Flooding Protection Subsidy Program provides homeowners with up to $3,400 per property to install flood protection devices like backwater valves and sump pumps, helping reduce the incidence of basement flooding and enhancing the city’s overall flood preparedness (City of Toronto, 2023).

Furthermore, Ontario's Community Emergency Preparedness Grant supports various communities in improving their emergency readiness for natural disasters. This grant helps communities and organizations purchase critical emergency equipment and supplies, strengthening their ability to respond effectively to emergencies. It is a vital component of Ontario's broader strategy to build resilient communities and enhance disaster response capabilities across the province (Ontario Ministry of Municipal Affairs and Housing, 2023).

Disaster Financial Assistance Arrangements (DFAA)

The Disaster Financial Assistance Arrangements (DFAA) is a critical program established by the Government of Canada in 1970 to provide financial support to provinces and territories when disaster costs exceed what they can manage independently. For over 50 years, the DFAA has been a key resource, offering financial assistance for disaster response and reconstruction, ensuring that provinces and territories have the necessary support to recover from catastrophic events (Public Safety Canada, 2022b).

The DFAA operates on a cost-sharing model, reimbursing provinces and territories for eligible expenditures that surpass a certain threshold, calculated on a per capita basis. As a funder of last resort, the DFAA typically covers an average of 82% of eligible disaster costs. While traditionally focused on post-disaster response and recovery, there is growing recognition that the program should also incentivize risk reduction and resilience-building efforts before disasters occur, to better mitigate future impacts.

The primary beneficiaries of the DFAA are provinces and territories, which receive financial support when disaster response and recovery costs exceed their capacity. However, municipalities, small businesses, and individuals also benefit indirectly through provincial and territorial disaster financial assistance programs that align with DFAA criteria. The program covers a wide range of natural disasters, including floods, wildfires, earthquakes, storms, and other significant events that cause extensive damage.

Despite its vital role in disaster recovery, the DFAA has notable limitations. Historically, it has been reactive, focusing primarily on post-disaster recovery rather than on pre-disaster risk reduction or resilience-building. This reactive approach limits its effectiveness, especially as disasters become more frequent, severe, and costly. The DFAA also has limited involvement in pre-disaster planning, investments

in prevention and preparedness. Additionally, the program is heavily focused on reimbursing structural damage, often restricting reconstruction to pre-disaster conditions, which may not be sufficient in the face of a changing climate and evolving disaster landscape. The program is further criticized for its inflexibility, high administrative costs, and restrictions that can delay aid and hinder strategic risk reduction efforts.

As disasters increase in frequency and severity, the DFAA's current framework is increasingly seen as outdated and inadequate for addressing these growing challenges. The program's emphasis on post-disaster response, with minimal focus on pre-disaster planning, risk reduction, or resilience-building, is insufficient in today's rapidly changing climate. Moreover, the DFAA lacks strong incentives for provinces and territories to invest in risk reduction or resilience-building, leading to missed opportunities to reduce future disaster costs and impacts. The program also operates separately from other federal initiatives aimed at disaster risk reduction and climate adaptation, resulting in a fragmented approach that lacks cohesion and effectiveness.

One of the most pressing challenges with the DFAA is its failure to adequately address the needs of vulnerable populations, such as Indigenous communities, who often face disproportionate impacts from disasters and have less support for recovery and resilience. In response to these challenges, the President of the King's Privy Council and Minister of Emergency Preparedness formed an expert advisory panel in March 2022 to review and recommend improvements for the DFAA program. This panel has initiated an ongoing process known as DFAA Modernization, aimed at enhancing disaster recovery, risk reduction, and resilience in light of the increasing frequency and cost of disasters. The modernization effort seeks to make the DFAA more responsive to current and future needs, ensuring that it remains an effective tool for disaster management in Canada.

Case Studies

The Reaction of Primary Insurance to Climate Changes

In response to the growing threat of flooding exacerbated by climate change, The Co-operators, a Canadian insurance company, has proactively developed innovative flood insurance products. Utilizing advanced modeling techniques to assess flood risk, The Co-operators provides coverage options tailored to various levels of risk, ensuring their insurance solutions are comprehensive and adaptable to different degrees of flood exposure. This approach underscores the company's commitment

to address the challenges posed by climate change and offering effective financial protection for their clients (Nolet and Guillot, 2016).

The politics of carbon pricing in Canada

In Ontario, carbon pricing has been a pivotal, albeit contentious, component of the province's climate policy. Despite efforts to involve stakeholders through participatory processes, Ontario's carbon pricing policy has encountered challenges in gaining widespread acceptance and legitimacy. These controversies have hindered the policy's effectiveness, highlighting the critical need for inclusive and transparent policy development. The complexities of Ontario's carbon pricing illustrate the difficulties in implementing climate policies that balance diverse interests while achieving environmental goals (Yankey, 2021).

Climate finance in action: case studies

At the same time, Ontario has been at the forefront of various climate finance initiatives aimed at supporting climate adaptation and mitigation. These initiatives include significant investments in renewable energy projects, the issuance of green bonds, and subsidies for sustainable infrastructure. Designed to ease the financial burden of climate change on vulnerable communities, these financial mechanisms ensure that the transition to a low-carbon economy is both equitable and effective. Through these investments, Ontario is actively working to mitigate the long-term impacts of climate change while fostering sustainable economic growth (JSTOR, 2020).

What We Don't Know

Research Areas

1. Climate Risk Assessment

Research in climate science is increasingly centered on understanding and mitigating the risks posed by climate change. A key area of focus is Climate Risk Assessment, which aims to model and quantify the impacts of climate change across various sectors, including agriculture, infrastructure, and public health. This research is crucial for developing strategies that enable societies to effectively manage and reduce these risks, ensuring adaptation to the evolving environmental landscape (Fields Institute for Research in Mathematical Sciences, 2022).

2. Big Data and Analytics

Another critical area of study is the application of Big Data and Analytics in predicting and managing climate risks. By utilizing advanced analytics and large datasets, researchers and industry professionals are creating new insurance products and pricing models that more accurately reflect the risks associated with climate change. These innovations are vital for providing adequate financial protection and incentivizing risk-reducing behaviors among businesses and individuals (Nolet and Guillot, 2016).

3. Enhancing Community Resilience

Sustainability and Resilience are also major focuses of climate research, with efforts directed towards investing in sustainable infrastructure and enhancing community resilience. This includes improving flood protection measures, upgrading building standards, and supporting renewable energy projects. These initiatives are essential for reducing the long-term impacts of climate change and ensuring that communities are better equipped to handle environmental challenges (Ontario Federation of Agriculture, 2023).

4. Policy and Regulation

Lastly, the development and implementation of Policy and Regulation are pivotal in driving climate adaptation and mitigation. Effective policies, such as carbon pricing, subsidies for green investments, and regulations promoting sustainable practices, are necessary to facilitate the systemic changes required to address climate change. These policies help create a regulatory environment that supports sustainability and fosters innovation in green technologies and practices (Fields Institute for Research in Mathematical Sciences, 2022).

Image: The Globe and Mail.

OUTCOMES FROM THE SESSION

1. Session Overview

The “Insurance and Financialization of Climate Risk in Ontario” session explored the current landscape, challenges, and future directions for integrating climate risk into financial decision-making. Led by Graham Huber from the Rotman School of Management, the session brought together researchers, community leaders, and industry practitioners to co-develop strategies and identify innovation opportunities at the intersection of climate science, finance, and insurance.

The session emphasized Ontario’s lack of a centralized hub for sharing information and best practices related to climate risk. There is a growing need for a climate modeling and services collaborative that can produce quality, downscaled, and user-friendly data to support governments, financial institutions, businesses, communities, and citizens in understanding emerging risks and taking timely, adaptive action. The session framed this ambition within a broader set of needs: the inadequacy of historical data for future planning, the urgency of real-time coordination, and the promise of emerging technologies. The session’s goals — identifying gaps and tensions, determining research priorities, and imagining new solutions — set the stage for a series of participatory exercises and structured conversations aimed at bridging the disconnects between climate data, financial systems, and community resilience.

Framed around a design-thinking approach, the session began with an interactive activity in which participants imagined new tools or services to support the insurance sector’s role in climate adaptation. This was followed by in-depth discussions that surfaced **opportunities and research priorities**, highlighting areas where better

coordination, equity, and data infrastructure could drive progress. In the second half of the session, participants engaged in structured conversations to **share knowledge and resources**, surfacing existing tools, gaps, and networks. Finally, each group presented **potential next steps**, outlining practical ideas, collaborations, and innovations to move the conversation forward. Together, these activities built a shared understanding of the challenges and opportunities facing Ontario's financial and insurance systems in the age of climate risk.

2. Design Workshop Reflections

During the interactive portion of the session, participants engaged in a design-thinking exercise that asked them to imagine creating a new product or service for the insurance industry in response to the growing challenges of climate risk. This activity was framed by two guiding questions:

1. *What excites you most about this opportunity?*
2. *What stands in the way?*

Participants shared a wide range of reflections, spanning ethical concerns, technical innovations, governance challenges, and intergenerational dynamics.

What are you most excited by?

Top themes that inspired participants included:

- Equitable approaches to climate resilience and adaptation (most popular theme)
- Advances in climate data, maps, and modeling
- Momentum for real progress on climate action
- Role of insurance in driving innovation
- Building and sustaining community resilience
- Opportunities for new and renewed collaborations
- Mobilizing financial resources to support real change
- Infrastructure and nature-based solutions for resilience
- Design optimization under uncertainty and scenario modelling
- Youth-led activism and cross-generational engagement
- Financial transparency and shared risk perceptions

What stands in the way?

Participants identified key barriers to realizing these opportunities:

- Structural barriers such as capitalism and entrenched systems (most frequently cited)
- Lack of political will and leadership, particularly at the provincial level
- Limited skills, education, and public awareness
- Funding shortages and misaligned financial priorities
- Data limitations and concerns about real estate market impacts from climate transparency
- Deficits in trust and misalignment of values among stakeholders
- Institutional inertia caused by bureaucracy and outdated traditions
- Systemic inequality, including racism and social polarization
- Siloed practices between industry and academia
- The dominance of proprietary interests over public benefit

These reflections highlight the creative energy and deep concern shared by participants, along with a shared sense of urgency to pursue inclusive, systems-level change. The design workshop surfaced a rich landscape of ideas that will help shape future policy, investment, and collaborative action.

3. Opportunities and Research Priorities

The session continued by identifying key opportunities for innovation and research at the nexus of climate risk data and financial stakeholders. This section allowed participants to reflect on pressing coordination issues, systemic data challenges, and knowledge gaps that impede effective risk management. Participants identified the following areas as requiring attention and collaborative innovation:

Overcoming Risk Aversion in Public Procurement

Several groups highlighted how municipal procurement policies can delay or deter the adoption of innovative tools and partnerships. Cautious budgeting processes, bureaucratic hurdles, and limited capacity to assess new offerings contribute to institutional inertia. Future research could explore alternative procurement models or pre-vetting systems for climate technologies.

Addressing Real Estate Market Sensitivities

The political and economic implications of sharing localized climate risk data were widely discussed. Participants warned that transparency might devalue property or trigger market fears, yet agreed that without open data, risk reduction is stalled. There is a need to study communication strategies and policy buffers that protect both transparency and housing equity.

Fixing Fragmented Data Governance

Incompatible data standards across institutions, sectors, and jurisdictions were seen as a major coordination failure. Mismatched formats, ownership concerns, and lack of interoperability prevent timely and effective use of climate data. Research into common data frameworks and governance models would support system-level reform.

Building Long-Term Financial Planning Capacity

Participants observed that many public institutions, especially at the municipal level, are not resourced to think beyond election cycles or annual budgets. Opportunities exist to embed climate risk in long-term financial forecasting tools and public finance frameworks.

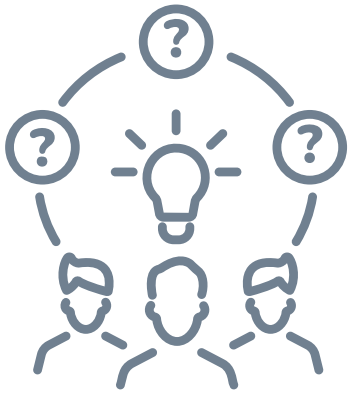
Exploring Ecosystem Services and Social Capital

Several tables examined how to quantify and integrate natural systems and social trust into financial models. These include proposals for assigning value to wetlands or green infrastructure, and financializing social capital for disaster recovery. This area calls for applied research and valuation methods.

Advancing Equitable Access and Use of Data

Equity was a recurring theme, especially around who has the capacity to interpret, access, and act on climate risk data. Participants urged for tools that center public benefit and language that bridges the gap between expert and non-expert communities.

Collectively, these research directions reflect the concerns and creative problem-solving efforts of participants, grounded in real-world implementation barriers and aspirations for more adaptive and inclusive climate-finance systems.



4. Share Knowledge and Resources

In the next part of the session, small groups engaged in structured dialogues to share knowledge and uncover mutual support opportunities. Participants discussed examples of what has worked, what remains a challenge, and how knowledge can be transferred and applied across different scales and institutional contexts.

Building Capacity Through Targeted Climate and Financial Literacy Training

There was an emphasis on addressing the lack of financial and climate literacy among key decision-makers. Participants underscored the need for professional development tailored to municipal leaders, risk managers, and planners who often lack the internal expertise to navigate climate data and insurance models. Programs that combine technical training with scenario-based learning were suggested as effective tools to bridge this knowledge gap.

Bridging the Communication Gap Between Experts and Practitioners

A recurring challenge is the disconnect between experts and practitioners, particularly in the use of language and frameworks. Participants advocated for deliberate translation efforts — creating glossaries, hosting interdisciplinary workshops, and developing visual tools that help financial and climate stakeholders to 'speak the same language.' Such efforts are seen as foundational to building trust and enabling shared action.

Leveraging Existing Platforms, Partnerships, and Technical Resources

Participants shared a wide range of existing platforms and initiatives. Climate Proof Canada and Shift were highlighted for their advocacy and policy contributions. Data platforms such as Climatedata.ca and the Canadian Climate Atlas, tools such as MITACS, CATIQ (especially their catastrophe data), and scenario modeling frameworks were also mentioned as critical resources. Participants noted the growing value of student involvement — leveraging university talent for climate modeling and impact assessment. Additionally, events like the CAT IQ Conference were suggested as important venues for ongoing learning and collaboration.

Participants shared examples of pilot projects, collaborative resource-sharing models, and emerging public-private partnerships that offer blueprints for scalable solutions. The session reinforced the importance of investing in collaborative infrastructure that supports both innovation and equity.

5. Potential Next Steps

Each discussion table presented highlights and proposed action points to move their insights forward. These outputs reflect a variety of themes — from data innovation to policy reform — and underscore the appetite for cross-sector experimentation and coalition building.

5.1. Community-Centered Insurance and Equitable Climate Literacy

The group focused on education, equity, and the need for community-centered insurance models. The group emphasized the importance of developing accessible platforms that demystify climate insurance and empower residents, particularly in marginalized communities, to understand their options. They proposed a platform for shared learning, targeting both public education and internal capacity building for municipal actors. They also stressed the ethical use of data, calling for data translation that prioritizes social welfare, rather than commercial exploitation. Their vision included greater alignment between insurance services and community organizing initiatives.

5.2. Institutional Collaboration and Incentive-Based Risk Governance

The group recommended a framework for government-insurance collaboration, with a focus on clearly articulated roles, mutual accountability, and shared incentives. The group discussed zoning policies that could encourage resilience, such as floodplain restrictions or green retrofit bonuses, while cautioning against unintended consequences, like increased housing vulnerability. They also highlighted the need for transparency in risk communication and proposed incentives for behavioral change that extend beyond the individual level, including community-wide engagement strategies.

5.3. Valuing Nature and Social Capital through Public Data Access

The group explored financialization of ecosystem services and social capital, with an emphasis on mechanisms that prioritize public benefit over proprietary data ownership. They proposed models for integrating nature-based solutions into insurance valuation, such as recognizing the value of wetlands or green

infrastructure in storm mitigation. The group also reflected on the tension between private data control and equitable access, advocating for the creation of public trusts or open-source repositories to support broader use of critical risk information.

5.4. Bridging Communication Gaps between Climate Science and Finance

The group highlighted the communication gaps between finance and science sectors. The proposed next steps included creating shared language frameworks and incentives for mutual understanding. They also stressed the need to integrate insurers more deeply into climate adaptation planning through co-investment in retrofitting programs and risk-disaggregated insurance products.

5.5. Governance Innovation for Climate Risk Data and Public Insurance

The group focused on legal and infrastructural frameworks for climate data governance, as well as emerging needs for public insurance systems. Participants proposed watershed-based flood insurance models that reflect real exposure and promote proactive risk reduction. The group stressed that current data infrastructure is fragmented and under-governed, leading to delays and uncertainty in financial planning. They recommended piloting public-nonprofit insurance programs that mirror healthcare models, as well as leveraging process-based climate modeling to inform long-term urban planning. Their vision involved scaling blue-green infrastructure with built-in risk assessment metrics and government-backed funding schemes.

Together, the proposed potential next steps illustrate a strong desire to build practical, interdisciplinary, and community-anchored solutions. There was a shared call for systems thinking — aligning policies, incentives, data, and education to collectively reduce risk and enhance resilience across Ontario's financial and climate landscapes.

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Climate Risk and Extreme Heat in Ontario

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Image: Waterloo News/ University of Waterloo.

BACKGROUND BRIEFING

Heat as a Risk

Under a warming climate, air temperatures across Canada have been steadily (and at times, rapidly) increasing (Lemmen and Bush, 2019; Lulham et al., 2023). Though heat-related deaths and injuries are not very common in Canada, the devastating impact of heat became clear during the 2021 BC Heat Dome, Canada's deadliest weather event, which led to nearly 700 excess deaths (Henderson et al., 2022). This tragedy illustrates the growing severity of extreme heat, even in regions that were previously considered less vulnerable.

While Canada's historical data on heat-related fatalities is incomplete, trends show a rapidly growing risk. Data from the US National Weather Service identifies heat as the number one weather-related fatality in 2023, as well as across the past 10- and 30-year averages (Figure 1). Between heat exposure and wildfire threats, the aging population, and the housing crisis, heat poses a significant threat to human health and flourishing in Canada.

Further, evidence from Phoenix, Arizona (Figure 2) shows that the National Weather Service is undercounting heat-related deaths. In Maricopa County (the county that houses Phoenix), there has been a rapid increase in heat-related deaths, topping out at 645 deaths in 2023 for Maricopa County alone. This is three times the US national statistic.

The risk is likely dramatically higher than what the US is reporting, and without a similar statistic for Canada, it remains to be seen what heat (often referred to as the silent killer) is doing to the health and wellbeing of Canadians.

Figure 1 depicts the historical frequency of weather-related fatalities in the US (as tracked by the National Weather Service). https://www.weather.gov/hazstat/

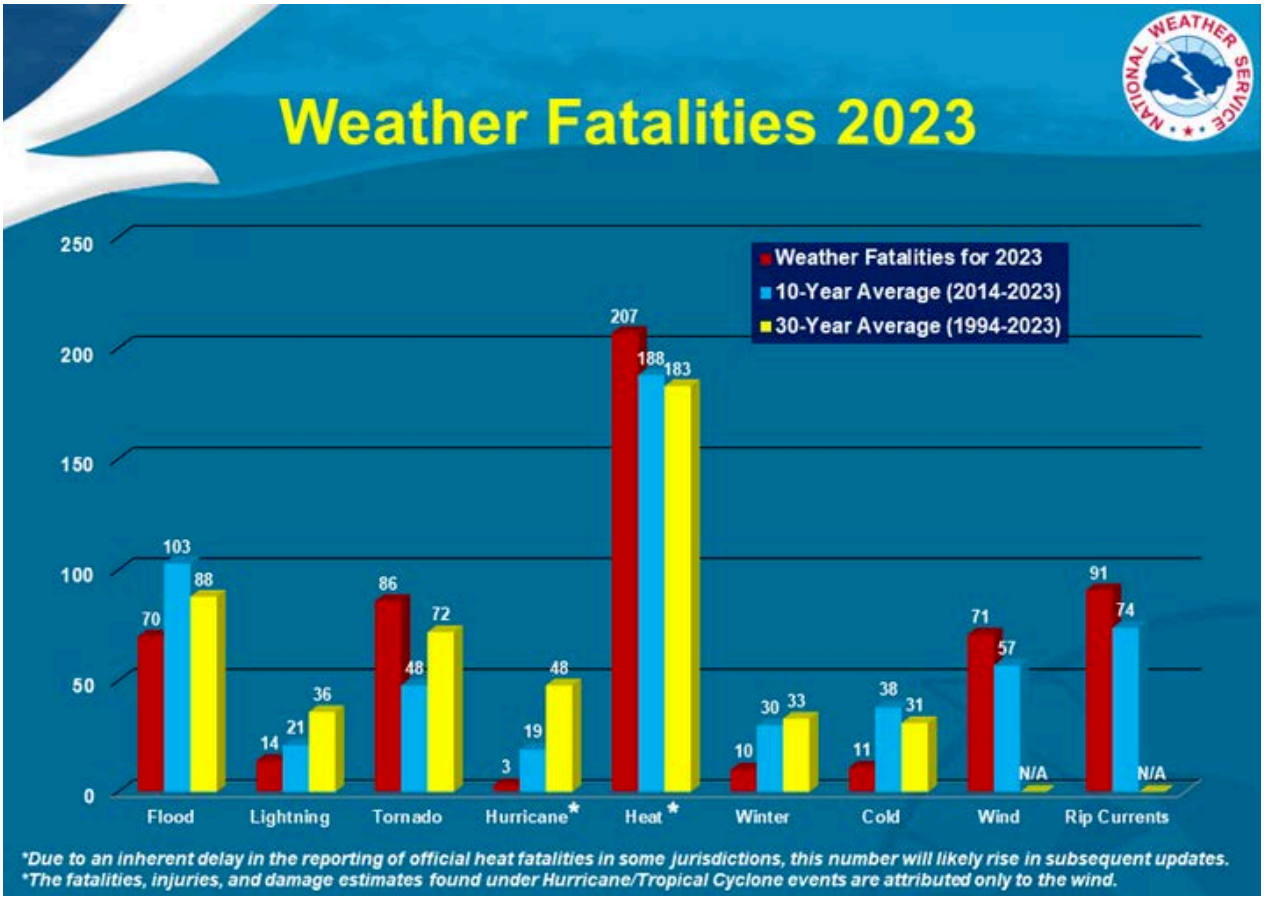
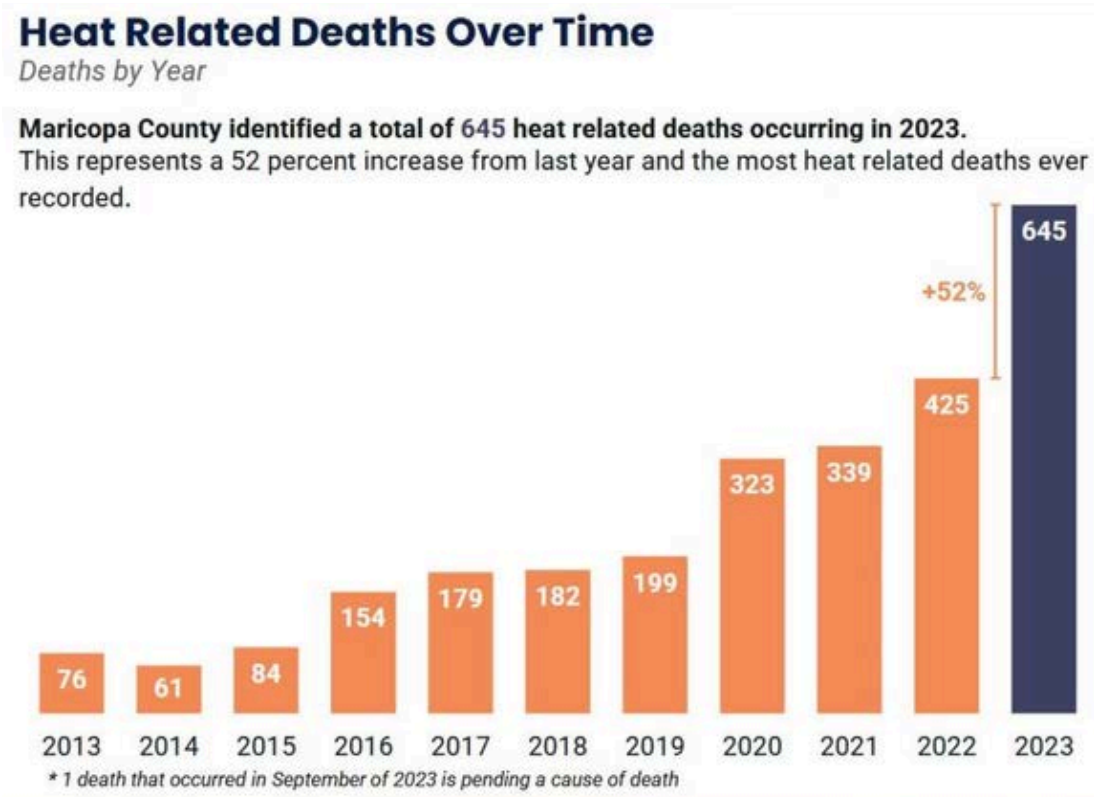


Figure 2 depicts the annual heat-related deaths in Maricopa County (where Phoenix, AZ is located) since 2013. The methodology for determining heat-related deaths are more refined and yet broader than the NWS definitions. Report: 2023 was the deadliest year for heat in the Valley



What do we know about heat in Ontario?

The City of Toronto has sought to address heat vulnerability through the operation of publicly accessible cooling centers for vulnerable citizens with limited personal access to cool spaces. The analysis of city-operated cooling centers shows they are well-positioned in areas with a high heat load (Anderson et al., 2022). Anderson and colleagues (2022) identified urban agriculture as demonstrating the largest cooling effect, with average temperature reductions of 0.5 °C in near-surface air temperature from green roofs. Urban forestry and greening provide cooling through shading of the surfaces, evapotranspiration, and a reduced albedo (reflecting more solar radiation) (Erell et al., 2012).

Modeling work to downscale climate projections for urban outdoor thermal stress has also identified Toronto and the Ontario climate as anticipating outdoor heat exposure to exceed thermal comfort thresholds during the summer months in Toronto (at all times of day) under a warmer climate (Jiang et al., 2023). Jiang et al. (2023) noted that while individual cities cannot alter anticipated global climate changes, they do have the capacity to use Combined Spatial-Climatic Design (CSCD) principles (Banerjee et al., 2024) to (re)develop the city to maintain thermal comfort conditions for residents and pedestrians.

Health Impacts

The Health Costs of Climate Change: How Canada Can Adapt, Prepare, and Save Lives - a series of five reports

Climate change is also creating significant challenges to health, healthcare, and quality of life in Canada (The health costs of climate change, 2024). The Canadian Climate Institute identifies heat-related productivity losses to grow to nearly $4 billion by mid-century and heat-related deaths to cost at least $3 billion in the same time period. Other research has shown that heat is creating significant healthcare impacts (costs and deaths) to mental health (Crank et al., 2023; Lee et al., 2023; Tupinier Martin et al., 2024) and older adults (Crank et al., 2024).

What We Don't Know

Problems, Challenges, and Opportunities

A significant challenge to a Canadian (or Ontarian) response to extreme heat is a lack of data on the heat-related deaths and/or hospitalizations (Henderson et al., 2022). A lack of official statistical tracking creates a patchwork of methods, data, and information that leads to gaps and an unclear picture of how heat is impacting

Canada. Without such data and information, the argumentation to governments and policymakers is weak. Yet, there are methods on how to develop this type of data (Lo et al., 2022). Thus, a problem, challenge, and opportunity for Ontario researchers interested in urban heat is to collaborate to tackle this challenge.

For example, extreme heat is rarely directly listed as the cause of death in medical reports (Grant, 2024; Lee, 2023). Instead, excess deaths — the difference between expected and actual deaths during a heat event — are used to estimate the true toll of extreme heat. This makes heat events an often "invisible" killer. Public health officials use this estimation technique to retroactively attribute deaths to heatwaves, but without better data, these estimates can be imprecise. And unlike any other environmental hazard, without targeted data and reporting, heat events are only ever just estimations.

Beyond the direct health impacts, there are other areas where a more cohesive and collaborative approach to data collection and methodology would serve the populations of Canada well. One of the key challenges of extreme heat is that it often leads to cascading hazards, such as wildfires (Jain et al., 2024; Sun et al., 2019). These secondary hazards further deteriorate air quality, worsening health outcomes, particularly for vulnerable populations. In Southern Ontario, increased heat could exacerbate the region's wildfire risks, creating a dangerous feedback loop between heat and air quality crises. The 2021 BC Heat Dome also demonstrated the cumulative strain that heat waves can place on multiple systems, from health services to emergency response (Henderson et al., 2022).

A better understanding of how urban heat is trapped and permeates all Ontario cities (not just Toronto) would greatly increase the adaptive capacity of Ontario to face the heat risks of climate change. Small and medium-sized cities (SMSC) need tailored solutions to their contexts and cannot rely on solutions identified in Toronto to work in their locales (Pham et al., 2024).

Further reading

Policies and Programs for Extreme Heat Prevention and Mitigation in Southern Ontario

City of Toronto Heat Relief Strategy

Green Roof Bylaw: Toronto was the first city in North America to have a bylaw to require and govern the construction of green roofs on new developments (City of Toronto, 2024). The Green Roof Bylaw sets out a graduated green roof requirement

for new developments that are greater than 2,000 m² in gross floor area. The requirement ranges from 20-60% of the available roof space of a building. The Bylaw includes an option for developers to seek approval to pay $200/m² as cash-in-lieu instead of constructing the required green roof. All funds collected as cash-in-lieu are directed to the Eco-Roof Incentive Program.

Eco-Roof Incentive Program: Toronto's Eco-Roof Incentive Program encourages the installation of green roofs and cool roofs on existing (and some new) buildings through financial incentives. The program offers $100 million for green roof projects and $2-5 million for cool roof projects. In addition, applicants who want to construct a green roof on an existing building may also be eligible to receive a Structural Assessment Grant, which provides up to $1,000 to help offset the costs associated with determining whether the building is suitable for green roof construction. The program is self-sustaining, drawing funding from cash-in-lieu payments through the Green Roof Bylaw.

Ontario Provincial Climate Change Impact Assessment: The Ontario Provincial Climate Change Impact Assessment highlights the growing risks of extreme heat in Southern Ontario due to climate change. It projects that by the mid-21st century, the region could experience a significant increase in the number of extreme heat days (days exceeding 30 °C), which could place a greater strain on public health and infrastructure. To mitigate these impacts, the report emphasizes the need for cities like Toronto to adopt nature-based solutions, such as green roofs and increased urban tree canopies, which help reduce surface and ambient air temperatures. The Impact Assessment also supports policies that enhance building resilience to extreme heat by encouraging the use of reflective and cool roofing materials, which reduce heat absorption and improve energy efficiency. Furthermore, it underscores the importance of integrating climate change considerations into urban planning to protect vulnerable populations from the increasing frequency and severity of extreme heat events.
Link: Ontario Provincial Climate Change Impact Assessment

Case Studies

1. Cooling Infrastructure and Nature-Based Solutions in Toronto

- Authors: Anderson, V., Gough, W.A., Zgela, M., Milosevic, D., & Dunjic, J.
- Details: In Toronto, nature-based solutions such as green roofs, urban agriculture, and green walls have been shown to significantly lower temperatures in high heat load areas. The City of Toronto operates publicly accessible cooling centers to serve vulnerable populations, and nature-based infrastructure, such as urban forestry and green roofs, contributes to an

average temperature reduction of 0.4–0.9 °C in near-surface air temperature. This has important implications for reducing heat vulnerability, particularly in urban areas that face the highest heat loads.
- Publication: Atmosphere, 2022
- Link: Lowering the Temperature to Increase Heat Equity

2. Projections of Urban Heat Exposure in Toronto
- Authors: Jiang, T., Krayenhoff, E. S., Voogt, J. A., Warland, J., Demuzere, M., & Moede, C.
- Details: This study used dynamic downscaling to project future urban heat exposure in Toronto, highlighting the increased thermal stress due to climate change. Projections suggest that by the end of the century (EoC), heat exposure in Toronto will rise, particularly during heatwaves, and will affect outdoor environments at all times of day. The findings emphasize that cities like Toronto must focus on local development patterns and urban planning to modulate thermal comfort for pedestrians and residents, especially in high-risk urban zones.
- Publication: Urban Climate, 2023
- Link: Dynamically downscaled projection of urban outdoor thermal stress and indoor space cooling during future extreme heat

3. Extreme Heat and Mortality in Southwestern Ontario
- Authors: Clemens, K. K., Ouédraogo, A. M., Li, L., Voogt, J. A., Gilliland, J., Krayenhoff, E. S., & Shariff, S. Z.
- Details: This study examined the relationship between extreme heat and mortality in Southwestern Ontario, using two temperature data sources to capture urban climate more accurately. While past studies showed a positive relationship between temperature and mortality, this study found that the effects in Southwestern Ontario were not statistically significant. The findings point to the importance of regional analyses in understanding heat-related health risks and suggest that future studies incorporate more localized data to evaluate mortality outcomes during extreme heat events.
- Publication: Scientific Reports, 2021
- Link: Evaluating the association between extreme heat and mortality in urban Southwestern Ontario using different temperature data sources

Image: Waterloo News/ University of Waterloo.

OUTCOMES FROM THE SESSION

Session Overview and the Start

The Urban Heat Session at the Ontario Climate Risk Workshop, held at the University of Toronto on October 31, 2024, was led by Dr. Peter Crank from the Department of Geography and Environmental Management. The session focused on the pressing challenges posed by urban heat and its implications for health, infrastructure, and equity in the Canadian context, particularly in Southern Ontario.

The session situated urban heat within Canada's rapidly changing climate, citing the Canada's Changing Climate Report (2019) and the Canada in a Changing Climate Synthesis Report (2023). These reports underscore the increasing frequency and severity of heat events driven by global warming and the ongoing climate crisis, with urban areas facing amplified risks due to the heat island effect. Key drivers of heat buildup in urban environments include a combination of factors, including a) impervious surfaces that retain heat and increase ambient temperatures; b) waste heat emissions from buildings and vehicles that further exacerbate the heat island effect; and c) individual metabolism contributions in densely populated areas. Contrary to prevailing assumptions that urban heat risks exist predominantly within large and urban cities, the session highlighted that urban heat persists in both large and small cities, though the severity of heat exposure may differ depending on infrastructure, green cover, and socioeconomic factors. Urban heat risk disproportionately affects marginalized and vulnerable communities, as noted in prior research (Oke et al.,2017; Urban Climates).

The Cost of Heat: Health Risks and Economic Impacts

The session then transitioned to a discussion of the public health impacts of extreme heat, highlighting that urban heat contributes significantly to heat-related hospitalizations and mortality in vulnerable populations. Multiple studies provide evidence and underscore the increasing burden of heat on public health. For example, Crank et al. (2023) analyzed heat-related hospital admissions for schizophrenia in arid urban climates, revealing a direct link between rising temperatures and increased mental health risks. Furthermore, Lee et al. (2023) examined the chronic diseases associated with mortality during the 2021 Western North America extreme heat event (Henderson et al., 2022) and emphasized the acute risk to vulnerable populations. Tupinier Martin et al. (2024) echo these findings in their investigation of the relationship between high temperatures and hospital admissions for psychosis in Quebec, further strengthening the case for addressing heat's impact on mental health. Specifically, extreme heat poses a disproportionate amount of risk to older adults. In their examination of sociodemographic determinants of extreme heat risk among older adults across multiple urban settings, Crank et al. (2024) emphasize the urgent need to develop targeted mitigation strategies to protect older adults (individuals 65 years old and up) from heat-related health risks.

There is a direct link between rising temperatures and increased mental health risks

Vulnerable populations face a higher risk of heat-related hospitalizations and mortality

Older adults are particularly susceptible to the health impacts of extreme heat

Heat-related impacts also carry significant economic costs, from increased healthcare expenditures to productivity losses due to heat stress. The Canadian Climate Institute has highlighted that heat-related impacts not only reduce workplace productivity but also escalate healthcare costs due to increased hospitalization and emergency room visits. For example, heat-related productivity losses are anticipated to grow to nearly $4 billion by mid-century and heat-related deaths to cost at least $3 billion in the same time period (Clark, 2021).

Recognizing and Tracking Heat Risk

1. Challenges in Data Tracking and Attribution

One of the significant challenges in extreme heat risk management has been Canada's incomplete historical data on heat-related fatalities or heat risk impacts. There is a critical lack of standardized data on heat-related hospitalizations and deaths in Canada, hindering evidence-based policy and emergency response. Participants in the workshop session highlighted the absence of consistent federal or provincial mandates for hospitals to document heat-related hospitalizations and deaths, undermining evidence-based policymaking and emergency preparedness. Public health officials, who were present, underscored the inconsistent federal and provincial tracking of extreme heat impacts, with no mandate for hospitals to systematically document heat-related morbidity. This complicates efforts to attribute health outcomes — such as heat stroke, cognitive decline, or chronic disease exacerbations — to specific heat events. This lack of systematic data collection hinders the ability to quantify healthcare costs, prioritize interventions, or allocate resources effectively. Ultimately, the lack of data is leading to decreased care of the vulnerable populations to heat and an underestimation of the risk to the general public by governmental authorities and the average citizen of Canada (Henderson et al., 2022).

2. Heat-related Health Impacts Require Distinct Responses

Second, health risks posed by extreme heat are often overlooked and require a distinct response approach, which is not commonly known in the region. For example, heat exhaustion (marked by dizziness, nausea, and sweating) and heat stroke (characterized by a lack of sweating, throbbing headaches, and high body temperature) require distinct responses, yet public awareness of these differences remains low (Sun et al., 2019; Lee et al., 2023). Participants noted that heatwaves disproportionately impair vulnerable groups, including outdoor workers, older adults, unhoused individuals, and residents of poorly insulated housing. Students with ADHD or learning disabilities were identified as particularly at risk, with heat exacerbating attention deficits and correlating with declines in standardized test performance.

3. Defining Heat Emergencies

Third, participants grappled with the urgent need to establish clear thresholds for declaring heat emergencies. Current parameters remain ambiguous, leaving

emergency responders and policymakers without consistent guidance. Tamiko Matsumoto, an emergency management professional, articulated the challenge: *"What factors define a heat emergency? We can't wait to see deaths in hospitals — there are too many variables at play."* The discussion emphasized the critical role of Environment and Climate Change Canada (ECCC) in improving regional forecasting and issuing targeted alerts. Participants stressed that a one-size-fits-all approach — such as using a single temperature threshold for the entire Greater Toronto-Hamilton Area (GTHA), cottage country, or the Niagara Peninsula — is insufficient. Instead, more tailored, granular data is needed at the municipal or county level to reflect differing vulnerabilities, microclimates, and urban infrastructure. The stakes are high: heatwaves create compounding risks such as overwhelmed healthcare systems. Emergency responders face dual pressures: surging heat stroke cases divert resources from other critical emergencies, while power outages disrupt communication and cooling access. Transportation infrastructure, such as warped rail tracks, further exacerbates supply chain disruptions, threatening food security and increasing long-term repair costs. Some participants proposed indicators for heat-related emergencies like sustained temperatures exceeding 35 °C, strain on power grids, or a 20% surge in heat-related EMS calls.

4. Non-Human and Ecological Impacts

Finally, the dialogue underscored that urban heat extends far beyond human health, destabilizing ecosystems and biodiversity in ways that threaten both ecological balance and human livelihoods. Participants highlighted the cascading effects of rising temperatures on pollinators, aquatic systems, agriculture, and wildlife. Native pollinators, particularly bees, face habitat degradation as urban heat reduces floral diversity and availability. This decline jeopardizes pollination-dependent crops, directly impacting food security and agricultural economies. Concurrently, aquatic ecosystems suffer from warmer water temperatures, which accelerate harmful algal blooms. These blooms deplete oxygen levels, creating dead zones that endanger fish populations and disrupt fisheries critical to local communities. Agricultural systems are equally vulnerable. Shifting growing seasons and prolonged droughts, exacerbated by heat, strain water resources and diminish crop yields. Participants noted that these challenges compound existing food insecurity, particularly in regions already grappling with climate variability. Migratory species, such as birds and fish, further illustrate the ecological toll: altered migration patterns disrupt breeding cycles and predator-prey dynamics, destabilizing ecosystems and diminishing biodiversity. The discussion concluded that ecological impacts are inextricably linked to human health and economic stability. Addressing urban heat requires holistic strategies that safeguard both natural systems and the communities reliant on them.

Mitigation Policies, Their Limitations and Recommendations for Improvement

The session emphasized that effective mitigation strategies hinge on robust data collection and analysis of urban heat risks in Southern Ontario. However, participants also examined existing efforts to mitigate urban heat in Southern Ontario, emphasizing opportunities for improvements and implementation considerations. The City of Toronto has been a leader in terms of developing bylaws to support green infrastructure and mitigate urban heat effects within the city. An example of these efforts is the Toronto Green Roof Bylaw is detailed below.

Toronto Green Roof Bylaw (Wright et al., 2021):

Introduced to incentivize green roofs and mitigate the urban heat island effect, this policy has seen mixed results. Participants noted significant limitations: most implementations occur on high-rise buildings (10–12 stories), where cooling benefits fail to reach pedestrians. Industrial zones disproportionately benefit, while residential areas — particularly low-income neighborhoods and schools — remain underserved. Instead, participants discussed prioritizing pedestrian-level green infrastructure (e.g., parks, street trees) over high-rise green roofs to maximize equitable cooling benefits. Furthermore, expanding the cool roof program to include reflective surfaces and solar panels can help reduce rooftop temperatures, leveraging cost-benefit evidence from cities like London. Increased canopy coverage in heat-vulnerable neighborhoods identified through mapping, can also help with cooling.

Building on this discussion, participants provided further insights on mitigation policies and approaches that can help address and mitigate the impacts of extreme heat, as presented below:

Building Design Innovations

Green roofs are not the only option for Ontario cities to consider for how to address urban heat. Passive cooling strategies, such as cross-ventilation and shaded building orientations, were highlighted as cost-effective ways to reduce reliance on energy-intensive air conditioning. Reflective "cool roofs" and solar panel installations were also discussed, with London, UK, cited as a model. Retrofit projects there avoided £615 million in healthcare costs by reducing heat-related mortality (Simpson et al., 2024). Participants stressed that such designs must be codified into updated building regulations to ensure widespread adoption.

Case studies from Phoenix, Arizona, and Singapore showcased climate-resilient housing models (Maricopa County, 2024; Banerjee et al., 2024; Crank et al., 2023). However, attendees cautioned that silos between affordable housing and climate adaptation persist. As one participant remarked: “We can’t focus on climate change because we need to prioritize affordability.” This disconnect often sidelines heat resilience in favor of short-term cost savings, leaving vulnerable populations exposed. Participants discussed mandating heat-resilient designs (e.g., cross-ventilation, shaded facades) in new developments as a way to address these challenges.

Resilience Hubs

Schools were proposed as cooling centers during heatwaves, providing safe havens for at-risk groups like the elderly and unhoused individuals. However, accessibility barriers might limit their effectiveness. For example, mobility-impaired individuals and those without reliable transportation might struggle to reach these hubs. Further, schools, as protected spaces, may legally restrict access to individuals with restraining orders or other court-mandated limitations. This creates a tension between inclusivity and legal safeguards, potentially eliminating certain locations from consideration as "universal" cooling centers.

Cost-Benefit Insights

The economic rationale for mitigation was underscored through cost-benefit analyses. Studies, such as Simpson et al. (2024), quantified the value of avoided deaths and hospitalizations from measures like cool roofs and green infrastructure. For example, London’s cool roof retrofits not only lowered ambient temperatures but also saved hundreds of millions in healthcare costs. These findings reinforce that mitigation strategies offer dual benefits: immediate cooling and long-term public health savings.

Finally, participants underscored the importance of integrating climate resilience principles into the design and construction of affordable housing developments to mitigate urban heat, emphasizing that proactive adaptation measures need not compromise affordability. To advance equitable and effective solutions, they advocated for cross-jurisdictional collaboration, drawing insights from established global models such as Phoenix’s heat action plans — including heat-responsive infrastructure like cooling centers and shade networks — and Singapore’s holistic urban greening strategies, which prioritize biodiversity-rich corridors and vertical greenery to reduce ambient temperatures. By synthesizing these approaches, cities can foster resilient communities while avoiding counterproductive trade-offs between cost-efficiency and climate preparedness.

Potential Pathways Forward: Becoming better at recognizing, tracking and addressing extreme heat in Southern Ontario

The workshop concluded with participants outlining actionable pathways to enhance Southern Ontario's capacity to mitigate urban heat risks. These recommendations, synthesized from interdisciplinary dialogue, emphasize data-driven policymaking, community-centered adaptation, and cross-sector collaboration.

1. Defining Heat Emergencies

A recurring theme was the urgent need to establish clear, evidence-based thresholds for declaring heat emergencies. As previously noted, participants recommended criteria such as sustained temperatures exceeding 35 °C, spikes in heat-related EMS calls, or strain on critical infrastructure (e.g., power grids). These thresholds would enable proactive responses rather than reactive measures tied to mortality data, which often lag behind real-time crises.

2. Managing Overwhelmed Systems

To mitigate healthcare strain during heatwaves, participants advocated for pre-emptive wellness checks targeting vulnerable groups, such as unhoused individuals and isolated older adults. Decentralizing energy systems — for example, deploying solar-powered cooling centers — was highlighted as a way to maintain communication and cooling access during power outages. Additionally, converting schools or community centers into multi-functional cooling hubs was proposed, though attendees cautioned that accessibility barriers (e.g., transportation gaps, legal restrictions on site access) must be addressed to avoid excluding marginalized groups. As one participant warned, *"Utilizing existing infrastructures without planning can disrupt social culture,"* underscoring the need to balance emergency use with community cohesion.

3. Preparedness Programs

Training programs to help first responders recognize heat stress symptoms (e.g., distinguishing heat exhaustion from stroke) were deemed critical. Participants also stressed the value of future city mapping to simulate heat risks under climate scenarios, guiding targeted infrastructure upgrades like shaded walkways or cooling corridors. Public education campaigns using culturally tailored messaging, such as art, music, or community-led media, were recommended to replace fear-based narratives with empowering, relatable content.

4. Communication Challenges and Strategies

Overcoming Canada's "cold-climate bias" emerged as a central challenge. Participants urged amplifying heat risks through storytelling that resonates with diverse audiences. Key approaches included:

1. Indigenous Expertise: Leveraging Indigenous communities' storytelling traditions to communicate heat resilience strategies rooted in intergenerational knowledge and ecological stewardship.
2. Climate Fiction: Referencing work like The Ministry for the Future (Robinson, 2020) to illustrate heat impacts while balancing dystopian warnings with actionable solutions.
3. Arts and Music: Adopting creative models, such as the musical In the Heights — which depicts coupled blackout and heat wave events in New York City — to humanize data and foster emotional engagement (Hudes, 2013).

Specifically expanding on storytelling for engagement, participants emphasized that storytelling is not merely a communication tool but a bridge between technical data and public action. For example, Indigenous stories that frame heat resilience as a collective responsibility could foster community-led cooling initiatives. Similarly, collaborative art projects could visualize heat risks in underserved neighborhoods, transforming abstract climate models into tangible narratives. Participants stressed that effective storytelling must center marginalized voices, ensuring that heat solutions reflect the lived experiences of those most affected. The session concluded by highlighting arts and music as pivotal tools to reframe heat preparedness. By integrating creative practices into public outreach, Southern Ontario can cultivate a cultural shift — one that recognizes extreme heat not as a distant threat but as an urgent, shared challenge demanding collective action.

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Climate Risk and Housing in Ontario

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Image: CBC News/ Mark Blinch/Reuters.

BACKGROUND BRIEFING

Ontario is Facing a Housing Crisis

Ontario is facing a housing affordability crisis, which can be attributed to multiple factors, including the lack of housing and affordable housing supply (Report of the Ontario Housing Affordability Task Force, 2022), the financialization of housing in Canada (August, 2022; Walks, 2019), and the increasing cost of living (Olive, 2024). Estimates for how many new homes need to be constructed in Canada range from 5.8 million to 9.6 million new homes over the next 6-10 years to make housing more affordable (Miller and Carriere, 2024). Therefore, increasing housing supply while decreasing affordability is a critical challenge. Moreover, the housing market should consider the diversity of household sizes and typologies and the existing bias on building high-density, small-unit high-rise development to the detriment of medium-density housing types that are scarce (Parker et al., 2023).

To address this crisis, the provincial government has introduced the *Helping Homebuyers, Protecting Tenants Act* in 2023 with the plan to introduce 1.5 million homes by 2031 under *Bill 23, More Homes Built Faster*. However, housing justice organizations like the Canadian Centre for Housing Rights have pointed out that current legislation raises concerns about the plan's lack of affordable rental housing (2023). Building more housing units does not address other factors like financialization, which sees housing as a commodity rather than a fundamental human right (Advocacy Centre for Tenants Ontario, 2022). Researchers also criticize that the Bill will not necessarily improve livability since the development applications are no longer revised by Regional authorities, and the rapid and competitive developments encouraged by this type of legislation may prioritize profit over environmental quality (Parker, 2022) and community needs (Dachis and Thivierge, 2018).

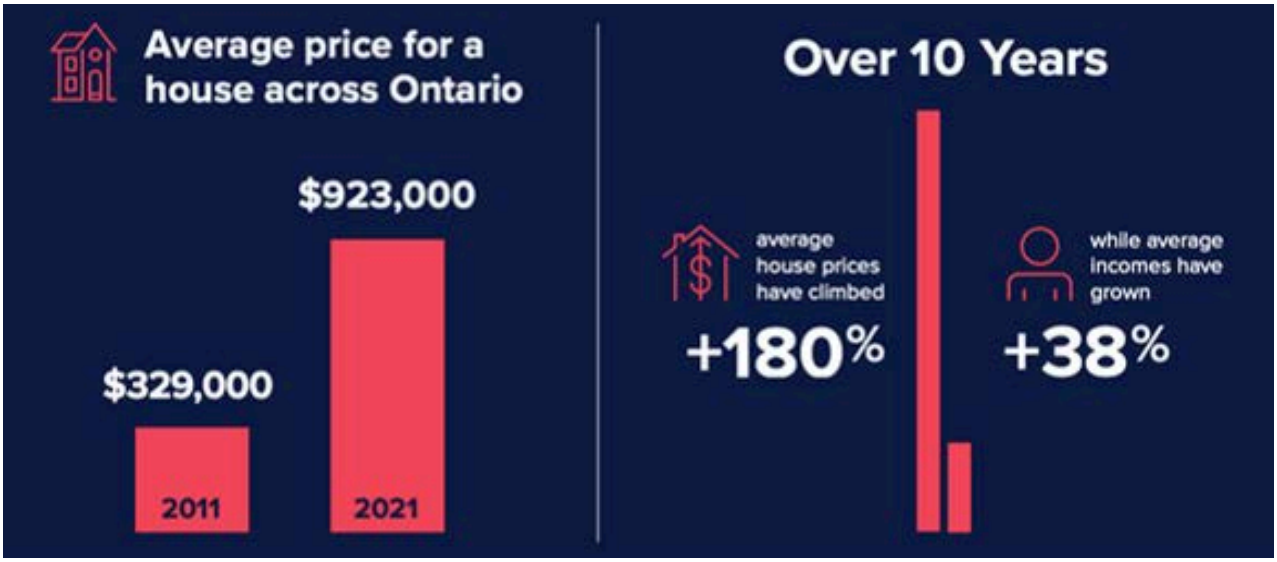
At the same time, a transformation of residential buildings is required to meet greenhouse gas targets. Addressing the housing crisis requires drastically ramping up the provision of affordable housing that addresses the housing crisis, increases resiliency, and meets net-zero targets. Furthermore, beyond increasing the housing supply, policymakers must also consider the climate impact of new developments since the loss of urban green spaces amplifies hazards such as urban heat and flooding (Drescher et al., 2022), highlighting the importance of local and regional planning.

Key Factors Attributed to the Housing Crisis

Lack of Housing and Affordable Housing Supply

Ontario is at the heart of Canada's housing crisis, accounting for two-thirds of the national issue (OHATF, 2022). Ontarians carry high levels of household debt, linked to high housing costs, and the Bank of Canada has found that over 50% of Ontario households have high exposure to both disasters and financial vulnerabilities (Duprey et al. 2021).

Housing prices in Ontario have nearly tripled over the past decade, a trend that underscores the severity of the province's housing affordability crisis. According to the Report of the Ontario Housing Affordability Task Force (OHATF, 2022), "[...] the average price for a house across Ontario was $923,000 at the end of 2021. Ten years ago, the average price was $329,000. Over that period, average house prices have climbed 180%, while average incomes have grown roughly 38%". This sharp rise in housing costs highlights the widening gap between property prices and income growth, further exacerbating affordability challenges.



A report from the Ontario Real Estate Association (OREA) provides an update on the implementation of recommendations from the Housing Affordability Task Force. Out of the 55 recommendations, 18 have been fully implemented (33%), major progress has been made on 9 (16%), some progress has been made on 15 (27%), and 13 recommendations have yet to be acted upon (24%). These statistics highlight the ongoing efforts and challenges in addressing Ontario's housing affordability crisis.

Adding to the discussion, profitability plays a crucial role in determining housing affordability, once developers' profitability perceptions significantly influence their decisions to initiate or continue housing projects and their final costs. Uncertainty created by fluctuations in construction costs, high interest rates and land value, and deficits in labour supply are barriers to new developments (Valaei Sharif et al., 2023).

The Financialization of Housing

An increasing share of Ontario's housing stock is owned by investment and trading companies, such as real estate investment trusts (REITs), private equity funds, asset management companies, and pension funds, according to the Canadian Centre for Housing Rights. This trend reflects a broader shift in the housing market, where homes are increasingly viewed as financial assets. In Toronto, the growing presence of privately owned condominiums — a phenomenon referred to as "condoization" — has significantly contributed to gentrification across the city (Grisdale and Walks, 2022).

To address these challenges, scholars have called for a reorientation of housing policy to prioritize its social function. August (2022) argues that the value of housing as a home should take precedence over its value as a commodity. However, under neoliberalism, market values such as financialization are prioritized, often undermining social objectives.

The financialization of housing takes many forms, including the financialization of mortgages, single-family homes, multi-family rental housing, senior housing, social housing, student housing, short-term rentals, and mobile home communities (August, 2022). This process has significant social implications, as it commodifies housing and disconnects it from its role as a basic human necessity. The United Nations Declaration of Human Rights explicitly recognizes housing as a universal human right, a standard that stands in stark contrast to the current financialized approach to housing in many parts of the world.

In response to these pressures, tenant organizing efforts have emerged to combat the financialization of housing. For instance, the York South Weston Tenants Union

in Toronto organized the largest rent strike in the city's history, with more than 100 residents withholding rent payments to protest unjust rent increases. Tactics such as "reno-victions" and "demo-victions," where tenants are forced out of their homes for renovations or demolitions to capitalize on higher rents, are also associated with this trend.

Efforts to address these issues must center on restoring the social value of housing and ensuring that it is treated as a human right rather than merely a financial asset. Also, the need to make housing more climate resilient and address adaptation must be collectively discussed so that more climate regulation does not dampen the housing supply.

The Increasing Cost of Living

In Ontario, approximately 30% of the population consists of renters, a figure that rises to about 50% within the City of Toronto (ACTO). Low-income earners are disproportionately represented among renters, with 71% of households earning below $20,000 per year relying on rental housing.

The rising cost of living, coupled with a shrinking supply of affordable housing, has significantly contributed to the increase in homelessness across the province (CMHA). As housing becomes less accessible, particularly for low-income individuals, the challenges of securing stable housing continue to intensify, further exacerbating Ontario's housing crisis.

Zoning

There is a growing call for the implementation of 'missing middle housing' as a solution to exclusionary zoning practices in Ontario. In collaboration with City Building at Toronto Metropolitan University, the School of Cities at the University of Toronto is exploring how housing options such as low-rise apartments and garden suites — collectively referred to as 'missing middle housing' — can be integrated into existing communities to help alleviate the housing affordability crisis. In addition, this type of housing promotes climate-friendlier environments and improves livability (Parker, 2024).

This research advocates for municipalities across the province to limit high-rise zoning and embrace the inclusion of 'missing middle' housing to create more diverse and affordable housing options in neighborhoods throughout Ontario.

Climate Risks Amplify the Housing Crisis

Figure 1 - Climate and Housing Intersections. Source: Urban Institute, 2024

The Impact of Climate Hazards on Housing

Climate hazards such as flooding and severe storms pose significant threats to housing stability and affordability. Recent flooding events in Toronto serve as a stark example, with many residents across the city left without power in their homes and over 700 recorded incidents of basement flooding (Colley, 2024).

Wildfires also present a severe threat to housing, intensifying risks to both the structural integrity of buildings and the health of residents, along with a threat to biodiversity. The severity of the 2023 wildfire season in Canada was unprecedented, affecting rural and urban populations with evacuations, home and infrastructure losses, power outages, and business interruptions. Early-season drought conditions were one of the drivers for Ontario's 341,599 Ha of land burned this season (Jain et al., 2024).

Another hazard to be considered is urban heat. Research focused on Toronto shows

that it has a large urban heat island effect, making it vulnerable to heat, and has found that "low-income tower block communities in Toronto are more vulnerable to heat." (Bu et al. 2024). Rapid and extremely dense urbanization, in addition to global warming, poses a potentially deadly combination for more vulnerable people, such as children and the elderly (Jiang et al., 2023). This is another issue in which urban planning and sustainable housing play a key role in improving a city's livability. Moreover, studies have shown that social issues such as housing affordability and urban disadvantage make cities less resilient to climate events like heat emergencies (Herath et al., 2024).

On the other hand, adaptation should also address the carbon footprint of the households. Given that residential buildings account for approximately 30% of Toronto's total greenhouse gas emissions as of 2021 (City of Toronto), there is an urgent need to develop affordable, sustainable housing solutions. These solutions must not only address Ontario's housing crisis but also contribute to the city's efforts to meet its net-zero emissions targets.

There are tools available for homeowners to assess the resilience of their homes. Resources from the Intact Centre on Climate Adaptation include flood, fire, and heat, and a tool from the Co-operators shows flood risk for homes in Canada (Iveson, 2024). However, knowledge of risks is poor. A survey of households living in high-risk flood areas found 94% are unaware of the risks (Ziolecki et al., 2020). Overall, Canada lacks current, location-specific data about climate hazards, which undermines the ability of homeowners, governments, and home builders to integrate climate risk data into housing (Miller and Carriere, 2024). Adaptation planning and progress on adaptation measures remains limited at the municipal level in Ontario as well (Climate Risk Institute, 2022).

Housing Retrofits

In addition to increasing the resilience of new homes, existing homes must also be more resilient. Residential home energy retrofits are eligible for funding, including the Home Energy Rebate Plus in Ontario. Retrofits can include installing energy-efficient appliances, updating insulation, replacing windows, installing renewable energy systems, etc. However, resilience goals are not integrated into retrofit programs. Efforts to improve the resilience and sustainability of housing and neighborhoods must take anti-gentrification approaches to avoid exacerbating inequalities. The implementation of environmental measures can drive green gentrification, which is the displacement of people from their communities due to the increased property value after an environmental intervention (Shokry et al., 2022; Taylor and Aalbers, 2022).

Residential home energy retrofits in Ontario are eligible for funding through programs such as the Home Energy Rebate Plus and the Canada Greener Homes Grant. These programs support homeowners in making energy-efficient improvements, which may include installing energy-efficient appliances, upgrading insulation, replacing windows, and implementing renewable energy systems.

Research conducted in Waterloo, Ontario, on residential energy efficiency projects has demonstrated that homeowners who adopted multiple retrofits were more likely to continue engaging in individual energy-saving actions. This approach, known as the "house as a system" model, resulted in the highest levels of energy savings by treating the home holistically and targeting a range of efficiency improvements simultaneously (Hoicka and Parker, 2011).

Nonprofit organizations, such as Green Communities Canada, have partnered with retrofit companies like Home Energy Solutions to facilitate the implementation of residential home energy retrofits across Ontario. These collaborations aim to enhance the accessibility of retrofits, ensuring that more homeowners can benefit from energy efficiency upgrades and contribute to the province's sustainability goals.

Green Gentrification

Green gentrification is defined as the displacement of people from their communities due to the increased property value after implementing Green Resilient Infrastructure (GRI). Research has shown that GRI can increase the vulnerability of low-income communities, particularly communities of color, to gentrification.

Case studies on this topic have taken place in American municipalities like Philadelphia (Shokry et al., 2022) and Miami (Taylor and Aalbers, 2022). In Toronto, tenants in the Yonge-St. Clair West (YSW) area facing Above Guideline Increases (AGI) in rent were informed by their landlord that these rent hikes were due to efforts to decarbonize the building. This highlights a concerning intersection between environmental sustainability initiatives and housing affordability, with vulnerable populations bearing the brunt of the costs.

What We Don't Know

Based on recent literature, several key challenges emerge:

1. Shortcomings of government regulations

Canadian Centre for Housing Rights points out that current legislation leads to a lack

of affordable rental housing. Also, there is a gap in understanding the long-term effectiveness of the implemented and proposed policies on housing affordability. Future research could examine the sustainability of these solutions and their impact over time.

2. Green gentrification

Cases like tenants in YSW facing rent increases due to decarbonization efforts demonstrate the need to further investigate the green gentrification phenomena and its consequences, not only in terms of housing affordability but also in terms of lost cultural capital, community cohesion, and access to social services.

3. Sustainable housing solutions

There are several challenges to be tackled, from evaluating which sustainable housing solutions have been most successful in mitigating the impacts of climate hazards and contributing to net-zero emissions targets, to the barriers homeowners face to accessing and implementing these solutions, and how to include them in the for-and-not-for-profit housing supply chains effectively.

Further reading

Policy Recommendations

Affordability Action Council:

Retrofit Reset: Prioritize Low-Income Households

Key Recommendations:

- Federal government should establish a new free retrofit program aimed at making about 100,000 homes per year more affordable, energy efficient and climate resilient
  - Offer free and turnkey retrofits
  - Generate savings for renters
  - Pivot the retrofit strategy to start with low-income homes

Affordable Housing Reboot: Bring Back Federal Leadership

Key Recommendations:

- Federal government should aim to build one million rent-geared-to-income community homes by 2030 and reboot the not-for-profit and co-operative housing sector. To align with climate-change goals and provide lasting affordability, these homes should be built near public transit and meet net-zero

and climate–resilient codes and standards
- Acquire property near transit to build net-zero and climate-resilient community-housing infrastructure
- Provide more attractive financing to scale the not-for-profit housing sector

Source: IRPP (Institute for Research on Public Policy)

Policies and Data

1. Government of Ontario's *Helping Homebuyers, Protecting Tenants Act*
In 2023, the Government of Ontario introduced the *Helping Homebuyers, Protecting Tenants Act*, with a plan to build 1.5 million homes by 2031. It includes *Bill 23: More Homes Built Faster*, which aims to expedite housing development. However, concerns have been raised about the plan's limited focus on affordable rental housing (Canadian Centre for Housing Rights, 2023).

2. Provincial and Municipal Greenhouse Gas Emissions Inventories
Provincial and municipal greenhouse gas emissions inventories highlight the significant contribution of residential housing to overall emissions. In Toronto, residential buildings accounted for approximately 30% of total greenhouse gas emissions in 2021. Provincially, residential buildings in Ontario contributed around 19% of total emissions as of 2023. These figures underscore the importance of addressing energy efficiency and sustainability within the housing sector as part of broader efforts to reduce emissions and combat climate change.

Organizations and Community Engagement

1. Task Force for Housing and Climate
The *Task Force for Housing and Climate* was launched in September 2023 to assist federal, provincial, and municipal governments in addressing the ongoing housing crisis. Its mandate includes producing a series of reports for federal and provincial governments, and providing recommendations to tackle the housing challenges. However, the Task Force has faced criticism for its narrow focus on increasing housing supply, with critics arguing that it overlooks other key issues such as the financialization of housing. **Link:** Task Force for Housing and Climate

2. YSW Tenants Union
A group of tenants and tenant associations in the York South-Weston (YSW) area has been actively campaigning to protect tenant rights. Their efforts include organizing

rent strikes at properties such as 1440-1442 Lawrence Avenue West and 22 John and 33 King Streets. In addition to rent strikes, these tenant groups have launched petitions advocating for key issues such as stronger rent control, halting the sale of public land to private companies, and securing the "right to be cool," which addresses the absence of legislation on maximum allowable temperatures in homes. **Link:** York South-Weston Tenant Union

3. The Atmospheric Fund

The Atmospheric Fund is a Retrofit Accelerator project aimed at enhancing energy efficiency in multi-family buildings across the Greater Toronto and Hamilton Area (GTHA). This initiative offers free services to multi-family building owners through deep energy retrofits. The project is accompanied by a series of reports and case studies documenting the implementation process and outcomes of the retrofit efforts. These reports provide valuable insights into the effectiveness of deep energy retrofits and contribute to the broader understanding of energy efficiency improvements in multi-family housing. **Link:** Retrofit Accelerator

Case Studies

1. Town of Oakville Home Energy Retrofit Feasibility Study

The Oakville Home Energy Retrofit Feasibility Study was completed by Garforth International Canada Inc., and its report showcases the feasibility to support further development of the Home Energy Retrofit program. The program is feasible even under the assumption that government subsidies will not be provided, and the study shows that the home retrofit program has the potential to reduce up to 40% of the GHG emissions caused by existing homes. This report can be used as the basis for grant applications. **Link:** Town of Oakville Home Energy Retrofit Feasibility Study

2. Heat Pumps Add Cooling for Toronto Community Housing Residents

In 2019, TAF retrofitted a 1987 townhouse complex in Toronto's east end. It aimed to reduce site-wide energy consumption by 20% by introducing cold climate air source heat pumps (CC-ASHP) into each suite, investigating the opportunity for air source domestic hot water (DHW) heat pumps, and replacing all toilets with low flow equivalents. The project resulted in a 29% reduction in heating energy, and improved residents' thermal comfort, reducing their exposure to extreme summer heat. Additionally, there was a 56% reduction in domestic hot water heating energy and a 33% reduction in water consumption with low-flow toilets, leading to more sustainable households. **Link:** Heat Pumps Add Cooling for Toronto Community Housing Residents

Questions for Session Discussion:

1. What are some of the opportunities and challenges in the Ontario context related to Urban Institute's *Four Pillars of Housing Resilience*? (Fig. 2)

2. What do you believe are the priorities for short-term and long-term research efforts related to climate risks and housing?

Figure 2 - Four Pillars of Housing Resilience. Source: Urban Institute, 2024

Image: CBC News/ Mark Blinch/Reuters.

OUTCOMES FROM THE SESSION

Session Overview

This session, led by Laura Tozer, Assistant Professor at the University of Toronto, explored the intersection of climate risk and the housing crisis in Ontario. Professor Tozer highlighted the myriad factors driving the housing affordability crisis in Ontario, including the lack of affordable housing supply, the financialization of housing, and the rising cost of living.

Three core themes were leveraged to frame the conversation that investigated the affordability of housing and its intersections with climate risk. One, Professor Tozer highlighted analysis by organizations like the Canadian Centre for Housing Rights regarding the increasing commodification of housing, leaving low-income renters particularly vulnerable to this crisis. Two, other factors beyond housing that influence affordability were explored. For example, this is where the critical intersection with climate risk becomes abundantly apparent: climate hazards such as flooding and severe storms introduce an additional layer of complexity, and can threaten housing stability, affordability, and sustainable housing initiatives. Three, Professor Tozer emphasized the tendency of climate (mis)action to widen inequalities and perpetuate green gentrification, defined as the displacement of people from their communities due to the increased property value after implementing Green Resilient Infrastructure (GRI). Research has shown that GRI can increase the vulnerability of low-income communities, particularly communities of color, to gentrification.

Finally, Professor Tozer explored the urgent need for housing solutions that integrate affordability, equity, and sustainability, while addressing the financialization of housing and the risks posed by climate change. She also highlighted the need for a comprehensive approach to Ontario's housing crisis that ensures resilience and long-term affordability.

Contextualizing the conversation

The session was framed through an initial presentation by Professor Tozer, exploring some key arguments at the intersection of the housing crisis and climate risk. These included:

Climate action as a driver of inequality and green gentrification

Climate action has a history of exacerbating inequalities and causing green gentrification. Green gentrification is defined as the displacement of people from their communities due to the increased property value after implementing Green Resilient Infrastructure (GRI). Research has shown that GRI can increase the vulnerability of low-income communities, particularly communities of color, to gentrification.

Case studies on this topic have taken place in American municipalities like Philadelphia (Shokry et al., 2022) and Miami (Taylor and Aalbers, 2022). In Toronto, tenants in the Yonge-St. Clair West (YSW) area facing Above Guideline Increases (AGI) in rent were informed by their landlord that these rent hikes were due to efforts to decarbonize the building. This highlights a concerning intersection between environmental sustainability initiatives and housing affordability, with vulnerable populations bearing the brunt of the costs.

It is critical to ensure uniform application of mitigation and adaptation measures to prevent this phenomenon and to institutionalize equitable climate-resilient housing for vulnerable communities.

Key considerations for safe and affordable housing

- The need for additional, affordable, and safe housing is continuing to increase as time goes on. Estimates for how many new homes need to be constructed in Canada range from 5.8 million to 9.6 million new homes over the next 6-10 years to make housing more affordable (Miller and Carriere, 2024). Therefore, increasing housing supply while decreasing affordability is a critical challenge.

- The determinants of what makes housing safe are changing with increased exposure. Climate hazards such as flooding and severe storms pose significant threats to housing stability and affordability. Recent flooding events in Toronto serve as a stark example, with many residents across the city left without power in their homes and over 700 recorded incidents of basement flooding (Colley, 2024). Wildfires also present a severe threat to housing, intensifying risks to both

the structural integrity of buildings and the health of residents, along with a threat to biodiversity. Another hazard to be considered is urban heat. Research focused on Toronto shows that it has a large urban heat island effect, making it vulnerable to heat, and has found that "low-income tower block communities in Toronto are more vulnerable to heat." (Bu et al. 2024). Rapid and extremely dense urbanization, in addition to global warming, poses a potentially deadly combination for more vulnerable people, such as children and the elderly (Jiang et al., 2023).

- At the same time, adaptation and mitigation measures related to housing are key factors in meeting goals related to the clean energy transition. A transformation of residential buildings is required to meet greenhouse gas targets, given that residential buildings account for approximately 30% of Toronto's total emissions as of 2021 (City of Toronto). Addressing the housing crisis requires drastically ramping up the provision of affordable housing that addresses the housing crisis, increases resiliency, and meets net-zero targets. Furthermore, beyond increasing the housing supply, policymakers must also consider the climate impact of new developments since the loss of urban green spaces amplifies hazards such as urban heat and flooding (Drescher et al., 2022), highlighting the importance of local and regional planning.

Session discussion

Prompts:

1. What are some of the opportunities and challenges in the Ontario context related to Urban Institute's Four Pillars of Housing Resilience?

2. What do you believe are the priorities for short-term and long-term research efforts related to climate risks and housing?

Key questions explored:

- There was a question posed regarding how modern buildings are made to be less durable, and designed to be obsolete in 50-60 years. It was discussed that knocking down and disposing of buildings has a massive climate impact, and suggestions were made in terms of the need to consider emissions from materials more significantly. There is a significant need to consider the malleability of different built forms, given that some are much easier to update and change while others are static once built – for example, all-glass buildings can be much harder to retrofit meaningfully once built.

- Another question was posed regarding green gentrification and transit-oriented design opportunities, for example, the recent designation of an area in Waterloo as a new transit hub. It was mentioned that housing isn't the only thing affecting affordability, transit is a big driver of affordability as well. Discussions flowed into talking about deeper considerations around "missing middle housing". There is a growing call for the implementation of 'missing middle housing' as a solution to exclusionary zoning practices in Ontario. In collaboration with City Building at Toronto Metropolitan University, the School of Cities at the University of Toronto is exploring how housing options such as low-rise apartments and garden suites — collectively referred to as 'missing middle housing' — can be integrated into existing communities to help alleviate the housing affordability crisis. In addition, this type of housing promotes climate-friendlier environments and improves livability (Parker, 2024). This research advocates for municipalities across the province to limit high-rise zoning and embrace the inclusion of 'missing middle' housing to create more diverse and affordable housing options in neighborhoods throughout Ontario.

Challenges at the intersection of housing and climate risk in Ontario

- **Ontario is at the heart of Canada's housing crisis**
  - Accounting for two-thirds of the national issue (OHATF, 2022), Ontario has a significant need for new and affordable homes, where housing prices have nearly tripled over the past decade, highlighting the widening chasm between property prices and income growth that further exacerbates affordability challenges.
  - Ontarians carry high levels of household debt, linked to high housing costs, and the Bank of Canada has found that over 50% of Ontario households have high exposure to both disasters and financial vulnerabilities (Duprey et al. 2021).
  - An increasing share of Ontario's housing stock is owned by investment and trading companies, such as real estate investment trusts (REITs), private equity funds, asset management companies, and pension funds, according to the Canadian Centre for Housing Rights. This financialization of housing reflects a broader shift in the housing market, where homes are increasingly viewed as financial assets. In Toronto, the growing presence of privately owned condominiums — a phenomenon referred to as "condoization" — has significantly contributed to gentrification across the city (Grisdale and Walks, 2022).
  - To address these challenges, scholars have called for a reorientation of housing policy to prioritize its social function. These efforts must center on

restoring the social value of housing and ensuring that it is treated as a human right rather than merely a financial asset.

- **Climate risks amplify the housing crisis**
  - Climate hazards such as flooding, severe storms, wildfires, and urban heat pose significant threats to housing stability and affordability, and there is an increased concern for healthy and safe homes. Comfort is considered an issue of health and safety when it comes to heating and cooling.
  - Heating and cooling are significant concerns. It was discussed that vulnerability to heat is socially produced, and the impacts of heat stress are unevenly distributed across communities. In Ontario, there is a cultural connection to and awareness of the risks of extreme cold, and a proportionate disconnect from the implications of heat risk. One challenge discussed was the lack of access to air conditioning in older high-rise buildings, producing additional vulnerabilities. Finally, it was acknowledged that energy to heat and cool homes and buildings is critical for the low-carbon transition.

- **Climate action can often be exclusionary**
  - Historically, retrofits have been ineffective or limited, and the benefits are not equitably distributed
  - Too often, poorly designed climate solutions can be exclusionary, upholding the status quo or producing new forms of injustice and inequity.
  - For example, well-intentioned renovations and retrofits can cause “green gentrification”, drive up housing costs, and exacerbate affordability and housing precarity/instability. This is a direct result of inequitable implementation and access to these solutions — if such changes are made equitably, gentrification would not occur.

- Climate risk data is meaningfully available enough to inform housing development, however, data from insurance agency claims isn’t publicly available.

- There is limited progress on adaptation measures in Ontario, as well as on mitigation and energy transitions. It was discussed that a significant acceleration of the energy transition is needed to meet climate goals.

- You often really only have one chance to make significant retrofits to a building. For example, it is unlikely that you would be able to enact major energy retrofits now and major flood retrofits 5 years from now.

Research priorities and practical next steps

Retrofits were discussed as a high-priority item that is practical and actionable. In this context, participants spoke about the importance of energy efficiency measures and passive heating/cooling. Nature-based solutions were also brought up as important interventions, while the cost-effectiveness of mitigation and adaptation measures in the context of retrofits were highlighted as benefits. Critically, there was discussion around the equity implications of retrofit programs, and suggestions were made to address those concerns with retrofits specifically designed for affordable housing and differential programming for different housing typologies.

Mapping communities and understanding community needs and assets were highlighted as a priority. Some of the key areas of investigation highlighted were understanding barriers to safe homes, asset mapping, historic and systemic inequalities impacting housing risk/vulnerability, exclusionary zoning, multifunctional design, and looking at the vertical frame of buildings when considering exposure. Finally, it was also suggested to break silos and think about the community as a whole.

Another priority mentioned was to understand intersecting vulnerabilities, particularly in terms of who is in need of affordable housing, who has the lowest-quality housing at the moment, and thinking about retreat areas.

Moving away from the commodification of housing was mentioned as a priority, and deep-diving into what affordable housing really means. This included suggestions around rent control, alternative forms of housing ownership such as co-ops, and building a sense of community and resilience in renting. It was discussed that renting has precarity and access concerns over time, and that building renting resilience is critical to address them, but also good for the bottom line economically.

Technical aspects of housing, such as structural integrity and design, were also prioritized by participants. This included considerations such as quality, longevity, climate extremes, life cycle implications, code changes, and multi-hazard resilient materials.

Another critical priority that was highlighted was the nature of models and methods used to navigate concerns and solutions around housing and climate risk, for example, flood mapping models, or methods for testing “what-if” situations. Indigenous and local knowledge were emphasized as a critical tool to navigate this path. Further, storytelling as a method for communication and outreach, particularly around speculative futures, was another methodology discussed. An area of focus

mentioned was the articulation and communication of co-benefits in this space as an important methodology for generating consensus and buy-in. Further, participants discussed the importance of uniform implementation to prevent gentrification and the exacerbation of housing affordability and inequity concerns, incentivizing better new builds, advocating for transparency in spending, and identifying critical levers for the changes needed.

Finally, markets and business were discussed as priorities. For example, making the business case for affordable housing and retrofits, showcasing successes, and incentivising developers to go beyond the minimum standards were highlighted as potential practical next steps for action.

Other notes

Responses for each prompt were written on post it notes and grouped in general categories, so linking which suggestions came from which people wasn't really possible.

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Emergency Management and Recovery in Ontario

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Image: CBC News/Ministry of Northern Development, Mines, Natural Resources and Forestry.

BACKGROUND BRIEFING

Summary of the current emergency management framework in Ontario

Under the Emergency Management and Civil Protection Act (EMCPA), Emergency Management Ontario (EMO) is the organization mandated to monitor, coordinate, and assist with the development and implementation of emergency management programs in Ontario, and ensure the coordination of these programs with the federal government (Ontario Note from Minister, 2023). The vision, mission and values, principles of emergency management, and components of emergency management set the foundation for the creation and implementation of emergency management programs and guide the response to emergencies. Governance set out in the EMCPA provides accountability, strategic direction, and leadership for emergency management programs and responses to emergencies. Stakeholders are the formal and informal people/groups involved in emergency management in Ontario. The emergency management strategy lists goals and objectives that Emergency Management Ontario strives to achieve.

The Provincial Emergency Management Strategy and Action Plan outlines a clear goal for emergency management for the province which is that every person in Ontario should be safe, practiced and prepared before, during and after emergencies such as floods, wildland fires and threats like cyber security incidents.

Emergency management consists of five interdependent foundational components: **Prevention, Mitigation, Preparedness, Response, and Recovery.**

These five components of emergency management are implemented by all EM practitioners and organizations in Ontario to ensure a safe, secure and resilient Ontario.

Recent climate-related disasters in Southern Ontario and their impacts (Environment Canada, 2023)

2023 April Ice Storm

On April 5, 2023, a powerful late-season storm moved into the Great Lakes-St. Lawrence region bringing widespread freezing rain, ice pellets, hail and heavy rains. Ahead of the storm, mild air flooded the region, and a cold front undercut the mildness, destabilizing the atmosphere. The unsettled weather prompted tornado watches in southwestern Ontario and heavy rain warnings across the province. The bad mix led to several hours of freezing rain and rain with a few early-season "thundersnows". There was up to nine continuous hours of freezing rain in Ottawa. Ice accretion amounts totalled 25 to 30 mm in Ottawa-Gatineau. Accompanying wind gusts of 60 to 70 km/h for two days added enormous stress to ice-encased utility lines and trees. Where heavy rain fell on still-frozen ground, localized flooding swamped backyards and fields and filled basements. Ice build-up on trees and power lines caused extensive damage. Power outages topped 200,000 in Ontario. Thousands were still without power two days later. There were numerous vehicle accidents and traffic was slowed or stopped on several routes. Sidewalks were also coated with treacherous ice. Ottawa's light-rail transit went down, leaving dozens of commuters waiting hours to be evacuated. Fallen branches and limbs littered streets and properties, damaging cars and smashing windshields. Property losses from floods, winds and icing topped $335 million from Sarnia to Saguenay.

Southwestern Ontario severe storms

August 23–25, 2023 – Over $110 million

Moisture associated with the remnants of Hurricane Hilary fed thunderstorms over southwestern Ontario between August 23 and 25, 2023. This led to a series of heavy storms, producing significant rainfall, multiple tornadoes and large hailstones. More than 200 millimeters of rain fell on some communities, resulting in flooded roads, basements and properties. Downed power lines left many hydro customers in the dark across southwestern Ontario, with roughly 5,000 customers losing power by noon on August 24.

August 3, 2023 – Over $100 million in insured damage
A summertime frontal system moving through southern Ontario sparked severe thunderstorms on August 3, 2023. The hardest-hit areas saw large hailstones, violent wind gusts and torrential downpours. Lindsay and Ottawa were among the most significantly impacted regions. The storms knocked down homes under construction, downed trees and power lines, and damaged vehicles. Flash flooding left many vehicles partially submerged.

July 28–29, 2023 – Over $30 million in insured damage
A period of hot, humid weather culminated in severe thunderstorms across southern Ontario in late July 2023. Multiple supercell thunderstorms developed on July 28 and 29, with some of the strongest storms hitting the Ottawa region. Ottawa was pelted by hail up to the size of tennis balls, while strong winds brought down trees in Windsor. Heavy downpours also led to flash flooding.

Southern Ontario Winter Storm 2020

On January 10th, a low-pressure system moved through southern Ontario and Quebec, which began with temperature highs of 10-12 °C and rain, before changing to freezing rain and snow by January 12th in some locations. Extensive amounts of precipitation fell across southern Ontario: 78.4 mm in Toronto, 76.1 mm in London, and 65.5 mm in Peterborough. As a result of the frozen ground and rain, there was overland flooding and sewer backups in several regions. The passage of the cold front also brought high winds, which, in combination with freezing rain, led to tree damage and power outages. The system caused an estimated $95.3 million in insured losses — $81.6 million in Ontario and $13.7 million in Quebec (CAD 2020).

Key Challenges with Emergency Management and Recovery

1. Increasing Frequency and Severity of Weather Events

The increasing frequency and severity of weather events are presenting significant challenges for emergency management and recovery efforts. Additionally, climate change is leading to greater impacts on biodiversity, agriculture, and food systems. Projected reductions in summer rainfall, combined with more severe heatwaves and extreme precipitation, threaten farm operations and related sectors like food processing and distribution. Adapting the sector will allow for both risk management and new opportunities.

Human health inequities are worsening, with marginalized and low socioeconomic populations disproportionately affected by climate change. These groups will face greater difficulties in coping and adapting to climate impacts. Regional and local climate change vulnerability assessments that consider health equity are crucial for developing more robust adaptation strategies.

2. Infrastructure Vulnerabilities

As a result of interdependencies between multiple infrastructure types, climate change and especially extreme climate events can have cascading economic and social impacts. Flooding in the highly populated southern subregion and impacts on winter roads in the northern subregion of the province demonstrate the range of risks. Targeted approaches to better understand the threats and reduce infrastructure vulnerability across the province are recommended.

3. Complex Governance Structures

Example: Adaptive management is key for addressing impacts in the Great Lakes Basin. The combined effects of climate change, land-use changes, and other stressors are negatively impacting the Great Lakes Basin. Despite mechanisms to address complex governance challenges, adaptation efforts across the Basin remain relatively fragmented. Many communities have embraced adaptive management practices to address impacts in light of uncertainties in future changes (Changing Climate, 2020).

4. Progress on adaptation remains limited in Ontario

Levels of climate change adaptation planning and implementation vary considerably across Ontario, with the primary focus still placed on the assessment of risk and vulnerability. Although there are examples of implementation, there is little evidence of adaptation being mainstreamed into decision-making broadly. Systems for monitoring and evaluating adaptation action and effectiveness remain inadequate in most jurisdictions.

Recommendations

Based on recent literature, several key recommendations emerge:

1. Strengthening Community Engagement and Participation

Strengthening community engagement is essential for enhancing disaster preparedness and resilience. Encouraging household- and neighborhood-level

initiatives, such as community-based programs, improves local resilience and empowers residents to take proactive measures. Studies highlight that developing these community programs can foster local leadership and preparedness, as well as improve disaster response (Murphy et al., 2005). Recent Ontario research suggests that engaging communities in flood preparedness and creating public awareness programs can significantly mitigate flood risks (Henstra et al., 2019).

2. Investing in Resilient Infrastructure

Investing in climate-resilient infrastructure is a critical recommendation in the literature. Upgrading and adapting infrastructure, especially in vulnerable areas, can significantly reduce the risks posed by climate-related hazards. Prioritizing investment in critical infrastructure, such as transportation and stormwater systems, is essential for long-term resilience. The recent Ontario Risk Assessment Report underscores the importance of infrastructure investments to manage the increasing frequency and severity of extreme weather events (Ontario Risk Assessment Report, 2023).

3. Enhancing Coordination and Collaboration

Improving coordination among different levels of government, agencies, and stakeholders is a key recommendation for effective emergency management. Establishing partnerships with the private sector and non-governmental organizations fosters a more comprehensive approach to disaster response. This collaborative effort allows for better resource allocation, information sharing, and joint planning, as emphasized in emergency management frameworks for Ontario (Thistlethwaite et al., 2020).

Further reading

Key agencies and their roles in managing emergencies

In Ontario, core, legislated EM programs are mandated for municipalities. A municipality is a geographic area whose inhabitants are incorporated. However, EMO's responsibility to provide EM program guidance and incident response coordination support extends to all local communities, whether incorporated, unincorporated, or a First Nation community.

EMO has established geographic sectors across the province and assigned field staff to these sectors. Field staff provide advice and assistance to municipalities within their sectors on an ongoing basis to support developing, maintaining, and enhancing

municipal emergency management programs. Using the sector structure, EMO Field Staff work with municipalities' community emergency management coordinators to provide a forum to exchange best practices, learn about evolving trends in emergency management, and provide updates. Emergency management best practices and challenges shared by municipalities at sector meetings are used by EMO to support emergency management program enhancements and/or to identify solutions.

The stakeholders involved in the development and implementation of emergency management in Ontario include, but are not limited to:

- Individuals - Individuals should be prepared to deal with an emergency on their own for a minimum of three days (72 hours).
- Municipalities - Under provincial legislation, municipalities have certain responsibilities for the safety and well-being of the public. Each municipality must develop and implement an emergency management program that can be tailored to its local needs.
- Province of Ontario - The Ontario government retains aspects of provincial emergency management, designates provincial government bodies to be responsible for aspects of provincial emergency management programs, and delegates certain emergency management program responsibilities to municipalities.
- First Nations Communities in Ontario - When an emergency in a First Nation community requires a partial or full evacuation of that community, and upon the request of the Chief of that First Nation community, EMO operates the Provincial Emergency Operations Centre in partnership with other relevant provincial ministries and federal departments and coordinates the preparation and conduct of the evacuation.
- Government of Canada - The federal government implements programs regarding prevention/mitigation, preparedness, response, and recovery. During emergencies, the federal government may provide assistance to the provincial government, subject to requests and the availability of resources.
- Non-Governmental Organizations (NGOs) - NGO's (like the Canadian Red Cross, Team Rubicon or Salvation Army) are non-profit, voluntary citizen groups that are organized on a local, national, and/or international level. NGOs perform a variety of services and humanitarian functions and are often in a unique position to mobilize communities at the grassroots level. NGOs play an important role in fostering greater emergency awareness and preparedness, provide physical and

human resources during an incident, raise emergency relief funds, conduct research, provide valuable input on, and advocate for changes in emergency management policies and procedures.

Graphics

Figure 1: Representation of emergency management in Ontario..
Source: https://www.ontario.ca/document/emergency-management-framework-ontario/overview-emergency-management-ontario

Policies and Programs for Emergency Management and Recovery in Southern Ontario

1. The Emergency Management and Civil Protection Act (EMCPA)

The **Emergency Management and Civil Protection Act (EMCPA)** is Ontario's key legislative framework for emergency preparedness and response. The Act mandates the development of emergency management programs at both the provincial and municipal levels. These programs include risk assessments, public education, training, and coordination efforts aimed at preventing, mitigating, responding to, and recovering from emergencies. The EMCPA provides the legal foundation for the declaration of emergencies and outlines the powers and responsibilities of various officials, including the Premier and local municipalities, during an emergency. The act also stipulates that municipalities must create an emergency plan to ensure a coordinated response to natural disasters and other threats.

2. Ontario's Climate Change Strategy and Action Plan

Ontario's Climate Change Strategy and Action Plan outlines the province's long-term vision for reducing greenhouse gas emissions and adapting to the impacts of climate change. This strategy aims to achieve a low-carbon economy by setting specific targets for emissions reductions and implementing adaptation measures to build climate resilience. Key areas of focus include energy efficiency, green infrastructure, transportation electrification, and enhancing the resilience of public assets and ecosystems. The Action Plan is updated periodically to ensure it reflects the latest science and policy developments, and it includes funding mechanisms such as Ontario's Green Bonds to support climate adaptation and mitigation projects.

3. A Safe, Practiced, and Prepared Ontario — 2023 Annual Report

The 2023 Annual Report, titled "A Safe, Practiced, and Prepared Ontario," provides an overview of the province's emergency management efforts for the year. It highlights key developments in enhancing Ontario's preparedness for a range of emergencies, including natural disasters, cyberattacks, and public health emergencies. The report outlines the progress made in the implementation of the Provincial Emergency Management Strategy and Action Plan, which aims to build a resilient Ontario by improving coordination between government agencies.

4. Emergency Management Strategy for Canada: Toward a Resilient 2030

The **Emergency Management Strategy for Canada** aims to build a more resilient Canada by 2030 through improved coordination and cooperation across all levels of government, as well as with the private sector and Indigenous communities. The strategy is aligned with international frameworks such as the **Sendai Framework for Disaster Risk Reduction** and focuses on five priority areas: understanding disaster risk, strengthening disaster risk governance, investing in disaster risk reduction, enhancing disaster preparedness, and supporting recovery efforts. It sets the agenda for a collaborative approach to reduce vulnerabilities to both natural and human-made disasters, ensuring that all Canadians, particularly marginalized communities, are better protected against future emergencies.

5. Ontario Provincial Climate Change Impact Assessment

The **Ontario Provincial Climate Change Impact Assessment** is a comprehensive evaluation of the potential impacts of climate change on Ontario's communities, infrastructure, economy, and ecosystems. Released in 2023, this assessment is part of Ontario's efforts to understand the risks posed by climate change and to inform

policy and decision-making. It provides detailed projections of how climate change will affect different regions of the province, including changes in temperature, precipitation patterns, and the frequency of extreme weather events. The assessment emphasizes the need for adaptation strategies to protect Ontario's natural resources and built infrastructure and to ensure the resilience of key sectors such as agriculture, health, and energy.

Link to the assessment: Ontario Provincial Climate Change Impact Assessment

Image: CBC News/Ministry of Northern Development, Mines, Natural Resources and Forestry.

OUTCOMES FROM THE SESSION

Session Overview and the Start

Co-facilitated by Dr. Kim Slater (Director, Disaster Risk Reduction and Climate Change Adaptation, Canadian Red Cross) and Christopher Allsop (Manager of Operations, Emergency Management Canadian Red Cross) and Scott Connell Pullandre (Senior Advisor, Readiness and Operational Planning, Emergency Management, Canadian Red Cross), this session explored the integration of emergency management (EM), disaster risk reduction (DRR), and climate change adaptation (CCA) to address escalating climate risks in Southern Ontario. Participants included municipal emergency managers, academics, community development and environmental specialists, who emphasized the need for equitable, community-centered approaches to enhance preparedness, response, and recovery. The discussion was framed by recent extreme weather events — including the 2023 April ice storm, which caused an estimated $335 million in damages, and recurrent flooding in Southern Ontario — causing an estimated $100 million in insurance damages, as evidence that “once-in-a-century” events are now occurring with alarming regularity. These disasters serve as both cautionary examples and entry points into a deeper conversation about shifting from reactive crisis response to long-term resilience.

Three core themes emerged throughout the session:

- First, participants emphasized the disproportionate impact of climate-related disasters on marginalized populations, particularly racialized, low-income, elderly, and health-compromised groups. These vulnerabilities were tied to long-standing systemic inequities, often exacerbated during and after climate emergencies.

- Second, the conversation turned to the critical importance of data accessibility, public literacy, and storytelling in improving climate and risk communication. Participants noted that for communities to meaningfully engage in preparedness efforts, information must be both actionable and relatable.

- Third, the session focused on the urgency of bridging formal emergency systems with grassroots and community-led initiatives. Effective emergency management, it was argued, cannot exist solely within institutional silos — it must be interwoven with lived experience and localized knowledge.

The session aligned with established policy frameworks, notably Ontario's Emergency Management and Civil Protection Act (EMCPA) and the Emergency Management Strategy for Canada: Toward a Resilient 2030, while emphasizing practical lessons drawn from recent regional disasters.

Context: Climate Risks in Southern Ontario

Facilitators opened with an overview of the accelerating climate risks that are reshaping vulnerability in the region. The frequency and intensity of disasters — from flooding to ice storms — have increased, with "hundred-year storms" now striking every 5–10 years. The 2023 ice storm and recurring floods in Burlington were cited as cases that highlight both infrastructure fragility and the need for more proactive planning. Discussion also highlighted the disproportionate burden on marginalized groups. Many racialized, elderly, low-income, and medically vulnerable individuals live in high-risk areas with limited access to resources, rendering them especially susceptible to both immediate and long-term effects of climate shocks.

Participants pointed to critical coordination gaps:

- Fragmented collaboration among levels of government, NGOs, and community groups.

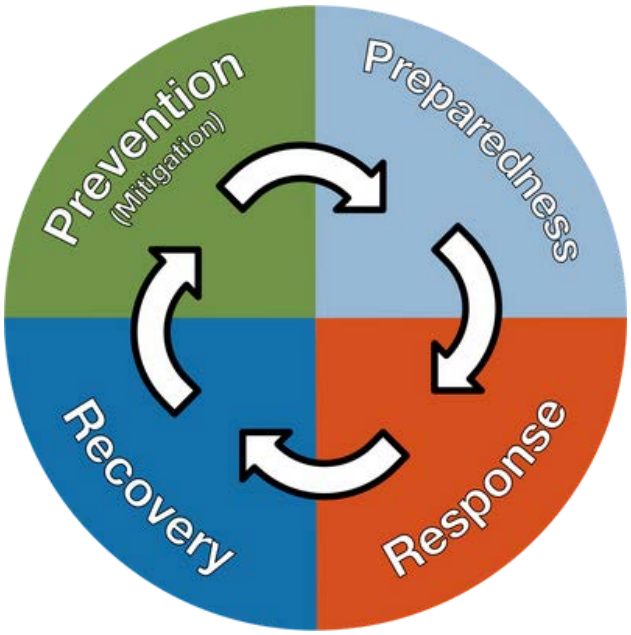
- An overreliance on reactive emergency responses, with insufficient emphasis on resilience-building or long-term recovery strategies.

The Canadian Red Cross's Role

The Canadian Red Cross presented its evolving dual approach to disaster management. On one hand, it provides immediate emergency support, including evacuation assistance and emergency shelter operations. On the other, it invests in proactive community resilience-building initiatives. For example, in Burlington, the Red Cross led door-to-door outreach campaigns between 2023 and 2024, targeting flood-prone neighborhoods with preparedness information and risk assessments. While these efforts aim to support the readiness of households, facilitators acknowledged that longitudinal data to assess the effectiveness of such campaigns remains limited. Training and education were also key tools. The organization offers community-level programs that help residents assess local hazards and prepare contingency plans — supporting a shift toward localized resilience.

The session explored how DRR and CCA can serve as bridges within the emergency management cycle, integrating systemic risk reduction with forward-looking climate planning. This framework was broken down into the following components:

- Prevention/Mitigation: Efforts like floodplain mapping to reduce exposure to hazards.
- Preparedness: Ensuring communities are equipped with training, resources, and communication tools.
- Response: Coordinated action during crises.
- Recovery: Applying Bounce Forward principles to not only restore but improve community systems and address root causes of vulnerability.



In this model, Disaster Risk Reduction (DRR) focuses on analyzing and minimizing hazard exposure, while Climate Change Adaptation (CCA) seeks to future-proof systems against worsening climate conditions. The integration goal, according to participants, is to transition from a reactive, incident-focused system to one that is proactive, preventative, and equity-centered.

As Dr. Kim Slater poignantly summarized:

"There isn't just a need to address a single emergency— how do we create a culture of preparedness while communities are still recovering?"

Key Challenges

Participants identified a range of systemic and operational barriers that undermine effective emergency management, climate adaptation, and disaster risk reduction across Southern Ontario. These challenges are interlinked and often compound one another, particularly in vulnerable communities. The discussion was organized around four primary domains: inequity, data and communication, infrastructure and governance, and funding and collaboration.

1. Inequitable Impacts and Community Vulnerabilities

A persistent challenge highlighted during the session was the disproportionate risks faced by marginalized populations during climate-related disasters. Racialized communities, low-income households, elderly individuals, and those with existing health conditions were repeatedly cited as groups experiencing the greatest impacts — yet often receiving the least support. The 2023 ice storm offered a stark illustration: vulnerable populations endured prolonged power outages and limited access to emergency shelters, revealing systemic gaps in emergency planning and response. Moreover, the conversation extended into the post-disaster phase, where even well-intentioned green infrastructure projects — such as the creation of flood-resilient parks — can unintentionally drive gentrification, resulting in the displacement of long-standing low-income residents. These dynamics reinforced the need for equity-first approaches that not only respond to crises but also safeguard housing and community stability over the long term.

2. Data Gaps and Communication Barriers

Accurate, open, and consistent data is foundational to risk analysis and emergency planning, yet critical data gaps hinder both real-time response and long-term resilience strategies. For example, power outage reporting systems frequently underrepresent the scale of impact by counting “customers” instead of actual residents — treating a multi-unit apartment complex housing hundreds or thousands of people as a single account. Additionally, there is currently no standardized protocol for tracking heat-related hospitalizations or flood-related damages across Ontario municipalities, making it difficult to understand patterns, compare regions, or allocate resources equitably. Communication practices were also scrutinized. Emergency alerts and preparedness materials are still too often distributed through pamphlets, which fail to engage or reach many communities, particularly those with

language or accessibility barriers. Compounding this, conflicting weather forecasts — especially during high-stakes events like windstorms — can confuse residents and erode public trust in official guidance. Participants emphasized that data must be both accurate and actionable, and that communication strategies must evolve to reflect how communities access and process risk information today.

3. Infrastructure and Governance Shortcomings

The session overview highlighted how aging infrastructure and fragmented governance continue to undermine regional resilience. In Toronto, outdated sewer systems and electrical grids proved highly vulnerable during the 2023 ice storm, which caused an estimated $335 million in damage. Facilitators noted that many municipal systems are not designed to withstand current climate extremes, let alone future projections. Regulatory frameworks also pose unintentional barriers to adaptation. For instance, Ottawa's bylaws restrict tree planting near homes, a measure that may limit root damage but also undermines local flood mitigation efforts. Furthermore, municipal stormwater standards vary significantly, creating a patchwork approach to resilience that limits cross-jurisdictional coordination and consistency. Emergency management structures themselves remain largely siloed, with crisis response often separated from long-term resilience and planning. In Toronto, Emergency Management (TEM) is primarily responsible for coordinating emergency response, while other departments handle infrastructure and climate adaptation. This division results in misalignment and missed opportunities to integrate disaster risk reduction (DRR) and climate change adaptation (CCA) into day-to-day governance.

4. Funding and Collaboration Hurdles

Finally, facilitators discussed the institutional and financial barriers that slow or block critical partnerships and innovation. Academic-municipal collaborations, which could provide evidence-based insights and evaluation, often face bureaucratic delays, particularly in securing funding for applied research. One example cited was a heat stress study designed for firefighters that stalled due to procedural hurdles — despite its clear relevance to occupational health and emergency readiness. The private sector was also called out for withholding key data, particularly regarding critical infrastructure such as telecommunications networks. This "data hoarding" leaves public agencies in the dark during outages and compromises their ability to make timely decisions during emergencies. As climate risks accelerate, participants called for more open data policies and collaborative frameworks that ensure shared responsibility and information transparency.

Discussion #1 Take Stock

This interactive segment of the session was structured in two parts, each designed to elicit reflections from participants on how emergency management (EM), disaster risk reduction (DRR), and climate change adaptation (CCA) are experienced within communities — and how these experiences shape both perceived and actual resilience. Facilitated through small group discussions, participants shared lived insights and practical challenges across all phases of disaster management.

Part 1: Community Experiences with EM/DRR-CCA (30 min)

Guiding Question:

How do communities experience EM and DRR-CCA across disaster phases?

Before Emergencies:
Participants noted that emergency management systems are often invisible until something goes wrong. While planning structures may be in place, community members typically do not engage with or recognize these systems in their daily lives. This disconnect was identified as a barrier to proactive preparedness and risk literacy. As one group observed, "People don't see EM until something goes wrong," highlighting the need for more visible, sustained engagement with the public well in advance of disaster events.

During Emergencies:
A common challenge identified was the barrier to accessing real-time information and support during crisis moments. Participants reported that cascading infrastructure failures — particularly the interconnected collapse of electricity and telecommunications — undermine the effectiveness of official response systems. "When electrical goes down, telecoms follow," one participant noted, underscoring the fragility of critical services and their dependencies. In such moments, grassroots groups often scramble to create their own resilience networks, stepping in to fill voids left by formal emergency systems. These improvised efforts, while resourceful, also reveal the limits of institutional preparedness and the urgent need to better support and integrate community-led responses into broader emergency frameworks.

After Emergencies:
Recovery was framed as a critical but uneven phase of disaster management. Participants questioned who actually leads recovery efforts, and whether communities are genuinely included in "Build Back Better" (BBB) strategies. Toronto's

formal mandate to engage communities post-disaster was cited as a positive example, yet participants also pointed out that such commitments are inconsistently implemented and often fail to reflect the full diversity of affected residents. There was consensus that community inclusion in recovery planning must be both early and ongoing, rather than reactive or symbolic.

Part 2: Data Needs and Gaps (30 min)

Guiding Question:

What data is used — or missing — to understand risks and vulnerabilities?

Current Data Sources:
Groups cited commonly used resources such as weather forecasts, floodplain maps, and utility outage dashboards. However, several participants raised concerns about how these tools fail to reflect the actual lived experience of impacted communities. A particular critique focused on utility outage maps, which report the number of affected "customers" rather than the actual number of people impacted. As one participant put it, "An apartment building with 1,000 people is counted as one customer," distorting both the scale and severity of service disruptions.

Missing Data:
To move toward more inclusive and responsive emergency planning, participants stressed the need for granular, equity-centered data. Suggestions included:

- Neighborhood-level vulnerability indices that capture intersecting factors like age, income, mobility, and health conditions.
- Real-time data on health impacts during events such as heatwaves or power outages.
- Systems to track population density per utility account, particularly in high-rise residential buildings.

Discussion #2 Assess

In the second interactive segment of the session, participants were invited to critically assess both the strengths and barriers within current emergency management (EM), disaster risk reduction (DRR), and climate change adaptation (CCA) efforts.

Part 1: Sector Strengths (25 min)

What is working well in EM and DRR-CCA, and why?

Cultural Shifts:
Participants observed a significant evolution in how emergency management is conceptualized. The field is increasingly moving beyond a traditional, militarized approach, embracing a more holistic and community-centered understanding of disaster resilience. There is a broader acknowledgment that disruption is no longer a rare anomaly — it is now viewed as inevitable, and planning frameworks are beginning to reflect this reality. This cultural shift has opened the door to greater integration of climate adaptation principles and long-term planning into what was once a narrowly focused, reactive discipline.

Systemic Progress:
At the institutional level, there is a growing awareness of the importance of proactive emergency planning. Participants noted that agencies and municipalities are increasingly receptive to conversations about climate-linked hazards, and that EM is now more widely recognized as a necessary and foundational component of urban governance. While progress is uneven, this shift in perception was seen as a key enabler of future reforms.

Part 2: Data Needs and Gaps (30 min)

What are the biggest barriers to effective EM and DRR-CCA?

Equity Gaps:
Participants expressed deep concern that equity remains sidelined in many EM and DRR strategies. While municipalities increasingly reference vulnerable groups in planning documents, actual implementation often fails to consider their specific needs or lived realities. One group reflected that municipal policies frequently ignore or marginalize vulnerable populations, and in some cases, decision-making continues to actively harm communities, further eroding trust. Participants stressed the need for deliberate, sustained trust-building and the inclusion of equity metrics in planning and evaluation.

Resource Limitations:
Limited funding and staff capacity were repeatedly cited as obstacles to long-term resilience work. Many municipalities, particularly smaller ones, lack dedicated personnel to support sustained risk reduction or community engagement. As one group noted, “There’s no staff for long-term resilience work,” highlighting a structural reliance on short-term, reactive measures over integrated, future-focused investments.

Siloed Systems:
Collaboration breakdowns also featured prominently in the discussion. Participants identified data hoarding between and within government agencies, and by private-sector actors — particularly around infrastructure outages — as a significant barrier to coordinated response. This lack of transparency and information-sharing makes it difficult for emergency planners and responders to anticipate needs or allocate resources effectively. Additionally, government agencies and sectors often operate in isolation, with limited mechanisms for cross-sector communication or joint planning.

Part 3: Synthesis (10 min)

Group Reflection:
Several themes emerged. One was the power of multi-sector dialogues to align goals across governments, civil society, and private stakeholders. These conversations, participants suggested, could be used to advance equity priorities, integrate grassroots knowledge, and foster more collaborative models of governance. The role of community leadership also came into focus. As one participant stated, "We need community champions to shift attitudes." This insight encapsulated the broader sentiment that systems-level change requires both institutional buy-in and local ownership. By empowering trusted leaders within communities—and pairing them with responsive, well-resourced institutions — the sector can begin to shift from fragmented responses toward shared, equitable resilience.

Discussion #3 Act

The final session segment focused on turning insights into action. Participants were asked to envision how research, policy, and community practice could work in tandem to address key challenges while building on sector strengths identified earlier in the workshop.

Part 1: Research Agenda Development (25 min)

How can research address key challenges while leveraging sector strengths?

Data-Driven Solutions:
Participants identified "data storytelling" and "risk perception" as two critical research gaps. While data is abundant in some areas, it is often inaccessible, abstract, or divorced from community realities. There was strong interest in research that combines statistical risk assessments with narrative approaches that translate risk

into relatable, localized stories, particularly for underrepresented or vulnerable groups. Doing so, participants argued, can help reshape public understanding of safety and preparedness in the face of climate threats.

Private Sector Engagement:
Another key discussion point was the persistent challenge of data access from private utilities and telecom companies. Participants asked: What mechanisms could compel better cooperation or data sharing? While recognizing the sensitivities around proprietary information, there was consensus that public interest must take precedence during crises. The difficulty of coordinating across government and private-sector silos was noted repeatedly, and participants called for research into policy tools or incentive structures that could promote more transparent and cooperative data sharing during emergencies.

Part 2: Action Planning (25 min)

What immediate and long-term actions can build resilience?

Short-Term (0–2 Years):
One recurring theme was the need to operationalize "Build Back Better" (BBB) principles immediately after evacuations and disruptions. This includes integrating resilience-building into recovery processes — not as an afterthought, but as a baseline expectation. Participants emphasized that rebuilding efforts must not simply restore pre-disaster conditions but address underlying vulnerabilities.
Community education also emerged as a near-term priority. Participants stressed the importance of models that change the mental model of safety, shifting from a mindset of dependency on formal systems to one of community agency and mutual support. Such education efforts could be supported through schools, local organizations, and emergency preparedness campaigns that use culturally relevant language and formats.

Cross-Sector Collaboration:
Finally, participants identified cross-sector collaboration as a cornerstone of both immediate and sustained resilience. Stronger partnerships are needed among academia, communities, and government agencies to co-create solutions that are informed by evidence and grounded in lived realities. "Coordination of efforts" was described as a consistent theme across the day's discussions — whether in sharing data, designing outreach, or responding to complex, cascading disasters.
The session concluded with a collective understanding that action must be both strategic and inclusive — mobilizing diverse stakeholders to shift systems, mindsets, and practices in the face of accelerating climate risk.

Recommendations

To conclude the session, facilitators and participants outlined a series of strategic recommendations designed to guide the future of emergency management (EM), disaster risk reduction (DRR), and climate change adaptation (CCA) in Southern Ontario. These proposed actions build directly on the lived experiences, institutional insights, and cross-sector expertise shared during the session.

1. Community-Driven Resilience

Participants emphasized that long-term resilience must be built with — not for — communities, particularly those who face disproportionate risks due to systemic inequities. To this end, the co-design of interventions with vulnerable groups was seen as essential. One recommended action was to convert public schools into 24/7 cooling hubs during heatwaves, ensuring these facilities are accessible to marginalized populations, including unhoused individuals, seniors, and people with disabilities. Another proposal was to replicate and expand door-to-door outreach models, such as the Red Cross's campaign in Burlington, which aimed to educate flood-prone households and build localized knowledge before crises occur. The importance of trusted community intermediaries was also highlighted. Partnerships with tenant associations, cultural organizations, and Indigenous leaders can help bridge trust gaps, improve engagement, and ensure that emergency planning reflects the lived realities of those most at risk.

2. Improved Data and Communication

Enhancing the availability and accessibility of climate risk information was another top priority. Participants called for the development of open-access climate risk portals that deliver real-time, neighborhood-level data on heat waves, flooding, and power outages. These platforms should disaggregate data to surface patterns of disproportionate impact and enable a more targeted response. Crucially, participants stressed that data must be made meaningful through storytelling. Suggested strategies included integrating Indigenous oral histories and climate fiction — such as *The Ministry for the Future* — to connect data with cultural narratives and engage broader audiences (Robinson, 2020). Current public alert systems, often reliant on impersonal pamphlets, were seen as outdated and ineffective. In their place, participants proposed community-led workshops and innovative engagement tools such as "audio walk tours" through flood-prone areas, offering residents experiential learning that is both localized and accessible.

3. Infrastructure and Policy Reforms

Participants also called for a rethinking of both physical infrastructure and regulatory

frameworks to align with a changing climate. Nature-based solutions were a strong area of consensus. Citing the example of Schneider's Creek in Kitchener, where renaturalization efforts led to a 30% reduction in flood peaks, attendees advocated for scaling up similar projects across urban and peri-urban environments. Other priorities included the implementation of green roofs, permeable pavements, and urban wetlands, which serve both ecological and adaptive functions. However, infrastructure upgrades must be pursued with equity safeguards. Policies such as community land trusts and rent freezes were recommended to prevent the displacement of low-income residents from neighborhoods undergoing climate resilience investments. In parallel, attendees urged municipalities to harmonize regulatory standards, particularly for stormwater management, to reduce fragmentation and improve coordination across jurisdictions.

4. Strengthened Collaboration

Finally, participants called for a renewed commitment to cross-sector collaboration. Academic-municipal partnerships were seen as a vital resource for innovation, but many are hampered by bureaucratic funding delays. Streamlining support for applied research, such as the University of Toronto's study on heat stress in first responders, was viewed as an urgent priority. Efforts to expand collaboration were also recommended within existing structures. For example, the City of Toronto's Climate Collaboration Platform could be broadened to include a wider range of stakeholders — Indigenous leaders, non-governmental organizations, and private-sector actors — to ensure that decision-making reflects a diversity of voices and expertise.

Case Studies and Lessons Learned

1. Burlington Flood Campaign (Canadian Red Cross, 2023–2024)

Approach: Door-to-door education in flood-prone neighborhoods.
Outcome: Recurrent 2024 floods highlighted the need for longitudinal impact tracking.

2. Toronto's Electrical Grid Vulnerabilities

Issue: Prolonged outages during the 2023 ice storm exposed cascading risks (e.g., telecom failures hampered emergency coordination).
Lesson: Infrastructure upgrades must prioritize redundancy (e.g., decentralized solar-powered cooling centers).

3. Schneider's Creek Restoration (Kitchener)

Success: Hybrid design blending Indigenous knowledge and engineering reduced flood risks while restoring ecosystems.

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