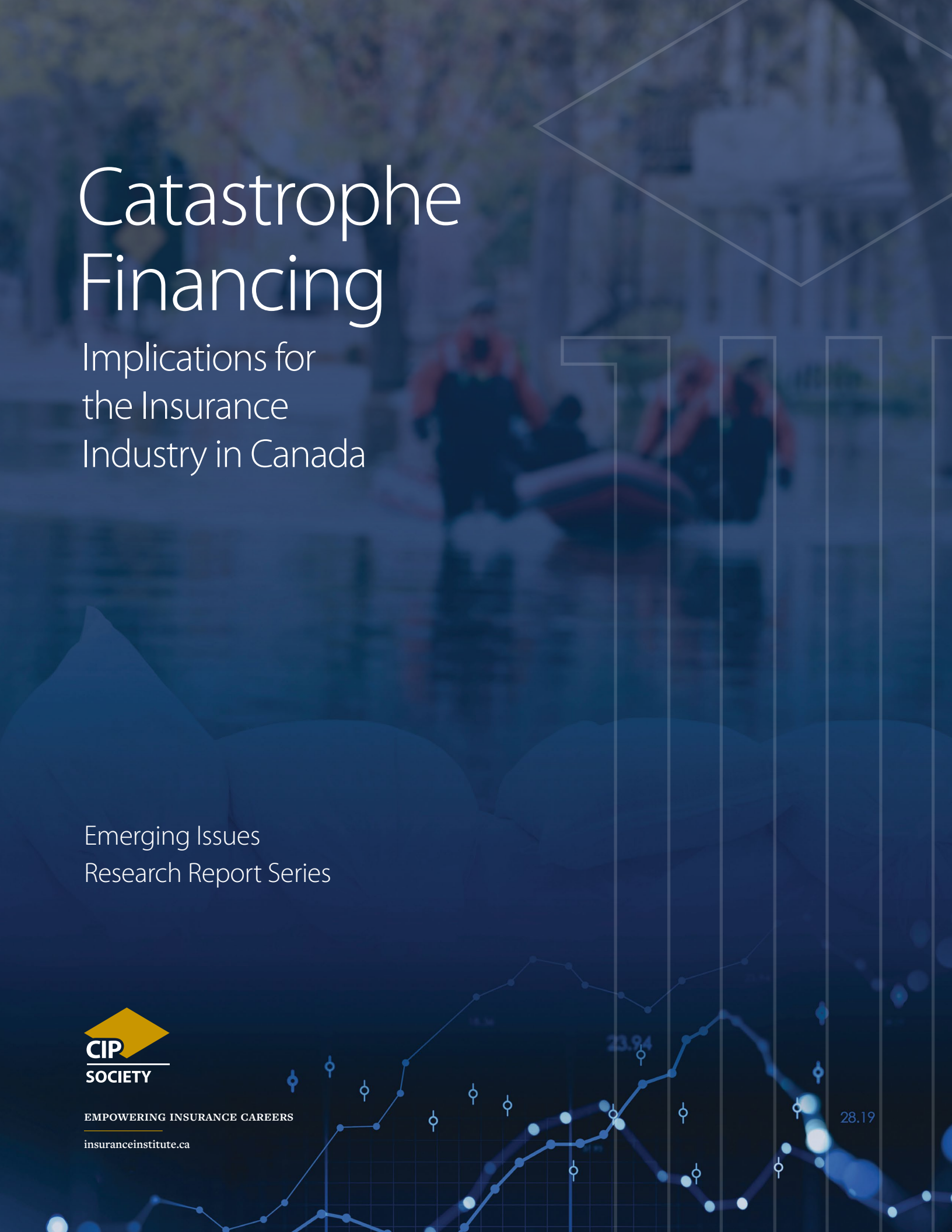
# Catastrophe Financing

## Implications for the Insurance Industry in Canada

Emerging Issues
Research Report Series



CIP SOCIETY

EMPOWERING INSURANCE CAREERS

insuranceinstitute.ca

## About the Insurance Institute

The Insurance Institute is the premier source of professional education and career development for the country's property and casualty insurance industry. Established in 1899, the Institute is a not-for-profit organization serving more than 40,000 members across Canada through 19 volunteer-driven provincial Institutes and chapters. For more information, please visit **insuranceinstitute.ca**.

## About the CIP Society

Since 1998, the CIP Society has represented more than 18,000 graduates of the Insurance Institute's Fellowship (FCIP) and Chartered Insurance Professional (CIP) programs. As the professionals' division of the Insurance Institute of Canada, the Society's mission is to advance the education, experience, ethics, and excellence of our members. The Society provides a number of programs that promote the CIP and FCIP designations, continuous professional development, professional ethics, mentoring, national leaderships awards, and understanding of emerging issues in the industry. The CIP Society, on behalf of its membership and for the benefit of the industry, is proud to have contributed to the development of this research report. Please visit **insuranceinstitute.ca/en/Membership/CIP-Society.**

## About the Institute's research

This research report is part of the Insurance Institute's Emerging Issues Research Series—providing relevant and insightful research reports on the issues impacting the property and casualty insurance industry in Canada. Completed Emerging Issues reports address the changing workforce (2007, 2012, 2018, and 2023), cyber risks (2015 and 2019), automated vehicles (2016), the sharing economy (2017), climate risk (2020), AI and big data (2021), managing risk (2022), political risk (2024), and catastrophe financing (2025). For more information, please visit **insuranceinstitute.ca/en/Insights-And-Publications/Research-Reports-archive.**

## About the author of this report

Paul Kovacs is Senior Researcher with the Insurance Institute and is Canada's leading authority on insurance and climate change. For more than 20 years, Paul was a contributing author to the Intergovernmental Panel on Climate Change, the world's leading forum for the study of climate issues. Paul was part of the team at the Panel that won the Nobel Peace Prize. He is well known and respected in the industry as founder and Executive Director of the Institute for Catastrophic Loss Reduction, former President and Chief Executive Officer of PACICC, and former Senior Vice President of Policy and Chief Economist with the Insurance Bureau of Canada. Paul is a popular commentator on insurance, disaster resilience, and economics and has written more than 250 publications and articles.

# Acknowledgements

The Insurance Institute would like to thank the following people who reviewed, commented on and/or contributed to the report:

**NIKOL KOVACS & NANCY KOVACS,**
PAUL KOVACS & ASSOCIATES

**SEAN RUSSELL**
MANAGING DIRECTOR, GUY CARPENTER

**ALISTER CAMPBELL**
PRESIDENT & CEO, PROPERTY AND CASUALTY INSURANCE COMPENSATION CORPORATION (PACICC)

**MARIA PAO**
VICE PRESIDENT, CATASTROPHE ANALYTICS GALLAGHER RE



**insuranceinstitute.ca**

# Catastrophe Financing

## Implications for the Insurance Industry in Canada

# Executive Summary

In early 2023, there was a marked increase in the cost of reinsurance for insurance companies, and restructuring imposed significant changes in coverage, including higher retentions. Everyone involved, including long-term industry veterans, described the 2023 renewal season as one of the toughest ever. Importantly, the restructuring was not anticipated by most involved. This report explores a range of catastrophe financing issues, including lessons from the 2023 reinsurance renewal experience, industry advocacy for an earthquake liquidity backstop, the idea of a government reinsurance program to address high-risk residential flooding, and other challenges that may emerge, with a focus on the implications for the insurance industry in Canada over the next 10 years.

The report begins with an exploration of what a catastrophe is. Three dimensions considered in this report include catastrophic events where insurance claims exceed $1 billion, catastrophic years when total claims from small and large events combined exceed $3 billion, and a mega catastrophe with industry claims greater than $35 billion. Catastrophe risk has increased in frequency and severity. There have been 10 catastrophic events in Canada, including nine over the 11-year period since 2013. There have been five catastrophic years, including the last three years. These events and years present circumstances when catastrophe financing is critical for the successful operation of property insurers in Canada. Moreover, it is inevitable there will eventually be a year when industry claims exceed $35 billion. Plausible, extreme losses present additional challenges for the industry and society as they may introduce systemic risk.

In the early 1980s, catastrophe claims paid by the Canadian insurance industry were $150 million a year, on average, adjusted for inflation. In 2024, the industry paid more than $8.5 billion in catastrophe claims. Claims increased 50-fold over 40 years. This report explores the factors driving losses higher. Climate change is increasing the frequency and severity of many hazards. Also, values at risk are growing faster than the overall rate of inflation. The housing crisis and inflation are adding to construction costs, particularly in Toronto, Vancouver, and remote areas. Population growth increases the number of risks covered by the industry. The rate of catastrophe claims growth has been remarkably stable for more than 40 years, warning that these factors are deeply rooted.

There are a number of financing options used by Canada's insurers. Importantly, this begins with capital and surplus at risk. Reinsurance purchased from independent carriers is the primary source of catastrophe financing. Some companies manage part of their risk through reinsurance provided within a corporate group. Also, indexed linked securities, including catastrophe bonds, have increased in popularity over the past decade as an alternative to traditional reinsurance, particularly in the United States. Public reinsurance is a financing option in several countries that may be introduced in Canada, starting with high-risk residential flooding. Since the 2023 renewal season, more of the financing risk for wildfires and severe storms shifted to insurance companies through higher retentions and a constrained appetite from reinsurers on frequency layers that contribute to earnings volatility protection.

Catastrophic events can threaten the solvency of an insurance company. More than 500 insurance companies worldwide have become insolvent since 2000, and some failed as a result of extreme events. Catastrophe finance is a critical tool for managing solvency risk from severe events. Models and claims experience estimate the potential costs, while design of reinsurance programs spread the risk consistent with the risk tolerance of the insurer. In contrast, a mega catastrophe has the potential to threaten the solvency of the

insurance industry as a whole. Fortunately, systemic risk is very low in the Canadian insurance industry, but it does exist. Systemic risk is a challenge for society, not just the insurance industry, and requires partnership with government to prepare for an event where losses may exceed the industry's capacity to pay.

Supervising catastrophe risk management is a critical element of prudential regulation in Canada. The Office of the Superintendent of Financial Institutions and insurance regulators in Quebec, British Columbia, and Ontario require insurance companies to demonstrate each year that they have reinsurance, surplus capital, and other financial capacity to successfully respond to the impact of a very large earthquake. Companies must demonstrate engagement of senior management and members of their board in the active management of earthquake and climate-related risk. Companies are required to conduct stress tests to measure their financial capacity to respond to the impact of multiple large events like wildfires, flooding, windstorms, and earthquakes. Catastrophe risk is also of growing interest to market conduct regulators. The Canadian Council of Insurance Regulators issued a series of discussion papers setting expectations for the industry to communicate coverage options and policyholder risk. Moreover, governments also provide disaster financial assistance to property owners that do not have insurance for hazards like a high risk of flooding.

Insurance is a promise. Payment of a premium establishes a promise to pay if a covered loss occurs. Increasing catastrophe losses create challenges for the industry relating to affordability, availability, time required to respond, time required to close a claim, and difficulties working with recovery agencies. Capacity to pay claims has not been an issue. That is to say, catastrophe financing has been managed well. Nevertheless, there are limits to the industry's capacity to manage sustained increases in the frequency and severity of catastrophe claims. Most buildings and infrastructure, new and old, are at risk because they do not have adequate protection. This must change. Aggressive investments in resilience are needed to break the trend of rising loss and damage. The insurance industry, in partnership with government and other stakeholders, must confront the unsustainable trend of underinvestment in protection. Ultimately, the most important catastrophe financing opportunity for the Canadian insurance industry involves increasing society's preparedness through investments in loss prevention.

## Recommendations for the Canadian insurance industry with respect to catastrophe financing:

**Over the next 10 years, senior management in most insurance companies should spend more time addressing the growing importance and complexity of catastrophe financing and the broader implications for the company.** Annual catastrophe claims paid by the industry in Canada 15 or 20 years ago were about $1 billion a year. Catastrophe claims over the next 10 years are expected to be much higher. More claims result in more capital at risk and require more reinsurance coverage. An appropriate reinsurance program may become more difficult to design and perhaps secure. Some years there will be rate increases that are discovered after annual budgets have been completed. Unanticipated increases in reinsurance costs may have consequences across the company, like concerns over rate adequacy, while higher retentions increase earnings volatility.

**If needed, the insurance industry must be prepared to take action if the availability or affordability of reinsurance is threatened.** The Canadian insurance market has been attractive to global reinsurers. Affordable

reinsurance capacity has been available to meet the needs of the Canadian insurance industry at a cost that has been attractive to insurers and reinsurers. Industry pricing and coverage commitments have built in an expectation that affordable reinsurance will remain available. Nevertheless, the insurance industry should be prepared to act if concerns arise about the availability and cost of reinsurance, as this would represent a threat to the industry. Availability of coverage from some reinsurers was significantly curtailed during World War II. Canada and several other markets considered regulations to require reinsurers to significantly increase the capital retained in each market, contrary to the design and purpose of global risk sharing. Inappropriate design of public reinsurance has the potential to displace current providers. Further consolidation may reduce the capacity of insurers to diversify their risk.

**There are limits in the financial capacity of the insurance industry to respond to very large catastrophes, so it is important to formalize the role of the government to provide a liquidity backstop to address this systemic risk.** The insurance industry has demonstrated its financial capacity to respond to large hazards. While these hazards are unlikely at any point in time, it is inevitable over the longer term that circumstances will arise with the potential to overwhelm the financial capacity of the insurance industry. A known risk involves a very large earthquake in Montreal or Vancouver. The industry has acknowledged the risk and presented a solution. The need is to secure a commitment from the federal government to provide a liquidity backstop if required.

**Significant investment in seismic and climate resilience is a core strategy for the insurance industry to manage catastrophe financing over the longer term.** First, those who benefit from asset owner investments in loss reduction—governments, insurers, asset owners, lenders, and others—must work together to develop coordinated financial incentives that are effective in securing increased resilience investments by homeowners, businesses, and infrastructure owners. If bold actions are not taken, current trends could lead to a crisis of insurance affordability and availability. Second, the insurance industry must integrate seismic and climate resilience in all aspects of its work—coverage redesigned to add resilience when responding to claims, communications with policyholders designed to share resilience knowledge and proven protection practices, and pricing that appropriately rewards those who are resilient. Most Canadians remain at risk. Industry efforts to promote resilience have not been sufficient. Larger gains require partnership. Municipal governments have been the first to take action. Ultimately, the resilience solution to the catastrophe financing challenge will involve significant investments in preparedness by homeowners, businesses, and builders empowered by awareness, directed by regulations, and encouraged by financial incentives.

# Foreword

Since 2007, the Insurance Institute is proud to have published more than a dozen reports on emerging issues impacting the property and casualty insurance industry in Canada. These reports address the changing workforce, cyber risks, automated vehicles, the sharing economy, climate change, AI and big data, risk management, social unrest, and now catastrophe financing.

This research report, and our series of reports more broadly, offer information and insights to assist P&C organizations deepen their understanding of how emerging risks will impact insurance products and services in Canada over the next five to ten years.

The frequency and severity of large loss events has increased and is expected to continue to rise in the near term and future. This report provides a lens into catastrophe financing, which is essential to prevent insolvency, smooth earnings, and ensure capacity for the timely payment of claims. We focus on the factors driving loss costs higher, financing options, evolving regulations, and challenges expected for the industry.

The hope is that this research report is not only helpful and interesting but also lays the foundation for continued leadership by the insurance industry as society works to address the challenges resulting from climate change.

Sincerely,

**PETER HOHMAN, FCIP, MBA, ICD.D**
**PRESIDENT & CEO**
THE INSURANCE INSTITUTE OF CANADA

# Contents

# Introduction

Toronto, Montreal, Vancouver, Ottawa, and Calgary are the five largest cities in Canada. All five experienced hundreds of millions of dollars in severe storm damage in the same year, 2024. Record numbers of Canadians experienced losses or know of family and friends with losses. And everyone is talking about severe weather, wildfires, and insurance.

In the 1960s and 1970s, insurance catastrophe claims were in the tens of millions of dollars each year—so low that the industry did not measure and track these claims. Forty years ago, the insurance catastrophe claims were $150 million a year, on average, and the industry's primary focus was on auto insurance reforms that sought to remove the use of age, sex, and marital status as rating criteria. Seven or eight years later, catastrophe losses doubled to $300 million a year, while the industry fought the threat to introduce public auto insurance in Ontario. Catastrophe losses doubled again, again, again, and again—reaching $8.5 billion in 2024. Catastrophe loss and damage is now firmly established as a priority concern for the insurance industry and society.

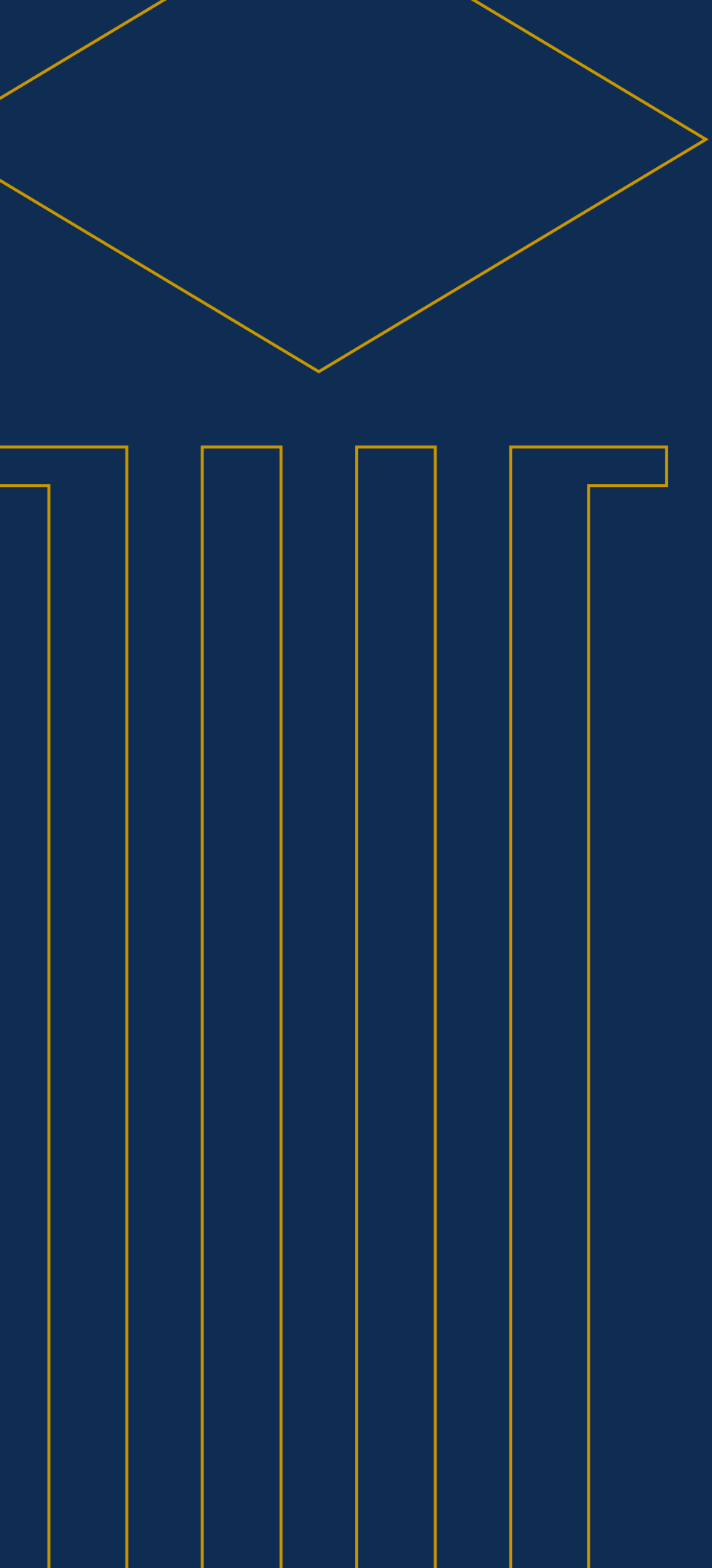
Disasters are complex. This report focuses on catastrophe financing. Other industry issues are the speed of response, communicating coverage options, availability, affordability, underinsurance, use of settlements, product innovation, working with government agencies, debris removal, additional living expenses, and others. The good news is that the increase in the frequency and severity of disasters in Canada has not resulted in concern about the ability of insurance companies to pay claims. The insurance industry is financially sound and well prepared for large loss events. Catastrophe finance has been managed well.

More good news is that the 40-year trend of alarming claims growth can be broken if Canadians invest in proven resilience measures. For example, investment of a few hundred million dollars in the Red River Floodway prevented more than $50 billion in flood damage. On a smaller scale, investments in proven protective measures for a home or business at risk will generate savings many times greater than the initial cost. Presently, however, most homes, businesses, and infrastructure are not appropriately protected. Affordable resilience solutions are known in the expert community but are absent in existing homes and most new construction. This must change.

However, it remains unclear what progress on loss prevention will be evident over the near term. It is prudent to assume that catastrophe losses will continue to trend higher over the next 10 years. More claims require more funds. The industry must maintain adequate pricing for the risks assumed. Insurers must secure sufficient reinsurance to protect their capital and support payment of claims. The insurance industry should expect increased attention from policyholders, regulators, shareholders, and others seeking assurance about the industry's ability to pay claims, while also being concerned about the affordability and availability of cover. Industry management of and financing catastrophe risk will significantly shape perceptions of the industry for most Canadians over the next 10 years.

This report will explore the implications for the insurance industry in Canada of catastrophe financing. Some questions addressed include:

- What is an insurance catastrophe?
- What is driving catastrophe losses higher?
- What financing options are available?
- What is solvency and systemic risk?
- What is the changing role of regulation?
- What is the insurance promise and resilience solution?



# Six critical questions

# Six critical questions

## What is an insurance catastrophe?

*Canadians likely experienced $14 to $16 billion in insured and uninsured catastrophe damage in 2024 when insurers paid $8.5 billion in catastrophe claims, the difference representing the insurance gap.*

A catastrophe is a sudden, large loss with the potential to significantly challenge the financial health of a well-functioning insurance company. This report focuses on tools used by insurers to manage and finance catastrophe events. Accordingly, the definition of catastrophe used here addresses the impact on the insurance industry. Elsewhere, analysis of emergencies, disasters, and catastrophes may focus on broader societal impacts—loss of life, injuries, time required to recover, impact on vulnerable populations, and so on. These are essential issues for society, but they are not directly linked to how insurers finance catastrophe exposure, which is addressed here.

For this report, an insurance claims catastrophe is an event where insurance claims for the industry are in excess of $1 billion. A catastrophic year will have total insurance claims in excess of $3 billion across all measured events, large and small. And a mega catastrophe would have insurance claims in excess of $35 billion in the same year.

These definitions are useful for this report, yet they will require modification over time as financial preparedness and impact expectations evolve. The objective is to identify events or years when circumstances have the potential to significantly challenge the performance of an insurance company that is in good financial health or threaten to overwhelm the insurance industry as a whole without government support.

It is important to acknowledge the insurance gap. Swiss Re estimates that in Canada and the United States insurance covered about 60 percent of total damage from extreme events over the period from 2014 to 2023.[1] Some homeowners and businesses do not purchase coverage. Insurers impose deductibles and limits. Most governments do not purchase insurance coverage for their infrastructure and other assets. Canadians likely experienced $14 to $16 billion in insured and uninsured catastrophe damage in 2024, where insurers paid $8.5 billion in catastrophe claims; the difference is the insurance gap.

## A terrible disaster

More than 40 years ago, the disaster research pioneer Enrico Quarantelli spearheaded a series of volumes exploring "what is a disaster?"[2] This work was a collaboration with leading researchers of the era. Others are continuing this research today. Dozens of alternate and conflicting definitions were discovered and assessed. Professor Quarantelli concluded that "it would be difficult to deny that there is substantial lack of consensus" about what a disaster is.[3]

Dr. Quarantelli, a sociologist, concluded that disasters are inherently a social phenomenon. Each disaster is rooted in our social structure. To use a Canadian illustration, in 2021 Logan Lake, British Columbia, had no lives lost or structures destroyed when threatened by an enormous wildfire because the community actively invested for more than 25 years in wildfire protection and had the capacity to work with partners to mount a successful defence of the community.[4] In contrast, Fort McMurray, Jasper, Kelowna, Lytton, and other communities experienced extensive destruction because they were not as prepared. Each community was threatened by fire, but the ultimate impact was determined by the behaviour of the community, a social phenomenon, not just exposure to a major wildfire.

1 Swiss Re, "How Big Is the Protection Gap from Natural Catastrophes Where You Are?"
2 Perry & Quarantelli, *What Is a Disaster?*
3 Perry, "What Is a Disaster?"
4 Fletcher, "Premier Says Logan Lake Wildfire Prevention a Model for B.C."

The United Nations defines a disaster in social terms: "A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources."[5] The United Nations defines more than 50 terms in its report on terminology for disaster risk reduction, including "disaster," but does not define "catastrophe."

In the United States, the Federal Emergency Management Agency's glossary identifies 758 terms, including "disaster" and "large disaster," but it does not define "catastrophe."[6] The Insurance Institute of Canada and the Insurance Bureau of Canada provide a glossary of almost 250 insurance terms. An "insurance claims catastrophe" is defined as "A sudden and unexpected event causing many insured claims, often on a large scale. The event often creates an urgent situation of need for policyholders that is a challenge to service due to the scarcity of resources in the aftermath."[7]

The Cambridge dictionary defines a "catastrophe" as "a terrible disaster," which is helpful simplicity for a complex phenomenon.[8]

## Catastrophic events

The Halifax explosion of 1917 was a large disaster, but it was not an insurance claims catastrophe because insurance did not make a major contribution to the recovery. At least 1,782 people were killed and more than 9,000 injured.[9] In addition, more than 1,630 homes were destroyed by the blast and fires that followed (five times more homes than were lost in the recent Jasper wildfire), and 12,000 homes were damaged.[10] Most of the industrial core of Halifax, schools, and hospitals were destroyed. The estimated damage was $35 million, which would be more than $700 million (when adjusted for inflation). Halifax could not have recovered on its own. Assistance was provided from across the Maritimes and New England. About $30 million in financial aid was raised to rebuild the community, including funds from the federal, British, and Massachusetts governments. The Halifax explosion, however, did not result in catastrophic insurance claims.

The 1998 ice storm was Canada's first insurance claims catastrophe with $2.6 billion in claims paid (adjusted for inflation).[11] This was the first event in Canada where claims were paid in excess of $1 billion. The financial impact on insurance companies was three times greater than any previous event. It was estimated that 90 percent of the payments made by insurers were recovered through reinsurance. Catastrophe financing through reinsurance significantly reduced the adverse impact on the earnings of insurance companies and removed the risk of insolvency. The number of insurance claims paid (but not the value) was the highest from any event in the world at the time.[12] Modern catastrophe response approaches used by Canadian insurance companies emerged during the ice storm.

In 2013, more than 15 years later, the industry experienced its second and third billion-dollar claims events. Flooding in Calgary and across southern Alberta resulted in claims paid of $2.0 billion (adjusted).[13] Water in the downtown core resulted in Canada's largest

5 United Nations Office for Disaster Risk Reduction, "Sendai Framework Terminology on Disaster Risk Reduction."
6 Federal Emergency Management Agency, "Guide for All-Hazard Emergency Operations Planning."
7 Insurance Bureau of Canada, "Glossary."
8 Cambridge Dictionary, "Catastrophe."
9 Canadian Encyclopedia, "Halifax Explosion (Plain Language Summary)."
10 Wikipedia, "Halifax Explosion."
11 Insurance Bureau of Canada, "Section 1: Canada's P&C Insurance Industry, All Sectors."
12 Kovacs, "Ice Storms Lessons Learnt."
13 Insurance Bureau of Canada, "Section 1: Canada's P&C Insurance Industry, All Sectors."

commercial loss event.[14] Two weeks later, intense rainfall in the Toronto area led to claims of $1.1 billion (adjusted).[15] This event largely involved extensive basement flooding in Mississauga, Burlington, and Toronto.

In 2016, the Fort McMurray wildfire led to insurance claims paid of $4.4 billion (adjusted).[16] Briefly, this was the most costly wildfire in the world. Insured and uninsured direct damage was estimated to be $8.9 billion.[17] The Fort McMurray wildfire is still Canada's most costly disaster and most costly insurance claims catastrophe. The remote location of the community coupled with severe strain on the local economy from the downturn in the energy sector before the fire increased the cost of supporting the recovery.[18] The entire population was evacuated for 30 days, which was an unprecedented disruption.

In 2020, Calgary experienced Canada's first catastrophic hail storm with $1.3 billion in claims (adjusted).[19] Extensive losses were concentrated in the northeast part of the city. Calgary provided a $3,000 rebate to homeowners that rebuilt with a class 4 impact-resilient roof.[20] The insurance industry joined with the city to promote the installation of impact-resilient roofing and sheltering of vehicles when a storm approaches, as set out in the Institute for Catastrophic Loss Reduction's HailSmart program.[21]

The 2022 derecho was Canada's most destructive windstorm, resulting in $1.3 billion in claims (adjusted) paid across Ontario and Quebec.[22] Strong winds blew from Sarnia along a 1,000 kilometre path through Ontario and Quebec. Estimated peak gusts of 190 kilometres per hour were experienced near Ottawa. The storm generated several tornadoes. The unusual storm may warn that climate change will increasingly push windstorms common in the northern United States up to Ontario and Quebec.

In the summer of 2024, there were four catastrophic loss events in Toronto ($1.0 billion), Jasper ($1.0 billion), Calgary ($2.9 billion), and Montreal ($2.7 billion). This was followed in October by heavy rains in Vancouver.[23] The combined insurance claims for the full year of $8.5 billion was an unprecedented total for the Canadian insurance industry, involving four catastrophic insurance claims events over a period of 26 days.

Prior to 2013, there was only one insurance catastrophe event in Canada. Since 2013, there have been nine in 11 years. Catastrophic claims events are taking place with increased frequency and severity. In 2013 and 2024, there were multiple events in the same year, just weeks apart.

## Catastrophic years

A catastrophe year for the insurance industry is defined to occur when all the events during the year result in combined industry claims paid in excess of $3 billion. The Canadian insurance industry has experienced five catastrophic years: 2013, 2016, 2022, 2023, and 2024.[24] The highest loss years were in 2016 at $6 billion and 2024 at $8.5 billion.

Insurers typically purchase reinsurance once a year to cover a 12-month period. Reinstatement is an important financing risk that must be managed. For catastrophic excess-of-loss reinsurance, this coverage

14 Kovacs & Sandink, "Best Practices for Reducing the Risk of Future Damage to Homes from Riverine and Urban Flooding."
15 Insurance Bureau of Canada, "Section 1: Canada's P&C Insurance Industry, All Sectors."
16 Ibid.
17 Wallis, "Fort McMurray Wildfire Costs to Reach Almost $9B, New Report Says."
18 Institute for Catastrophic Loss Reduction (ICLR), "Fort McMurray Wildfire."
19 Insurance Bureau of Canada, "Section 1: Canada's P&C Insurance Industry, All Sectors."
20 Strasser, "In wake of Another Devastating Hailstorm, Should the City Revive Its Resilient Roofing Program?"
21 Institute for Catastrophic Loss Reduction, "HailSmart."
22 Insurance Bureau of Canada, "Section 1: Canada's P&C Insurance Industry, All Sectors."
23 Insurance Bureau of Canada, "Summer 2024 Shatters Records for Severe Weather Damage."
24 Insurance Bureau of Canada, "Section 1: Canada's P&C Insurance Industry, All Sectors."

typically includes one paid reinstatement per reinsurance layer. This means that for each separate insurance layer purchased there is coverage for two times the limit, being the original limit plus the restated limit. With a paid reinstatement, there is an additional premium required to reinstate coverage, and once the second limit is exhausted there remains no more limit for the remainder of the year. In a year with many losses, like 2024, insurers must manage the potential need to purchase additional backup coverage if they exhaust their limits on any given reinsurance layer. Some insurers choose to do this after one large event, others wait until after a second event, and others decide to retain the risk for the rest of the year. The decision depends on the size of the losses, the impact on their particular reinsurance program, and their willingness to expose their capital to subsequent events. As more losses occur, the relative price of these backup covers increases, and the availability of capacity is reduced.

## Mega catastrophes

The largest catastrophe claim event for Canadian insurers was the $4.4 billion loss in Fort McMurray (adjusted for inflation). Over the past 40 years, records track dozens of industry loss events. Given this experience, combined with predictions from catastrophe models, it appears highly unlikely that Canadian insurers will experience a $35 billion mega catastrophe flood, wildfire, or windstorm. Such large losses are possible, for example, in the United States if a category 5 hurricane makes landfall near a major urban area like Miami or Houston, but it is extremely unlikely in Canada.

Insurance companies conduct stress tests where multiple events are simulated to occur in the same year. Indeed, large losses were experienced in 2016 and then again in 2024. The combined losses in 2016 and in 2024 were significant, but much less than $35 billion. It is extremely unlikely over the next 10 years that a combination of severe weather hazards would threaten to overwhelm the capacity of the insurance industry to pay claims.

However, loss models show that a large earthquake in Montreal or Vancouver could result in more than $35 billion in insurance claims.[25] Indeed, some scenarios result in much greater insurance claims.[26] The likelihood is very low, involving events expected every 1-in-750 to 1-in-1,000 years or more, but it is possible.[27] Such a large loss has the potential to represent a systemic risk.[28] For example, if several insurers become insolvent, Property and Casualty Insurance Compensation Corporation (PACICC) assessments that are required to cover the claims of the policyholders of failed companies, in the absence of a liquidity backstop from the government, may cause the strained balance sheets of otherwise solvent insurers to fall below solvency thresholds, threatening the insurance industry.

Solvency supervision of catastrophe risk in Canada began 30 years ago with a focus on earthquake exposure. Appropriately, management of mega catastrophe risk in Canada today continues to focus primarily on a low-probability, high-severity earthquake in Montreal or Vancouver. The risk of a large earthquake in Montreal of Vancouver is known, it can be measured, and this risk is being managed by the insurance industry.

Research published by PACICC finds that catastrophe financing is in place and is reported each year by insurers to their solvency regulators to ensure that an earthquake generating industry claims of up to $30 billion should not result in any healthy insurance companies failing or the realization of any systemic risk.[29] Moreover, insurers typically maintain a buffer to exceed the regulatory requirements for managing

25 AIR Worldwide, "Study of Impact and the Insurance and Economic Cost of a Major Earthquake in British Columbia and Ontario/Québec."
26 McIntyre & Desormeaux, "Canada's Earthquake Risk."
27 Goda, Wenzel, & Daniell, "Insurance and Reinsurance Models for Earthquake."
28 Kelly, "How Big Is Too Big?"
29 Ibid.

their earthquake exposure. The industry has sufficient reinsurance protection in place and surplus capital to successfully respond to a loss much greater than the largest historic catastrophe event and much greater than the industry's worst catastrophe year.

A mega catastrophe will take place, however, when an earthquake impact exceeds the planned exposure. There are circumstances where claims could overwhelm the insurance industry.[30] Catastrophe models show such large losses are unlikely, but possible.[31] Earthquake preparedness planning by the City of Vancouver and City of Victoria is based on extreme events.[32] Builders must prepare for low-probability, extreme-shaking events when designing new buildings. The Government of Canada, however, is yet to set out a detailed commitment that it will provide a financial backstop to the insurance industry if there is a systemic threat to the industry from a large earthquake.

## Implications for the insurance industry

For more than 40 years, there has been debate about the definition of terms like *emergency, disaster,* and *catastrophe*. A *disaster* is bad, particularly for those directly involved, their families, and their friends. Communities that experience a disaster are unable to recover without assistance. There are one or two dozen disasters experienced in Canada each year. Insurance protection helps policyholders recover.

A *catastrophe* is a terrible disaster. This is very bad. There have been 10 insurance catastrophes in Canada where the industry made payments in excess of $1 billion. This began with the ice storm in Quebec (1998), followed by flooding in Calgary (2013), basement flooding in Toronto (2013), wildfire in Fort McMurray (2016), hailstorm in Calgary (2020), derecho in Ontario (2022), extreme rain in Toronto (2024), wildfire in Jasper (2024), a larger hailstorm in Calgary (2024), and basement flooding in Montreal (2024). In 2024, insurance companies paid more than 270,000 catastrophe claims. These catastrophic loss events will long be remembered. These are circumstances when catastrophe financing is essential for the successful operation of the property insurance industry in Canada.

The insurance industry experienced catastrophe claims in excess of $3 billion in each of the last three years, reaching $8.5 billion in 2024. While catastrophic events are now experienced every two years, on average, every year may be another catastrophic year when all events are combined. Catastrophic years are likely to continue as the frequency and severity of major losses increases. It is very likely that the insurance industry in Canada will need to prepare for even larger catastrophe financing over the next 10 years.

It is inevitable there will eventually be industry catastrophe claims of $35 billion or more during a single year. These are mega catastrophes and will likely be triggered by a large earthquake in Montreal or Vancouver. A mega catastrophe will severely challenge all of society, not just those directly affected in Quebec or British Columbia. A very large catastrophe has the potential to threaten the viability of the Canadian insurance industry. The federal government needs to confirm its commitment to support Canadians and the insurance industry when a large earthquake strikes.

The rising frequency and severity of catastrophe claims is increasing the importance of catastrophe financing for Canada's insurance industry.

30 Contant, *Reinsurance Reset.*
31 Goda, Wenzel & Daniell, "Insurance and Reinsurance Models for Earthquake."
32 Emergency Management BC, "Provincial Earthquake Immediate Response Strategy."

# Six critical questions

## What is driving catastrophe losses higher?

*Overwhelming scientific evidence demonstrates that change in the climate and global warming will be accompanied by an increase in the frequency and severity of many hazards across most of the country and around the world.*

One of the most remarkable years in the industry was 2024, which say large losses in Toronto, Montreal, Vancouver, Ottawa, Calgary, and Jasper over a period of a few weeks. Some markets, like Alberta and British Columbia, have experienced several loss events over the last 11 years, including frequent storms in Calgary and wildfires in Fort McMurray, Lytton, Kelowna, and Jasper. The impact of catastrophic events has been more evident for the insurance industry in Canada since 2013. Nevertheless, these impacts reflect deeply rooted factors that have been building for more than 40 years.

Overwhelming scientific evidence demonstrates that climate change and global warming will be accompanied by an increase in the frequency and severity of many hazards across most of the country and around the world. Increasing extreme climate hazards is a global trend that is directly related to emissions of carbon and other greenhouse gas emissions. Moreover, the pace of warming in Canada and other northern countries has been double that of the rest of the world. Future warming in Canada is projected to remain at twice the global pace. Warming increases the risk of many hazards, such as extreme rainfall, areas burned by wildfire, and possibly local severe wind events. These hazards account for the majority of the catastrophe claims in Canada. Warming reduces some hazards, like winter cold, but the balance of impacts increases the risk of damage to vehicles, homes, businesses, and infrastructure across Canada in a changing climate.

Several other factors are also driving losses higher. Population growth is increasing the number of covered vehicles and structures. Average home size has increased, and more space has been accompanied by increased contents at risk. Use of space is also changing. For example, many basements are transitioning from storage areas to living space. Construction costs for materials and labour have been rising faster than the rate of inflation. And Canadians depend on our aging public infrastructure—power grids, transportation systems, and sanitary sewers—which means there are insurance claims when these systems fail during a flood, storm, or earthquake. Several international studies find that the combined impact of these other drivers on severe weather direct damage has been greater than the impact of climate change.[33] For example, some studies of the expected damage in 2050 from hurricanes in the United States find that societal impacts on damage are more than 10-fold greater than climate change impacts.[34]

Insurance catastrophe events and years emerged as a financial and operational challenge for the industry over the past five to ten years, yet this reality simply reflects the impact of trends that have been building since the 1980s. It is likely that catastrophe claims will continue to grow over the next 10 years and beyond until aggressive action is taken to confront the root causes of rising losses—the absence of appropriate resilience and protection in buildings and infrastructure, climate change, and growth in values at risk.

## Our changing climate

The United Nations' Intergovernmental Panel on Climate Change (IPCC) is the world's leading forum for the study of climate change. The IPCC reports the following:

33 Pielke, "Misdefining 'Climate Change.'"
34 Pielke & Sarewitz, "Bringing Society Back into the Climate Debate."

Human activities have warmed Earth's climate by more than 1°C since the late 19th century, and the effects on our climate are unprecedented. We are increasingly feeling the consequences in every inhabited region, and the changes we experience become larger the more the Earth warms. People in all regions will be affected in multiple ways. We're already seeing more severe and frequent extremes. Future emissions will determine future global warming. With higher emissions, nature becomes less efficient in absorbing the carbon we emit. Some changes cannot be avoided, but by limiting our warming we can slow, and even stop, many of them. The good news is that reducing our emissions quickly can limit global warming.[35]

The contribution of global warming to the risk of climate extremes is evident around the world. More frequent and severe storms have been experienced in North America, Europe, Asia, Africa, Central and South America, and Antarctica. Further increases in extremes are projected as warming continues. Human choices about future emissions will determine the extent of further change in the climate and extreme weather.

Canada is warming twice as fast as the global average,[36] and the extreme north of Canada is warming three times faster than the global average. Arctic ice cover is rapidly disappearing. Countries nearest to the equator are experiencing warming, but at a slower pace. Canada and other large countries like Russia, China, and the United States are experiencing more complex impacts relative to smaller countries. Regional variations are significant. Local geography and other factors are important to determine local impacts.

In May 2022, Canadian insurers paid more than a $1 billion in claims when a derecho blew across Ontario and Quebec. These significant wind events are common in the United States and a warming climate may bring more derecho north into Canada.[37]

The 1998 ice storm was Canada's first catastrophic insurance claims event. Conditions frequently bring similar storms to the northern United States, and climate change is expected to result in more of these ice storms in Canada.[38] Warming will likely result in more large hurricanes that bring intense winds to Atlantic Canada and extreme rainfall in Ontario, Quebec, and Atlantic Canada.[39] It is possible that warming will bring conditions that could contribute to the formation of more intense and frequent summer storms, tornadoes, and hail across the Prairies and central Canada.[40] There will be an increase in intense rainfall that will add to the threat of basement flooding.[41] Intense rainfall following a winter of heavy snow accumulation will increase the risk of spring flooding. The levels of the Atlantic, Pacific, and Arctic oceans are rising and increasing the risk of coastal flooding. Significant increases are projected in the area burned by wildfires and the length of the fire season because of more extensive periods of drought drying the forests, reduced snow cover most winters, and more insects and diseases eroding forest health.[42]

35 IPCC, *Climate Change 2021.*
36 Government of Canada, "Canada's Changing Climate Report 2019."
37 Bernstien, "What's a Derecho and Why Is It so Destructive?"
38 Mahdavi, "Why Winter Storms Are Becoming Bigger and Badder around the Great Lakes."
39 Madge & Smith, "Hurricanes and Climate Change in Atlantic Canada."
40 Ibid.
41 Canadian Climate Institute, "FACT SHEET: Climate Change and Flooding."
42 World Weather Attribution, "Climate Change More Than Doubled the Likelihood of Extreme Fire Weather Conditions in Eastern Canada."

There is Canadian and global evidence that the frequency and severity of some climate and climate-related extremes in some locations has taken place. There is high confidence that there will be an increase in many climate extremes in the future, and the magnitude will be driven by the pace of global warming. Moreover, Canada has been warming faster than most other countries, and this will continue. Our changing climate is one factor that may result in more catastrophe risk for insurance companies in Canada.

## Other major drivers

Canadians invested significantly in public infrastructure in the 1950s, 1960s, and 1970s. These systems are essential to distribute electricity, move vehicles, manage rainwater, and much more. However, there has been an alarming underinvestment over several decades to maintain, modernize, and expand our critical infrastructure. Each year, thousands of Canadians experience extended periods without power following a windstorm or wildfire, contributing to the risk of claims for spoiled food and other losses. Flooding and wildfires close roads and increase the risk of business interruption claims and disruption in supply chains. Aging combined and sanitary sewers are sometimes overwhelmed by extreme rainfall events that may have been unimaginable when these systems were originally designed and installed, contributing to a higher risk of sewer backup claims, like many of the residential claims in the summer of 2024 in Montreal and Toronto.[43] More investment is needed if the performance of our infrastructure is to return to levels experienced 40 or 50 years ago.[44]

The Canadian population doubled from 21.6 million in 1971 to over 42 million in 2024.[45] Over that 50-year period, population growth has been between 142 percent and 269 percent in Toronto and adjacent municipalities, metro Vancouver, the Calgary area, the Edmonton area, and Ottawa/Gatineau. In contrast, population growth in Montreal and the rest of Canada was 54 percent. This is sustained growth that is three to five times faster over 50 years in Toronto, Vancouver, Calgary, Edmonton, and Ottawa relative to that in Montreal and the rest of the country (see the table).[46] In particular, the population in Calgary grew almost fourfold, Canada's fastest growing large city. So the storms that hit this city in 2020 and 2024 resulted in a total of $4.2 billion in hail damage claims across an area of northern Calgary that previously was farm land. Over the 50-year period before the 2016 wildfire, the number of people living in Fort McMurray increased tenfold, including temporary workers, significantly increasing the values at risk when the wildfire embers rained down.[47] More insured values at risk is the primary driver of more claims. More concentration of people and assets in a few large centres contributes to more catastrophic events.

| Population | 1971[48] | 2021[49] | Increase |
|---|---|---|---|
| Montreal CMA | 2,823,639 | 4,366,487 | 55% |
| Toronto CMA | 2,699,927 | 6,543,866 | 142% |
| Metro Vancouver | 1,082,441 | 2,743,765 | 153% |
| Edmonton CMA | 530,888 | 1,467,219 | 176% |
| Ottawa/Gatineau | 484,326 | 1,462,582 | 202% |
| Calgary CMA | 418,510 | 1,542,956 | 269% |
| Rest of Canada | 14,012,595 | 21,562,205 | 54% |
| CANADA | 21,568,000 | 38,226,498 | 77% |

The average size of a new home has doubled over the last 50 years.[50] The vast majority of homes in Canada have a basement, and increasingly basements are used for living space, not just storage.[51] The value of contents in a typical home has increased much faster than the overall rate of inflation

43 CatIQ, "Canada's Loss and Exposure Indices Provider."
44 CanInfra, "Estimates of Canada's Infrastructure Deficit Vary Widely."
45 Statistics Canada, "Canada's Population Clock."
46 Statistics Canada, "Population Estimates, 2021."
47 ICLR, "Fort McMurray Wildfire."
48 Statistics Canada, "Population by Census Metropolitan Area, 1971, 1991, 2001 and 2011."
49 Statistics Canada, "Archived: Population Estimates, 2016."
50 Qualman, "Home Grown."
51 Mallarino, "The Difference in Price of Homes with a Finished Basement vs. Homes without a Finished Basement."

for several decades. House prices are volatile, with an overall trend of strong growth, in part reflecting an increase in construction costs.[52] Construction costs are driven by the cost of labour, supplies like lumber, compliance with provincial and local regulations, building size, and several other factors. Similar drivers are evident for commercial structures and vehicles. In general, the average value of a catastrophe claim has increased and is likely to continue to rise over the next 10 years.

A number of studies, most using data from the United States, find that the majority of the increase in loss and damage due to extreme events is the result of increasing values at risk and the higher cost of repairs.[53] Climate change added somewhat to claims costs, and the impact is expected to grow in significance over time unless aggressive action is taken quickly to reduce carbon and other greenhouse gas emissions. Structures are built with a safety buffer that provides protection beyond regulatory minimums set out in building codes. Further increases in the severity of extreme events would increase the risk of impacts exceeding protective capacity.

In the United States, there has been an alarming increase over the past 30 years in damage from hurricanes. There have been a number of studies seeking to measure the impact of climate change relative to the other factors driving damages higher.[54] The studies find that climate change has increased the frequency and severity of large hurricanes, but more than 90 percent of the increased loss and damage is due to other factors.[55] In particular, there has been a remarkable increase in value and the number of properties located in Florida and other coastal locations in the United States that experience hurricanes.

## Implications for the insurance industry

The factors driving catastrophe claims higher are deeply rooted and likely to be sustained over the next 10 years. The trends evident in Canada over a period of 40 years or more are also found in the United States, Europe, and elsewhere. Our population is growing. Canadians are building larger homes, converting basements into living space, and continuing to pay high values for homes and their contents. Warming will increase the frequency and severity of extreme climate-related hazards. Global emissions of greenhouse gases continue to rise, and Canadian investments in resilience protection remain low for new and existing structures.

The insurance industry should not view the large loss events since 2013 with a sense that future losses will stabilize and remain near recent levels—that is, it should not be seen as a "new normal." The factors driving losses higher have been building for several decades and are expected to drive claims even higher until there is significant investment in resilience. Sustained, large increases in loss and damage brings a growing concern about insurance affordability and availability, financing challenges, and increased uncertainty.

The insurance industry, through the premiums that it charges, puts a value on the annual risk of loss and damage for each home and business across Canada. Higher premiums are an important metric of growing risk, a value provided by the industry. Insurance premiums have increased faster than the overall rate of inflation for many years, driven largely by evidence of the rising risk of damage from severe weather.

The insurance industry should plan for more catastrophe claims, perhaps with totals doubling over the next 10 years, while aggressively working to break the trend by promoting and rewarding investment in proven resilience protection.

52 Solá, "Home Prices Rose 2.4 Times Faster Than Inflation since 1960s, Study Finds."
53 Mohleji & Pielke, "Reconciliation of Trends in Global and Regional Economic Losses from Weather Events."
54 Pielke & Sarewitz, "Bringing Society Back into the Climate Debate.".
55 Pielke, "Misdefining 'Climate Change.'"

# Six critical questions

## What financing options are available?

*Catastrophe financing is the skill of finding the right balance between capital that remains at risk and the cost of reinsurance protection.*

Insurance companies expose their capital and surplus when confronted by catastrophe claims. Reinsurance is an important tool Canadian insurers use for catastrophe financing. Capital markets offer several alternative risk tools that have grown in use in recent years, but largely in the United States and a few other markets. Reinsurance is the primary source of catastrophe financing for Canadian insurers, and it is typically structured to protect against the accumulation of retained losses arising from a single catastrophic event.

Modern reinsurance programs are complex. They often involve facultative certificates to provide coverage for individual risks and treaties to provide coverage for a portfolio of risks. Cover may include proportional and non-proportional elements. Protection is typically set out in layers, involves many reinsurers, and can include independent reinsurers licensed in Canada, unregistered reinsurers, and other companies in a corporate group.

For thousands of years financial risks resulting from cargo and vessels lost at sea or structures destroyed by fire have been shared for large, complex risks. This was common before the practices we now call *insurance* and *reinsurance*. The modern industry of reinsurers accepting, for a premium, risks facing insurers began with coinsurance provided by foreign insurers in the early 1800s. This was followed in the late 1800s with independent specialized reinsurance companies building operations to spread risk across the world.

Catastrophe financing involves insurers sharing risk with their reinsurers. This was long viewed as a collaboration based on good faith. Insurance, reinsurance, and capital markets nevertheless operate as businesses. Informal relations and handshake agreements celebrated in the past gave way over time to the business of risk management. The 2023 reinsurance renewal season brought large rate increases, imposed significant changes in coverage, and provided a reminder that the collaborative relationship between insurers and reinsurers was giving way to modern business practices.

Catastrophe financing is the skill of finding the right balance between capital that remains at risk and the cost of reinsurance protection.

### Catastrophe financing options

Claims can be paid from current premiums, reinsurance recoveries, or drawing down accumulated capital and surplus. Reinsurance recoveries are particularly important to manage catastrophic claims. Indeed, reinsurance is the backbone of the insurance industry in the management of catastrophe financial risk.[56]

Reinsurance is insurance for insurance companies.[57,58] Catastrophe financing, particularly in the United States, is increasingly blending traditional reinsurance and capital market instruments that provide a range of alternative risk-spreading mechanisms.[59] Public reinsurance is a financing option in several countries that may someday be introduced in Canada. Indeed, in Canada a government reinsurance program is presently under development to support establishing a high-risk residential flood insurance program and a perhaps a

56 Kopf, "Notes on the Origin and Development of Reinsurance."
57 National Association of Insurance Commissioners, "Notes on the Origin and Development of Reinsurance."
58 Federal Insurance Office, "The Breadth and Scope of the Global Reinsurance Market and the Critical Role Such Market Plays in Supporting Insurance in the United States."
59 Insurance Information Institute, "Background on Reinsurance."

mechanism to provide an industry backstop for a large earthquake and fire in Montreal or Vancouver.[60]

Facultative reinsurance covers specific individual policies, typically those with high values and high risk.[61] The lead insurer works with a reinsurer to provide cover, and they jointly underwrite each policy. This type of reinsurance is called *facultative* because the reinsurer has the faculty to accept or reject all or part of a policy offered. Facultative coverage may be proportional (pro rata) or non-proportional (excess of loss). That is, the insurer and reinsurer can proportionally share the coverage (say, two-thirds of the premium and claims are retained by the insurer and one-third are ceded to the reinsurer), or the insurer may transfer to the reinsurer claims in excess of a threshold up to a limit. Facultative sharing of large risks is an approach that has been in place since 3000 BCE to provide financial protection for merchants with large values at risk—long before the introduction of modern insurance practices.[62,63]

Facultative reinsurance results in more effort for reinsurers than other forms of reinsurance and accordingly is more expensive. Insurers, nevertheless, choose facultative risk sharing because they see value in the knowledge and expertise that their reinsurance partner brings to the collaboration.[64] The expense of securing facultative reinsurance is offset by the reduced risk of experiencing a major loss and promised reinsurance recoveries. Facultative reinsurance is a long-standing continuation of insurance and reinsurance partnering to share expertise and best serve the needs of policyholders, particularly those known to face high and complex risks. Over the longer term, facultative reinsurance has been declining as a share of the catastrophe reinsurance protection provided to insurance companies, reflecting the growing capacity of insurance companies to manage all but the very largest risks.[65]

Treaty reinsurance are agreements that cover a broad group of policies.[66] This has grown to become the largest contribution of reinsurance to catastrophe financing. Treaty agreements can be proportional or non-proportional. Proportional policies are frequently used by newer insurers that lack sufficient capital to carry all the policies they have accepted. Proportional treaties can also support insurers that enter new markets and companies entering into voluntary wind up. Non-proportional excess-of-loss policies are typically designed specifically to cede catastrophe risk. An excess-of-loss treaty involves an insurer retaining responsibility for claims up to the retention threshold, while the reinsurer accepts, for a premium, claims in excess of the threshold up to an agreed limit. In brief, excess-of-loss reinsurance is catastrophe insurance for insurance companies.[67]

Reinsurance programs are complex, with several reinsurers involved and a program that is designed in layers.[68] The insurer retains catastrophe claims with high frequency and low severity, perhaps those expected every 5 or 10 years. The first layer of reinsurance coverage will be the most expensive when measured by the rate on line, covering claims that are most likely to be experienced as they extend from the basic retention up to a low limit. The second layer would cover claims beyond the first layer limit up to a higher limit. The second layer would be somewhat less likely to be triggered, so it would be somewhat less expensive than the first layer. The program will continue in layers up to the point where the insurer retains losses beyond

60 Insurance Institute, "Feds Commit $15 Million to Flood Insurance Backstop."
61 Sitole, "Basics of Facultative Reinsurance."
62 Kopf, "Notes on the Origin and Development of Reinsurance."
63 Holland, "Reinsurance."
64 Guy Carpenter, "Facultative or Treaty and Why the Need for Hybrid Solutions."
65 Federal Insurance Office, "The Breadth and Scope of the Global Reinsurance Market."
66 Axxima, "Ultimate Guide to Treaty Reinsurance."
67 Sanders, "When the Wind Blows."
68 Insurance Information Institute, "Background on Reinsurance."

the limit. The reinsurance program for large, multi-line insurers will include facultative and treaty reinsurance, proportional and non-proportional coverage, and several reinsurers.

Insurance companies carefully consider their risk tolerance and risk appetite when designing reinsurance coverage. *Risk tolerance* represents the maximum level of loss an insurer is willing to bear without jeopardizing their financial health. *Risk appetite* reflects the company's strategic willingness to assume risk in pursuit of profits. Reinsurance acts as a critical tool to align exposure with these parameters.

Insurers evaluate their risk tolerance by assessing factors that include capital reserves, regulatory requirements, and potential impacts of catastrophic events. This helps determine the level of retention—the portion of risk the insurer keeps—and the amount transferred to reinsurers. For example, an insurer with a low risk tolerance might opt for lower retentions and comprehensive reinsurance agreements to mitigate exposure to high-severity events like earthquakes.

Risk appetite influences the type of reinsurance coverage chosen, such as proportional (sharing both premiums and claims with the reinsurer) or non-proportional (where the reinsurer covers losses above a certain threshold). Companies with higher risk appetites may retain more risk or purchase excess-of-loss coverage, focusing on profitability from lower-frequency, high-severity events.

By carefully balancing these considerations, insurers ensure that reinsurance supports their financial stability while enabling strategic growth and risk taking within their defined limits.

A large share of the claims incurred in catastrophe events are recovered from reinsurers. Some estimate that reinsurance recoveries covered 90 percent of the claims from the 1998 ice storm, 67 percent of the claims from the 2016 Fort McMurray wildfire, and 50 percent of the claims from the 2024 summer events in Toronto, Jasper, Calgary, and Montreal.[69,70] The 2023 reinsurance renewal season sought to refocus the purpose of reinsurance to increasingly respond to large catastrophe events and primary global perils, like hurricanes and earthquakes. Reinsurance protection was withdrawn for small and more frequent hazards and became more expensive for secondary perils like flooding, wildfire, hail, and local severe wind events—hazards that dominate catastrophe claims risk for Canadian insurers. Prior to 2023, reinsurance would typically cover about 60 percent of catastrophe insurance claims in Canada, and since that time it typically covers about 50 percent.[71]

Since the late 1990s, managers of dedicated insurance-linked securities funds, fixed income asset managers, pensions funds, endowments, superannuation funds, hedge funds, and other capital markets have offered indemnity-triggered and indexed/parametric principal-at-risk securities and other alternative risk transfer tools.[72] Some insurers issued catastrophe bonds to investors structured like an excess-of-loss reinsurance contract, where all or a portion of the principal on the securities is lost if an identified catastrophe takes place.[73] Alternatively, insurers may establish a sidecar as a way to find capped quota share protection financed by debt and equity held in trust if losses arise from a specified event. Also, industry loss warranties are a contract where investors provide coverage to an insurer if an industry-wide loss exceeds a pre-established condition. Currently in global markets, traditional reinsurance accounts for about 80 percent and financial instruments

69 *Canadian Underwriter*, "Impact of Fort McMurray Wildfire Softened by Reinsurance Risk Sharing."
70 Gambrill, "What to Expect of the Reinsurance Renewal Season in 2025."
71 Gambrill, "How Record-High Cat Season Will Impact Reinsurance Renewals."
72 Insurance Information Institute, "Background on Reinsurance."
73 Swiss Re, "Insurance-Linked Securities Market Insights."

20 percent of catastrophe financing for insurance companies, compared to more than 95 percent and less than 5 percent 10 years ago.[74] These alternate instruments are permitted in Canada, and since 2017 it has become more common to include coverage for US and Canadian earthquake and hurricane losses in catastrophe bonds.[75]

Government-owned insurance and reinsurance programs are common in the United States, Europe, and elsewhere, designed specifically to finance recovery from hurricanes, earthquakes, flooding, and other hazards. The Canadian government is developing a reinsurance program to support the creation of a high-risk residential flood insurance program.[76] The Canadian insurance industry is also seeking a backstop to provide protection from a major earthquake and fire in Montreal or Vancouver, and this may involve a public reinsurance mechanism.

Canadian insurers typically purchase catastrophe reinsurance protection from independent reinsurance companies licensed in Canada. For small catastrophe programs they are often completed entirely with registered reinsurers. For mid- to larger-sized catastrophe programs, unregistered reinsurance is used to expand the supply and diversify placement, with perhaps 15 to 35 percent of the limits placed with unregistered reinsurers. Also, some insurers structure reinsurance protection within their corporate group.

## A brief history of catastrophe financing

Catastrophe risk management practices extend back to prehistory. Cooperatives, guilds, public granaries, and other structures provided mutual protection against the threat of catastrophic events like fire or drought. If a family home was destroyed, neighbours were committed to helping rebuild. Thousands of years ago, ancient Babylonian, Chinese, and Indian literature report merchants spreading their goods over several ships to reduce the risk of catastrophic loss if a ship and its cargo was lost.[77,78] Many societies, including the ancient Egyptians, maintained public granaries to manage the consequences of drought.

Insurance emerged as an essential foundation to support a society that became increasing monetized. The Babylonian Code of Hammurabi from 1750 BCE set out that a loan to merchants to cover the cost of shipping their goods could include a fee (that is, they could buy a form of insurance) in exchange for a guarantee from the lender to cancel the loan if the shipment was lost or stolen.[79] Over most of human history, fire has been a significant threat to structures. Mutual support from neighbours to rebuild in their time of need was replaced by fire insurance and fire protection in response to the remarkable and continuing population growth in major urban centres around the world.

The first reinsurance contract on record was in 1370 to reinsure a ship for part of its voyage between Genoa and Bruges. The insurer retained the risk through the Mediterranean from Genoa to Cadiz, and the contract transferred the risk along the French coast to another firm.[80] The term *reinsurance* first appears in a document written in Florence in 1457.[81] Coinsurance of cargo and ships has been common for hundreds of years.

The Great London fire of 1666 and fires in most other large cities were an important catalyst in the development of the modern

74 Gallagher Re, "Reinsurance Market Report."
75 Contant, "2017 Cat Bond Issuance Reaches Record Levels."
76 Canadian Mortgages Inc., "Flood Reinsurance: Wading into the Deep End."
77 Holland, "A Brief History of Reinsurance."
78 Kopf, "Notes on the Origin and Development of Reinsurance."
79 Holland, "A Brief History of Reinsurance."
80 Kopf, "Notes on the Origin and Development of Reinsurance."
81 Holland, "A Brief History of Reinsurance."

insurance industry.[82] Widespread destruction of property resulted in a surge of demand from homeowners and businesses to purchase fire insurance. Insurance companies, often with most of their customers located close together with correlated risk of loss, soon learned of the limits of their financial capacity to cover catastrophic loss events. This included individual customers with considerable assets at risk and portfolios of policyholders. Insurance companies began to seek financial protection to manage large risks.

Fire insurance in the early 1800s was sometimes written on a coinsurance basis.[83] Initially, premiums and claims costs were shared facultatively with local competitors.[84] Collaborating with competing insurers to share peak risks could not be sustained. To avoid disclosing terms and practices with competitors, insurers eventually sought to coinsure with insurance companies operating in another jurisdiction.[85] One agreement between British and French insurers has remained in force since 1824, even though no formal treaty was signed. It is conducted through binding arrangements in correspondence backed by the good faith of the companies involved.[86] Some large insurance companies established structures to share risk within their corporate group and perhaps accept coinsurance with other insurers. Over time, this practice evolved into reinsurance as a line of insurance.

The first fire reinsurance treaty was concluded in 1825 between an insurer in Germany and an insurer in France. The modern reinsurance industry emerged in the late 1800s. The first independent reinsurance company, Cologne Re, was established in 1842.[87] The two largest reinsurance companies today include Swiss Re, established in 1863, and Munich Re, founded in 1880.[88] Insurance companies can be licensed to provide reinsurance, while an independent reinsurer specializes in reinsurance for insurance companies and does not compete directly with insurers.

Carl von Thieme is recognized for his leadership at Munich Re between 1880 and 1922 to shape modern reinsurance practices based on internationalism and the widespread distribution of risk.[89] Global reinsurers would plan for losses by a branch in one location to be counterbalanced by the expectation of gains secured elsewhere. Internationalism is the idea of smoothing out fluctuations in risk around the world, an approach that can be shared with local insurance companies through reinsurance.[90] This approach was extended for reinsurance to also share risk across lines of business. Von Thieme demonstrated, with the rapid growth in Munich Re, that this could be supported by an insurer that specialized exclusively in providing reinsurance and did not compete with the insurance companies that it supported.

Global reinsurers significantly contributed to the reputation of the insurance and reinsurance industry when a series of catastrophic events struck in the early 1900s. This included the great fire of Baltimore in 1904 and the San Francisco earthquake and fire in 1906.[91] Many insurers were unable to pay their claims, while other insurance companies made their reputation and that of the reinsurance industry by their ability to pay. These events were followed by the sinking of the *Titanic* in 1912, World War I between 1914 and 1918, and the influenza pandemic in 1918. Ultimately, Swiss Re, Munich Re, Hannover Re, Lloyd's, SCOR, and

82 Ibid.
83 Kopf, "Notes on the Origin and Development of Reinsurance."
84 Holland, "A Brief History of Reinsurance."
85 Ibid.
86 Ibid.
87 Federal Insurance Office, "The Breadth and Scope of the Global Reinsurance Market."
88 Ibid.
89 Holland, "A Brief History of Reinsurance."
90 Ibid.
91 Ibid.

Berkshire Hathaway established themselves as the world leaders in providing independent reinsurance catastrophe financing for the insurance industry.

The depression years and World War II significantly impacted the reinsurance industry, bringing considerable financial harm to some companies and benefiting others.[92] Financial transactions, including the provision of reinsurance protection to insurers across certain national borders, were severely curtailed or halted during the war.[93] Moreover, the pace of recovery was affected by an ongoing conversation about protection of local insurance markets for local insurers and requests to maintain funds in each market, directly challenging the business model of spreading risk globally.

The reinsurance industry recovered rapidly following World War II. There was a marked increase in the cost of coverage that followed several large loss events, including Hurricane Andrew, the 9/11 attacks, and Hurricane Katrina. Demand for coverage increased as insurers and their shareholders learned that peak losses may be greater than previously anticipated, while the capital of the reinsurance providers was constrained by the losses, contributing to increased prices. These events often triggered new entrants into the market. Initially this involved new reinsurance companies. Bermuda, in particular, provided a base for many firms attracted by the high prices and not burdened with recovery costs.[94]

More recently new sources of catastrophe financing involve products developed for capital markets.[95] Early catastrophe bonds and other alternative risk tool products failed to provide sufficient returns to attract many investors and were not as attractive to insurers as traditional reinsurance.[96] With time, however, these offerings grew in popularity, particularly in the United States. Catastrophe bonds provided investors with an opportunity to diversify their portfolio with an instrument that was uncorrelated to other bonds and equities.[97] Similarly, some insurers were seeking to spread their catastrophe funding across a broader base of suppliers. Moreover, the past 30 years included significant consolidation of the reinsurance industry, thus reducing sources of coverage. In addition, catastrophe bonds and other alternative transfer products are typically fully funded, eliminating the risks for insurers associated with a promise to pay by reinsurers where there may be solvency risk. This can be important for peak perils, like a major hurricane or earthquake in the United States, that may threaten the failure of unprepared reinsurers.

## A changing relationship

The 2023 reinsurance renewal season was difficult for everyone involved. Big changes were imposed. Insurers without a significant catastrophic loss history saw rate increases of 25 to 30 percent, while others had rate increases of 50 to 70 percent.[98] Popular attachment points for catastrophes that repeat with two-year returns periods were withdrawn, removing the option to transfer higher-frequency losses.[99] The reinsurance industry chose to increase focus on the business of accepting low-probability, high-severity risks that may threaten erosion of capital for insurers, and they reduced their role in smoothing earnings. Also, reinsurers redeployed capital to focus on primary global hazards, including the risk of large hurricanes and earthquakes, and demonstrated a reduced appetite for secondary hazards, which happen to be common in Canada, like flooding, wildfire, hail, and local severe wind events.

92 Ibid.
93 Ibid.
94 Federal Insurance Office, The Breadth and Scope of the Global Reinsurance Market."
95 Ibid.
96 Insurance Information Institute, "Background on Reinsurance."
97 Holzheu & Lechner, "Economic Insights."
98 Contant, "Is It Time for a New Reinsurer to Enter the Market?"
99 Porado, "What's Keeping Reinsurance Renewals Steady?"

Patrick Delalleau prepared a series of masterclasses for CCR Re about the history of reinsurance.[100] He described several important changes in the relationship between insurance companies and reinsurers over the last 50 years (since 1975). Some of his observations include frequent legal disputes today versus a near absence 50 years ago; annual review of prices and terms, sometimes with sudden and significant change, versus stable and predictable prices and terms; emphasis on agile and anti-cyclical financial management seeking returns for investors versus a commitment to long-term collaboration and partnership; and a downgrade clause in every contract versus an absence of cancellation without extreme justification. He thinks that the long-term partnership between insurers and reinsurers still exists today, but the number of believers has declined. Requirements of a global reinsurance business will sometimes take priority over maintaining a vivid client-by-client partnership. Delalleau concludes by saying that proof of players sticking to fairness and a long-term approach is the best way forward as the relationship between insurers and reinsurers continues to evolve.

## Implications for the insurance industry

The 2023 reinsurance renewal season brought several changes that have been sustained in the catastrophe financing market since that time. Reinsurers lowered their exposure to secondary perils in Canada, like wildfire, hail, and basement flooding, with primary insurers retaining about 10 percent more of the catastrophe claims.[101] Before the 2023 restructuring, about 60 percent of catastrophe claims paid by insurers in Canada were recovered by insurers, but in 2024 it was about 50 percent. A year like 2024, with a larger number of events, had a bigger impact on insurer earnings than in the past. Reinsurance recoveries in 2024 and going forward will be lower when measured as a share of total claims paid by the insurance industry.

Some reinsurers cited difficulties with modelling secondary perils. Some reinsurers expressed the need for change because of poor results over many years. All involved found the changes to be significant, abrupt, and largely unanticipated.

The 2023 renewal season was evidence of the evolving relationship between the global reinsurance industry and Canada's insurers. Reinsurers chose to increasingly focus their capital on primary global risks, including hurricanes and earthquakes, and reduced the offer of coverage in Canada for flooding, wildfire, and summer storms. Some reinsurers imposed higher premiums despite the absence of major losses in Canada. Moreover, there was a sense that material changes in coverage may someday be imposed again. After all, the partnership between insurers and their reinsurers is also a business relationship.

Thoughtful design of effective reinsurance programs over many decades has been an important factor that largely eliminated the risk of catastrophe insolvency in Canada. This is clear evidence of a job done well. The importance of catastrophe financing will continue to grow for the industry over the next 10 years. Expectations of increased catastrophe claims paid will require larger spending on reinsurance coverage and catastrophe risk management.

Development of an effective reinsurance program is difficult. The 2023 renewal season provided a reminder that modern programs can change significantly in cost and protection provided with little notice with consequences across the organization. Review of catastrophe financing is now an ongoing responsibility with an annual renewal of reinsurance cover, the need to plan for reinstatement after a major loss, and ongoing learning about evolving risk of loss.

100 Delalleau, "The History of Reinsurance—Patrick's Masterclass."
101 Gambrill, "What to Expect of the Reinsurance Renewal Season in 2025."

# Six critical questions

## What is solvency and systemic risk?

*Looking ahead 25 or 50 years, anticipated growth in Canadian home and building values and the impact of climate change on the frequency and severity of extreme events will increase the low risk of a climate-related mega catastrophes if Canadians persist in underinvesting in appropriate protection.*

A catastrophic event or a cluster of events in a catastrophic year could result in the failure of an insurance company that does not have in place appropriate financing. Indeed, there have been several insolvencies in the United States and other markets, and several decades ago there were one or two in Canada. Insurance companies in Canada consistently demonstrate skill in managing this risk. There have been many catastrophic loss events and years combined with a near absence of concern about the ability of insurers to pay. Catastrophe risk management tools and financing options are widely known and effectively used. Moreover, regulatory oversight has been active and refined over more than three decades. Solvency risk is low because of effective management, nevertheless from time to time a few insurance companies are likely to fail in Canada, and catastrophe losses may be a contributing cause.

Systemic risk is a threat to the claims-paying capacity of the insurance industry. This is much less likely than the chance that a company fails, but the consequences are so severe that systemic risk requires active management. A mega catastrophe will occur at some point in the next 500 or 1,000 years. It could happen tomorrow. Claims from a single event or group of events could overwhelm the financial capacity of the insurance industry in Canada. The risk of a systemic shock is low over the near term, yet inevitable over the longer term. The Insurance Bureau, PACICC, and others have been proactive in describing the impact on society and the need for the government to commit to a liquidity backstop. A functioning insurance market is essential to support a prosperous society. A mega catastrophe is a systemic threat to the insurance industry that requires a commitment by the federal government to work with the industry in response.

This section explores how catastrophe financing is essential to manage solvency and systemic risk and how the market may evolve over the next 10 years.

### Solvency risk

PACICC protects eligible policyholders from undue financial loss in the unlikely event of an insurer insolvency, and it has done so since 1989.[102] The corporation is an insurance-industry-funded not-for-profit guaranteed fund that is approved by regulators to protect Canadians. PACICC is also a global leader in the study of insolvency risk in the insurance industry. An important contribution to the understanding of solvency risk is found the PACICC's "Why Insurers Fail" publications.[103]

Since 2000, more than 500 insurance companies have failed around the world. PACICC updates the list each year.[104] This is ongoing evidence that occasionally some insurance companies fail. Findings show that failures often come in bunches or clusters in Canada and in other countries.[105] Since 1979 (10 years before PACICC was established), PACICC has identified 32 property and casualty insurance companies that were closed by Canada's insurance regulators.[106] Failure does not include insurers that chose to exit the Canadian market, but instead focuses on companies forced to close because they were involuntarily placed into wind up by their regulator.

The largest number of insurance failures in Canada and the United States involve immature companies that do not survive

102 Property and Casualty Compensation Corporation (PACICC), "About Us."
103 Ibid.
104 Kelly & Peng, "When, Where and How Often Insurers Fail."
105 Kelly, Peng, & Campbell, "When It Rains ... It Pours."
106 PACICC, "Past Insolvencies."

the first five or ten years of operation. New management teams have greater risk that a threat will not be fully identified and addressed, initial capital may in inadequate, and the business model may have an unidentified fatal flaw. Some mature companies fail after entering a new, perhaps higher-risk, market where they do not have sufficient knowledge to succeed. Also, companies may fail after a period of extraordinary growth or dramatic decline in premiums. Rapid growth that exceeds efforts to increase capital may compromise a company's capacity to pay claims. A collapse in premiums is always a warning of serious trouble. In brief, domestic and international experience shows that it is widely known why most insurance companies fail. Signals of distress should trigger action by management and regulators seeking corrective action to prevent failure.

Some insolvencies involve fraud, other criminal activities, or gross incompetence by management and owners. These are very rare in Canada and difficult to detect in advance. Other financial industries have experienced insolvency resulting from a dramatic collapse in investment values, but the Canadian insurance industry is conservative in its investment practices, and companies have controls to catch rogue traders.

Catastrophic loss events sometimes result in insurance insolvencies. At least 14 insurance companies failed as a result of the 1906 earthquake and fire in San Francisco.[107] Industry claims paid were estimated at more than 100 times the fire insurance premiums paid that year, significantly depleting companies' capital that had been accumulated over many decades.

Eight insurers failed as a result of Hurricane Andrew in 1991, and dozens of companies left or sought to leave the market.[108] The Florida insurance market has been in extreme disarray for more than 30 years. Government-run, tax-exempt pools were established (and continue to be widely used) to cover homeowners unable to secure basic insurance in the private market or to provide wind-only coverage.

Lessons learned from Hurricane Andrew had a major impact on catastrophe financing for insurance companies in Canada and around the world. Catastrophe modelling, for example, was in its infancy at the time.[109] Claims experienced as a result of Andrew were much higher than predicted by the models.[110,111] Moreover, several decades of reduced storm activity and claims resulted in an unrecognized premium inadequacy and failure to establish sufficient catastrophe reinsurance protection. In 1992 there had been very few $1 billion insurance claims events in the world, and none in Canada. Insurance companies did not anticipate the need to put in place financing for an event that resulted in US$16 billion in claims—$42.5 billion when converted to Canadian dollars and adjusted for inflation.[112,113]

More than 30 years later, there has been a significant global investment in catastrophe models.[114] The initial focus in Canada was on earthquake exposure. In particular, the reinsurance and financing needs to manage this low-frequency, high-severity hazard if it were to strike in Vancouver. Over time catastrophe modelling in Canada has extended to hazards that strike with greater frequency but lower peak impact, such as hurricanes, storms, blizzards, floods, and wildfires.[115,116,117] These models are regularly

107 Insurance Information Institute, "The San Francisco Earthquake of 1906."
108 McChristian, "Hurricane Andrew and Insurance."
109 Clark, "The Evolution of Catastrophe Modeling Since Hurricane Andrew."
110 Business Insurance, "Lasting Effects of Hurricane Andrew."
111 JTL Re, "Catastrophe Models."
112 Insurance Information Institute, "Background on Reinsurance."
113 Sansone, "Remembering Hurricane Andrew's Lessons."
114 Clark, "The Evolution of Catastrophe Modeling Since Hurricane Andrew."
115 Moody's Insurance Solutions, "Catastrophe Models and Risks."
116 Verisk, "Catastrophe Risk Modeling Solutions."
117 Moorcraft, "Modelling."

refined using loss experience and evolving risk data from Canada and elsewhere.

Catastrophe reinsurance purchased by insurers in Canada, the United States, Europe, and other markets increased remarkably over the last 30 years.[118] Increased spending on reinsurance contributed to higher premiums paid by drivers, homeowners, and business policyholders. Higher premiums reflect growing industry awareness of the expected catastrophe losses, in particular the inclusion of model estimates for low-probability, high-severity events and the purchase of reinsurance protection.

The insurance industry in Canada and around the world was surprised by the scale of losses experienced in San Francisco, Florida, and some other events. Failure to anticipate the magnitude of the potential claims contributed to the absence of adequate reinsurance and other financial protection. In some circumstances this resulted in insolvency. Today, catastrophes are a known risk. Catastrophe models estimate tail risks, and recent loss events provide actuaries and underwriters with data about more frequent events. Proactive management of catastrophe risk by insurers includes management of financing to prevent insolvency. Large losses from extreme rainfall in Toronto and Montreal, hail in Calgary, and wildfires in Fort McMurray, Kelowna, and Jasper were significant events, but not a surprise like that experienced 30 years ago by insurers with coverage in Florida. Catastrophe financing is central to financial management in modern insurance companies, significantly reducing the risk of insolvency from all but extreme events.

## Systemic risk

A large catastrophe has the potential to threaten the insurance industry, including healthy companies with a history of strong financial results. This is systemic risk. Risk to the system is very low in the Canadian insurance industry, but it does exist. PACICC estimates that an event or group of events resulting in more than $35 billion in insurance claims has the potential to result in the insolvency of several insurers. If surviving insurers are burdened with the cost of compensating policyholders of the failed companies, without a government backstop, this may overwhelm the financial capacity of the insurance industry.[119]

Catastrophe models and experience finds that there are a few known hazards that have a remote chance of generating claims of this magnitude. Flooding, wildfire, hurricanes, tornadoes, hail, and winter storms occur frequently in Canada, and in some years the combined claims paid from several dozen events has been a few billion dollars. However, it is extremely unlikely that climate-related hazards would result in more than $35 billion of insurance claims in Canada in a single year.

Looking ahead 25 or 50 years, anticipated growth in Canadian home and building values and the impact of climate change on the frequency and severity of extreme events will increase the risk of a climate-related mega catastrophe if Canadians persist in underinvesting in appropriate protection.

Nevertheless, for more than 30 years the Canadian insurance industry has been actively discussing its exposure to the risk of a large earthquake in Montreal or Vancouver. Pioneering research by PACICC published in 2013, then updated in 2016 and 2021, details the size of an event with the potential to threaten the entire industry without a government backstop.[120] A number of published studies by the C.D. Howe Institute, Conference Board of Canada, Insurance Bureau of Canada, and others show that large historic earthquakes repeated today could generate industry claims that threaten

118 Pande, "The State of the Reinsurance Property Catastrophe Market."
119 Kelly, "How Big Is Too Big."
120 Ibid.

the insurance industry.[121,122,123] In Montreal, this would largely involve claims from fire following the earthquake and destruction of commercial structures, as more than 95 percent of homeowners in Quebec do not purchase shake coverage.[124] Vancouver has fewer buildings than Montreal and lower total values at risk, but the city has a higher likelihood of a large earthquake and many more homeowners and small businesses with shake coverage.

It is inevitable that a major earthquake will strike in Montreal or Vancouver. Regulations require that insurance companies demonstrate their financial capacity to cover the losses, with a buffer, from a 1-in-500-year loss event.[125] However, this does not mean that all seismic risks over the next 500 years are covered. It is possible that a more extreme earthquake could happen at any time. It is possible that an earthquake in Montreal or Vancouver could result in claims of $50 billion, $100 billion, or some other amount sufficient to threaten the industry.

Over several years, the Insurance Bureau of Canada, PACICC, and others have requested that the federal government commit to providing an industry liquidity backstop.[126] The backstop would be triggered by a loss event that threatens the insurance industry. The insurance companies demonstrate each year to regulators their capacity to respond in full to an extreme earthquake—a 1-in-500-year loss event. Following a very large loss event, the government will need to work with the insurance industry to restore Canadians, and it would be beneficial if the critical elements of the collaboration are agreed to and set out in advance.

## Changing use of reinsurance

Thirty years ago, the insurance industry and prudential regulators established a formula to measure the capacity of insurance companies in Canada to pay earthquake damage claims. This has been revised over time and is presently set out in the Office of the Superintendent of Financial Institutions (OSFI) Guideline B-9.[127] This includes a retention that is covered within an insurer's capital and surplus, earthquake reserves, catastrophe reinsurance, and catastrophe bonds or other approved financing tools. In practice, the vast majority of the financing for a large earthquake involves reinsurance and a retention against capital and surplus. The tax treatment of reserves is not favourable for insurance companies, and few companies in Canada purchase catastrophe bonds.[128]

The balance between capital at risk and reinsurance purchased by insurance companies to cover earthquake exposure reflects the risk appetite and tolerance of each insurer, confidence in the capacity of reinsurers to respond following a major loss, and the cost of reinsurance. The relationship between insurers and reinsurers is based on trust built up over many years.

Over many decades, there have been major international loss events that resulted in a material change in the Canadian reinsurance market. Some global events that increased the cost of reinsurance in Canada include the liability crisis, Hurricane Andrew, 9/11, and Hurricane Katrina. Insurance companies in Canada understand that participating in global reinsurance markets will sometimes impose change in terms of coverage and higher costs in Canada following large international

121 Le Pan, "Fault Lines."
122 McIntyre & Desormeaux, "Canada's Earthquake Risk."
123 AIR Worldwide, "Study of Impact and the Insurance and Economic Cost of a Major Earthquake in British Columbia and Ontario/Québec."
124 Insurance Bureau of Canada, "Earthquakes."
125 Office of the Superintendent of Financial Institutions (OSFI), "Earthquake Exposure Sound Practices."
126 Contant, "Reinsurance Reset."
127 OSFI, "Earthquake Exposure Sound Practices."
128 Gambrill, "Would a Cat Bond Work for Major Flooding?"

loss events.[129] Insurance companies have also experienced changes in the cost of reinsurance following large loss events in Canada or evidence that risks in Canada are larger than previously understood.[130]

When events resulted in higher reinsurance costs, some insurance companies responded by maintaining their reinsurance protection and perhaps seeking to pass on the higher cost to consumers. Some insurance companies chose to increase retentions and reduce their reinsurance coverage. Over time, there were periods where reinsurance costs fell or gradually eroded because of intense competition and capital entering the reinsurance market. This introduced additional scope for some insurers to reduce retentions and perhaps pass on lower reinsurance costs to consumers.

In summary, the relationship between insurers and their reinsurers has evolved in recent decades in a context of significant increases in global and Canadian catastrophe claims, explosive increases in data available for analysis, catastrophe models for previously unmodelled risk, changing risk tolerance, and regulatory oversight requiring stress testing.

## Implications for the insurance industry

Catastrophe claims are a growing part of the cost of providing insurance in Canada. As catastrophic events are projected to increase in frequency and severity, financing catastrophe claims is essential to smooth earnings and protect capital. Over the past 30 years, insurance companies have demonstrated skill at successfully managing the risk of insolvency from all risks, including catastrophes. In particular, the purchase of adequate reinsurance coverage and cautious exposure of capital and surplus has responsibly reduced, but not eliminated, the risk that an extreme event may threaten the financial health and solvency of an insurer.

It is important for insurers to invest in data collection and analysis, catastrophe models, and other tools to understand and proactively manage the solvency threat of extreme hazards. Most important is the need to purchase adequate reinsurance protection.

A large earthquake and fire in Montreal or Vancouver is inevitable over the longer term. Large earthquakes have occurred in the past and are certain to return, but now there are significant values at risk. Insurance companies must continue to demonstrate their capacity to fully respond to a major earthquake, as determined by their risk tolerance and as set out in regulations. Losses beyond these extreme levels require a government backstop. The industry should re-energize its support for the advocacy by the Insurance Bureau and PACICC to secure a commitment from the federal government.

The importance of reinsurance has increased for insurance companies and is expected to continue to increase as catastrophe risks grow in frequency and intensity. Management of catastrophe financing may require increased scope for uncertainty about renewal pricing and terms.

129 Artemis, "Legacy of Hurricane Katrina."
130 Artemis, "Fort McMurray Reinsurance & Retrocession Price Rises Filter Through."

# Six critical questions

## What is the changing role of regulation?

*There is extensive evidence that the majority of Canadians are not aware of their exposure to loss and damage from earthquakes, flood, wildfire, and severe weather. For example, most Canadians at high risk of flooding believe their risk is low or moderate.*

Perhaps 30 or 40 years ago, prudential and market conduct regulators seldom thought about catastrophe risk, but they do now. Supervision provides assurance to the public, elected officials, and the industry of the financial capacity of insurers to pay claims, and also ensures that consumers are appropriately aware of industry practices and coverage options.

Catastrophe financing assurance is critical to prudential supervision given the increase in claims paid. Appropriately, for several decades prudential supervision focused first and foremost on the risk of a large earthquake in Vancouver or Montreal. A large earthquake is inevitable and could threaten healthy insurers if they are not financially prepared—it could also overwhelm the entire insurance industry. Increasingly, however, solvency supervision is also requiring the filing of stress tests assessing the impact of multiple extreme climate-related events. Stress tests based on loss models and industry experience build industry capacity to demonstrate to management, shareholders, and the public that the industry has the capacity to respond to known hazards. OSFI has been working in partnership with insurance regulators in Quebec, British Columbia, and Ontario to provide a consistent approach to prudential regulation of earthquake and severe weather risks. A consequence of regulatory capital and reinsurance requirements in Canada has been a higher cost of insurance for Canadians.[131,132]

Beyond prudential regulation, interest by members of the Canadian Council of Insurance Regulators has been building over the past decade in the market conduct of the insurance industry. This includes a series of thoughtful research papers. Market conduct regulators question the insurance industry's effectiveness to inform Canadians about insurance coverage in place, coverage options, and the risk of loss for a specific property. In 2024, the Insurance Bureau and Insurance Brokers Association of Canada presented a three-part plan to address these concerns. Efforts are presently working to develop and implement the proposed solution.

### Prudential regulation

After Hurricane Andrew, Canadian insurance industry leaders formed a blue-ribbon committee to determine actions needed to ensure preparedness for the risk of a major loss in Canada.[133] Review of the available and emerging research determined that the most significant solvency risk for Canadian insurers from known catastrophic exposures involved a major earthquake in Vancouver or Montreal. Moreover, company practices to manage this risk varied extensively and perhaps dangerously, as some companies had made no effort to estimate potential losses and some had little or no reinsurance financing in place. An industry consensus was soon established to (1) propose regulations setting out requirements for the responsible management of earthquake exposure in British Columbia, Quebec, and Ontario; (2) request favourable tax treatment of earthquake reserves; and (3) establish the Institute for Catastrophic Loss Reduction to provide the industry and society with ongoing science advice about earthquakes, flooding, and extreme weather hazards.

The industry, through the Insurance Bureau, presented draft regulations that were largely enacted as proposed in 1998 by prudential regulators.[134] OSFI's "Guideline B-9—Earthquake Exposure Sound Practices" was

131 Cambell, "The Price of Protection."
132 Cambell, "The High Price of Prudence."
133 Zyl, "Earthquake's First-Step Budget."
134 *Canadian Underwriter*, "OSFI and Insurers Working on Updating Canadian Earthquake Guidelines."

updated in 2013 and retains elements viewed as innovative for the time.[135] This includes requiring the use of catastrophe models, ongoing management engagement of the board, and the decision to transition over 25 years from a 1-in-250-year threshold to a 1-in-500-year threshold.

Catastrophe models are presently recognized as critical tools supporting insurance management of exposure to earthquakes, flood, wildfire, severe storms, and other modelled hazards.[136] They are important to ensure appropriate reinsurance coverage, adequate rates, and overall management of catastrophe exposure. Thirty years ago catastrophe models were emerging as tools for insurance companies. Models in the United States initially focused on hurricanes and expanded to earthquakes, flooding, and other hazards. The first Canadian models addressed earthquake risk. Initially, models were used by insurers almost exclusively to determine appropriate reinsurance protection for a large earthquake. Canada was the first jurisdiction in the world to require the use of catastrophe models.

Much of Guideline B-9 sets out expectations of management to inform their board about earthquake exposure and choices made to finance potential claims.[137] Industry advice from 30 years ago sought to use regulatory guidance to bring the earthquake exposure management practices in place at leading companies into effect at companies lagging in their practices. This resulted in increased conversations by management and boards about risk tolerance and acceptable risk. Over time, OSFI made changes to Guideline B-9, yet the initial proposal from industry remains that management engagement with the board about catastrophe management and adequate financing is important, and supervisory oversight is a good thing.

The industry proposed a 1-in-500-year threshold of financial preparedness. At the time, all new large buildings required proof under the Canadian building code that there would be no loss of life if the building experienced a 50-year magnitude earthquake. Thirty years ago, several companies argued that it would take time to establish financial preparedness for a 1-in-250-year event, and longer for a more significant loss. Ultimately, the regulators accepted the industry proposal of a 1-in-500-year threshold, yet they established a 25-year transition period. All companies were obliged to immediately demonstrate financial preparedness for at least a 1-in-250-year event, and the requirement was increased each year until the higher threshold was in place.

A significant review of Guideline B-9 began in 2010.[138] Default loss estimates, for example, were included in the initial guide for insurance companies that did not use earthquake models, but all companies were using these models 12 years later and the defaults were eliminated. Important changes were made in the guidance about best practices in exposure management to reflect learning and experience over the previous 12 years. Also, regulators expanded their capacity to secure data needed to supervise this issue.

The Canadian process of managing earthquake exposure was presented in 1999 to the International Association of Insurance Supervisors as a model that should be used by prudential insurance regulators around the world. A joint presentation by the Insurance Bureau and OSFI stressed the value of collaborative industry/regulator development of guidance and the proactive anticipation of low-probability, high-consequence risks. The ideas pioneered in Canada significantly enhanced the industry's capacity to respond to large earthquakes.

In 2018, OSFI expressed concern and later issued a discussion paper about reinsurance arrangements in place for seismic and severe weather exposure.[139] This included

135 *Canadian Underwriter*, "OSFI Release Final Earthquake Exposure Guideline."
136 Marsh, "Catastrophe Modeling."
137 OSFI, "The Importance of Managing Risk."
138 Maldeniya et al., "OSFI Shakes Up Earthquake Exposure Sound Practices."
139 Cassels, "OSFI Releases Draft Guideline B-3."

insufficient collateral requirements for unregistered reinsurance, concentration risk, global treaties that may limit funds needed in Canada, failure of some insurers to retain the majority of the premiums earned, fronting, and foreign reinsurers ceding risks. OSFI proposed requiring more capital in Canada for insurers and reinsurers.

Annex I of OSFI's proposed revision in "Guideline B-3—Sound Reinsurance Practices and Procedures" set out a policy limit rule where each insurer would be required to demonstrate sufficient catastrophe financing to respond to its three largest risks taking place in a single year and reinsuring counterparties on each risk failing. Some industry actuaries calculated the likelihood of this scenario happening at between 1-in-1 billion and 1-in-5 trillion, an approach not in use by any of the insurance companies in Canada. The Insurance Bureau argued that the change would require that the industry raise an estimated $21–$30 billion in additional capital, which in turn would increase the cost of insurance for homeowners and businesses.[140]

The final revisions in Guideline B-3 take effect in 2025 and require that insurers demonstrate their capacity to cover their largest exposure assuming default of their largest unregistered reinsurer on that exposure.[141] OSFI also shifted the focus of the guideline to ensure that reinsurance is collectable in Canada rather than reinsurers being required to maintain additional capital in Canada. An insolvency clause is now required in all treaties clarifying that the reinsurer will continue to make full payments to an insolvent insurant without any reduction. The revisions demonstrate the capacity of Canada's insurers and regulators to work together.

OSFI's "Guideline B-15—Climate Risk Management" has been in effect since 2023.[142] The guideline focuses on evolving requirements to measure and disclose physical and transitional risks. Nevertheless, the guideline also sets out three expected outcomes for insurers, including the expectation that insurers remain "financially resilient through severe, yet plausible, climate risk scenarios, and operationally resilient through disruption due to climate-related disasters."[143] This is a direct link between prudential regulatory expectations for catastrophe financing management and related issues like climate risk disclosure. The overriding objective for prudential regulation is for insurers to demonstrate financial capacity to cope with low-probability, high-severity plausible risks.

## Market conduct regulation

Catastrophic risk is of growing interest to market conduct regulators in Canada. Since 2017, the Canadian Council of Insurance Regulators (and recently in partnership with the Canadian Insurance Services Regulatory Organizations) issued a series of position papers about natural disasters and consumer awareness.[144,145] Four gaps identified in the council's 2023 paper include the following:[146]

- Low awareness of property-specific catastrophe risk
- Low awareness of available insurance coverage options
- Low awareness of existing insurance coverage
- Low awareness of provincial disaster financial assistance

140 Gambrill, "$30-Billion Sticker Shock for OSFI's Proposed Reinsurance Rules."
141 Gambrill, "OSFI Softens Stance in New Reinsurance Guidelines."
142 OSFI, "Climate Risk Management."
143 Ibid.
144 Canadian Council of Insurance Regulators, "Natural Catastrophes and Personal Property Insurance."
145 *Canadian Underwriter*, "Insurers Should Ensure Consumers Are 'Better Able to Understand' Home Insurance Policies."
146 Canadian Council of Insurance Regulators, "Natural Catastrophes and Personal Property Insurance."

Recently, some insurance companies in the United States withdrew the offer of coverage from some markets, increasing concerns about the availability of catastrophe coverage.[147] Moreover, across Canada, the United States, and elsewhere the cost of coverage for catastrophic risks for homeowners and businesses has been rising much faster than the overall rate of inflation.[148] This creates concerns about the affordability of insurance, particularly for vulnerable homeowners who are seniors on a fixed income, marginal families lacking employment and income security, and younger families. Availability and affordability of insurance are important issues for market conduct regulators, elected officials, and the public.[149] Increases in the frequency and severity of hazards across Canada is naturally increasing the questions market conduct regulators are asking brokers, agents, and insurance companies.

There is extensive evidence that most Canadians are not aware of their exposure to loss and damage from earthquakes, flood, wildfire, and severe weather. For example, most Canadians at high risk of flooding believe their risk is low or moderate.[150] Most Canadians say they have never viewed a flood map or otherwise sought to learn about their exposure. With extensive evidence that most Canadians are not aware of the risks they face, studies also find that high awareness of earthquake risk in British Columbia is the most important factor contributing to the purchase of earthquake insurance.[151] That is to say that awareness is an important foundation for risk management action like buying insurance and investing in protection.

An important question involves the responsibility of brokers, agents, and insurance companies to inform policyholders about property-specific risks. Many agencies, largely government agencies, exist to inform homeowners, businesses, and others about their risk.[152,153,154] These public agencies have developed maps, models, and other risk communications tools. But the evidence suggests that these processes are not adequate. Support and leadership from the insurance industry can bolster efforts to better inform Canadians about property-specific risks. In 2024, the Insurance Bureau and Insurance Brokers of Canada presented an action plan to the Canadian Council of Insurance Regulators and the Canadian Insurance Services Regulatory Organizations. Efforts are underway to develop the details and move to implementation.[155] The insurance industry can be leaders to significantly improve risk awareness across the country.

There is also extensive evidence that most Canadians do not know what insurance protection they have or the options available. Most Canadians appear to read their policy after a loss, not when it is put in place. They do not appear to recognize that the frequency and severity of increasing losses may involve a loss to their own property.

It is the responsibility of the insurance industry to explain coverage in place and coverage options to each customer. Policyholders that may appear unwilling to make the time to listen is a challenge, but nevertheless the responsibility is with the insurance industry. Again, in 2024 the Insurance Bureau and Insurance Brokers of Canada presented an action plan to the Canadian Council of Insurance Regulators and the Canadian Insurance Services Regulatory Organizations, and efforts are underway to develop the details and move to implementation.

147 Cooley, "Home Insurance Was Once a 'Must.'"
148 Acera Insurance, "Alberta Home Insurance Rate Increase FAQ."
149 French, "Alberta Finance Minister Instructed to Address Rising Auto, Home Insurance Costs."
150 University of Waterloo, "Flood Risk & Homeowner Awareness."
151 Goda, Wilhelm, & Ren, "Relationships between Earthquake Insurance Take-Up Rates and Seismic Risk Indicators for Canadian Households."
152 FireSmart, "FireSmart."
153 Fraser Basin Council, "Lower Mainland Flood Management Strategy Initiative."
154 Conservation Ontario, "Building Resilient Watersheds to Prevent Flooding."
155 Canadian Council of Insurance Regulators, "Climate Change, Natural Catastrophes and Consumer Awareness."

Residential earthquake coverage illustrates the challenge of appropriately communicating provided coverage and coverage options. The highest concentration of Canadian homeowners that purchase earthquake insurance protection is found in the Victoria and Vancouver area, a region that also has very high house prices. Earthquake deductibles are much higher, often more than 100-fold higher than deductibles on the basic policy. Very few homeowners have made an earthquake damage claim, but many have made or know a friend, relative, or acquaintance that has made a claim against their basic coverage. It is difficult to communicate the additional risk assumed with earthquake deductibles, yet it is the responsibility of the insurance industry to do so. This challenge extends to caps, limits, and other conditions found in coverage for water damage, wildfire, severe wind, hail, and other perils. Communicating overland flood coverage options is complicated by material differences between insurance companies in the products offered, use of different flood models and maps, and 50 years of disaster financial assistance provided by governments.

Public awareness is low concerning provincial disaster financial assistance.[156] Those without insurance may learn after a loss if financial assistance is available from the provincial government. The provincial programs are complex. With the important exception of high-risk flood damage, the programs are designed to ensure that homeowners, small businesses, farmers, and not-for-profit organizations seldom if ever qualify for provincial assistance. Some of the perils typically excluded from provincial assistance are direct damage from basement flooding, wildfires, tornadoes, hurricanes, hail, winter storms, and lightning. Large businesses are always excluded, even for flood damage. Private insurance is seen as available and affordable, so provincial assistance is not offered. The vast majority of provincial assistance that is available is paid out to rebuild damaged municipal and provincial infrastructure and to respond when a hazard strikes.[157]

Provincial governments are responsible for explaining provincial disaster financial assistance to the public. An important role for the insurance industry deals with flood. Almost 10 million Canadian homeowners purchased private flood insurance in 2024. These are homes with low or moderate risk, so private insurance is offered. Private flood insurance is not available or very expensive for several million homes located at high- or extreme-risk areas.[158] High-risk homes typically qualify for provincial assistance because private insurance is not available or is viewed by provincial governments as being unaffordable. Insurance brokers, agents, and insurers need to participate in the conversation about what financial protection is available from private insurers and provincial assistance for flooding. This conversation is challenging because of (1) large differences in residential flood insurance coverage between insurance companies, (2) large differences in provincial disaster assistance by province and sometimes between floods in the same province, (3) changes in the federal Disaster Financial Assistance Arrangements that will result in significant reform in most provincial disaster financial assistance programs over the next few years, and (4) ongoing discussion about establishing a high-risk residential flood insurance program.[159]

## Implications for the insurance industry

The increased frequency and severity of catastrophe claims events has naturally been accompanied by growing regulatory interest. Thirty years ago, the insurance industry invited prudential supervision of industry practices. A result has been greater industry,

156 *Laval News*, "Financial Assistance for Disaster Victims of Tropical Storm Debby."
157 McClearn, "Canada's Disaster Aid System Is Overwhelmed."
158 Government of Canada, "Adapting to Rising Flood Risk."
159 DiSabatino, "Brokers, Insurers Differ on the Value of Numerous Flood Products for Home Owners."

regulatory, and public confidence in financial preparedness. It is encouraging that concern about industry capacity to pay claims almost never arises after a catastrophic loss event in Canada. A federal backstop is important to complete the protection for a large earthquake or fire in Montreal or Vancouver. Much progress is evident over the past 30 years for severe weather and most earthquake risk to reduce concern about insolvency risk—progress that has been achieved through industry and regulatory collaboration.

There is a growing concern about the rising cost and affordability of insurance. In the United States concerns also include availability and the consequences of underinsurance, which may eventually come to some Canadian markets. Market conduct regulators are presenting findings that show many and perhaps most policyholders do not know what losses are covered by insurance. It is welcome that the Insurance Bureau and Insurance Brokers Association are working with market conduct regulators to address this and other issues.

# Six critical questions

## What is the insurance promise and resilience solution?

*Over the longer term, reducing and preventing losses is the best mechanism to ensure adequate catastrophe financing. Lower risk of loss is good for asset owners, insurance companies, and society – a win-win-win outcome.*

Much higher damages over the last 40 years from floods, wildfires, and severe storms has been accompanied by challenges for the insurance industry. In particular, some question the promise of insurance to restore Canadians that experience a loss. This report focuses on catastrophe financing. Some other issues include insurance affordability, availability, operational capacity to respond, communicating change in coverage and risk, working with disaster response agencies, debris removal, and use of settlements. It is encouraging that capacity to pay has not been an issue. Through many events over many years, insurance companies have consistently demonstrated their financial health and capacity to pay catastrophe claims.

Over the longer term, reducing and preventing losses is the best mechanism to ensure adequate catastrophe financing. Lower risk of loss is good for asset owners, insurance companies, and society—a win-win-win outcome. There are several factors driving the risk of loss higher, but these can be overcome by investments in proven and known protective measures. Presently, most homes, businesses, and infrastructure are not adequately protected for climate extremes and earthquakes. The need to transition to a future where appropriate investments have been made in resilience so that most Canadian structures are prepared for the risk of loss and damage from extreme hazards is clear. This transition will take time, certainly longer than the 10-year time frame addressed in this report.

Over the past decade, insurance companies and several industry-supported organizations have begun actively pressing for resilience actions. In 2021, the Insurance Bureau created Climate Proof Canada, a coalition to champion building disaster resilience. In 2015, the Intact Centre on Climate Adaptation was formed to promote adaptation to climate change. In 2015, Partners for Action was established to reduce the risk of flood damage. The Institute for Catastrophic Loss Reduction has been operating since 1997, and in 2021 it redirected its focus from academic research to the promotion of resilience solutions based on science. The Insurance Bureau, Insurance Brokers Association of Canada, Canadian Alliance of Direct Relationship Insurers, Canadian Association of Mutual Insurers, and many provincial industry organizations are also advocating for action by government. Industry efforts have focused on awareness, regulations, and financial incentives.

### The promise of insurance

Trust is a foundation for any successful business. This is very evident in property insurance. Policyholders pay a premium to secure a promise that they will be provided with support to recover if they experience a covered loss.[160] The promise of insurance is different than the relationship customers have with most other businesses.[161] Typically, a service or good is provided when a price is paid. Some products are consumed quickly, like a morning coffee, and a satisfied customer may come back the next day. Durable products, like a vehicle, will be used over many years. But insurance is a promise. Over a 12-month period, most policyholders do not experience a loss and will not make a claim. Indeed, policyholders pay for coverage yet hope to never need it. Some, however, may experience a total loss and submit a claim many-fold greater than the premium paid. The premium is paid for a promise of support for an unknown outcome, based on the trust

160 Calabrese, "Insurance—A Promise Made and Kept."
161 Kochenburger, "Claim Optimization and the Insurance Promise."

of customers in their insurer.[162] Trust would be lost for any who are not confident in the capacity of their insurer to pay.[163]

The risk of loss from a catastrophe has become a growing consideration in the decision to purchase insurance for a home or business as well as the choice of provider. Catastrophe financing is the mechanism to ensure that financially healthy insurance companies have adequate funds to pay all claims that may arise from catastrophic events. The record of the Canadian insurance industry is excellent. Policyholders, the public, regulators, shareholders, and others have not questioned the insurance industry's capacity to pay.

## A global perspective

Each January, the World Economic Forum releases its Global Risk Report,[164] and 2025 will be the twentieth edition. Business, political, and academic leaders assess and rank 30 leading global risks. In 2024, the highest-ranked risk in the world over the next 10 years was extreme weather. The forum described extreme weather as "Loss of human life, damage to ecosystems, destruction of property and/or financial loss due to extreme weather events. Inclusive of land-based (e.g. wildfire), water-based (e.g. floods), and atmospheric and temperature-related (e.g. heat waves), including those exacerbated by climate change."

Global conversations about the most important issues that must be addressed over the next 10 years include immigration, climate change, the cost of living, military conflicts, and other issues. Presently, these all rank behind the urgent global need to address the top risk—the impact of extreme weather.

In Canada, catastrophe insurance claims have increased significantly, which is also true around the world. Canadian claims remain very small relative to global insurance catastrophe claims. In particular, loss and damage in the United States is much higher than in Canada, both in absolute terms and relative to the population. Canada has experienced 10 insurance catastrophes, while more than 500 events in the United States since 1980 have been identified with losses in excess of $1 billion.[165] A single event, Hurricane Katrina, resulted in damage many-fold greater than all the losses in Canadian history combined. Catastrophe challenges in Canada are significant, but not as difficult as those in the United States. Accordingly, the Canadian insurance market remains attractive to reinsurance companies and cat bond investors working to diversify their global exposure.

## The resilience solution

For many years in the United States and since 1973 in Canada, higher catastrophe claims paid by insurance companies have resulted in higher premiums, higher deductibles, sublimits, exclusions, and withdrawal of capacity in zones of high risk. There is a growing concern about affordability, availability, and underinsurance expressed by the public, media, regulators, elected officials, and others. This is evident today in British Columbia, Quebec, and Ontario for earthquake coverage. Looking ahead 10 years or more, and the risk is that these issues will grow in importance for severe weather coverage.

Aggressive investment in resilience is the solution to this challenge. Appropriately protected assets will not trigger claims, or the risk of damage will be meaningfully reduced. A home that is resilient may qualify for a lower premium and broader coverage. We know what is required to break the 40-year trend of rising insurance claims.

The insurance industry is ramping up its efforts to champion investments by Canadians

162 Accenture, "Satisfaction with Insurance Claims Settlements Not Enough to Keep Customers Loyal. "
163 Leadbetter, Kovacs, & Harries, "Guaranteeing Public Confidence."
164 World Economic Forum, "The Global Risks Report 2024."
165 National Centers for Environmental Information, "Billion-Dollar Weather and Climate Disasters."

in disaster resilience, protection, climate preparedness, hazard mitigation, adaptation to climate extremes, and loss reduction. Many terms are used to describe this shared goal. We will not stop extreme rain from falling, fires from burning, severe storms from forming, or the ground from shaking violently. Nevertheless, the insurance industry can promote a culture of seismic and climate preparedness, where Canadians expect to return to their homes and businesses after the hazard passes, confident that most will experience little or no damage. This would be a future where comprehensive financial protection from insurers remains available and affordable.

A Canadian resilience success story is the Red River Floodway. Since the floodway opened in 1968, the Government of Manitoba estimates that more than $53 billion ($40 billion in 2011 dollars) in flood damage has been prevented.[166] Phase one, to protect Winnipeg from a 1-in-100-year flood, cost $65 million. Phase two, to expand to 1-in-700-year protection, cost $665 million. Clearly, this example demonstrates that investments in resilience solutions deliver significant savings.

A large share of the catastrophe damage to homes, businesses, and infrastructure in Canada could have been reduced or prevented if Canadians had invested in resilience.[167] Unfortunately, most existing structures do not have appropriate protection. Moreover, new construction does not include many proven resilience measures, and buildings may be located in zones that are known to be at high risk.

The Mitigation Saves program in the United States and the Institute for Catastrophic Loss Reduction Resilience Solutions program for Canada finds that investments in resilience are cost effective. For example, each additional dollar spent on resilience by homeowners or builders results in $5–$10 or more in avoided future damage.[168,169,170,171,172,173] Some projects, like the Red River Floodway, generated much larger benefits. However, benefits and costs are often not aligned to encourage action. Loss prevention investments by homeowners and builders result in savings for governments, insurers, lenders, and future homeowners. Homeowners and builders question the benefit they themselves secure relative to the cost, knowing that they expect to move in a few years or transfer the home to a buyer in a few months. There are no benefits to share with governments and insurers if asset owners are not provided with sufficient incentives to result in investments in protection.

Canadian insurance industry efforts to champion preparedness for seismic and climate extremes began almost 30 years ago. In 1997, the Institute for Catastrophic Loss Reduction was established at Western University to study and assess resilience solutions to address the perils that result in the majority of catastrophe insurance claims: basement flooding, wildfire, hail, severe wind, and earthquakes.[174] Research includes new construction, renovation of existing buildings, and public infrastructure. This includes research in the laboratory, review of international findings, and field studies. An expert consensus has been established and is continuously updated as new findings emerge. Findings are being integrated into insurance practices, municipal government programs, provincial building codes, and construction standards published by the National Research Council, the Standards Council of Canada,

166 Government of Manitoba, "Flood Fighting in Manitoba."
167 ICLR, "On-Site Damage Assessment Finds Much of the Destruction from the Angus Tornado Could Have Been Prevented."
168 National Institute of Building Sciences, "National Hazard Mitigation Saves: 2019 Report."
169 ICLR, "An Impact Analysis for Mitigating Wildland-Urban Interface Fires."
170 Porter, "A Benefit-Cost Analysis of Impact-Resistant Asphalt Shingle Roofing."
171 Porter, "High-Wind Design of New Wood Frame Houses Has an Average Benefit-Cost Ratio of 6:1 in Canada."
172 Ibid.
173 Standards Council of Canada, "Affordable Solutions Proven to Significantly Reduce Wind Damage to Canadian Homes."
174 ICLR, "The First 25."

the Canadian Standards Association, and others.[175,176,177]

Homes with a backwater valve, sump pump, and landscaping that directs rainwater away from the building are less likely to experience basement flooding.[178] Structures with a fire-resistant roof and siding and nothing combustible within 1.5 metres surrounding the home are less likely to ignite by hot embers and be destroyed in a wildfire.[179] Structures with a class 4 impact-resilient roof and without vinyl siding are less likely to experience hail damage.[180] Buildings with a premium roof and hurricane ties or truss screws to connect the roof truss, supporting walls, and foundation are less likely to experience damage from severe wind.[181] Solutions that were unproven or unknown 30 years ago are now known.

Recent insurance industry leadership in Canada is focused on actions to implement loss reduction solutions. For example, the Insurance Bureau is pressing for a national flood insurance program offering financial protection for those at high and extreme risk. The developing public/private collaboration will adapt practices in place in other countries and include actions to reduce the risk of flood damage. Flood Re, the flood insurance support program in the United Kingdom for private insurers, has been designed to cease operations in 2039 because flood risk reduction actions will eliminate the need for subsidized flood coverage as high-risk structures are protected.[182] The program includes a payment of £10,000 to homeowners that build back better after a claim.[183] Similarly, the National Flood Insurance Program in the United States includes incentives for local governments and homeowners to reduce the risk of flood damage.[184,185]

Established in 2021, Climate Proof Canada is a broad coalition of insurance industry representatives, municipal governments, Indigenous organizations, environmental non-governmental organizations, and research groups.[186] With leadership from the Insurance Bureau, the coalition is encouraging the federal government to create a culture of preparedness and build a more disaster-resilient country. Coalition members were actively involved in the development of Canada's National Adaptation Strategy. The coalition continues to press the federal government to establish climate protection goals supported by adequately funded risk reduction programs.

The Institute for Catastrophic Loss Reduction and the Intact Centre on Climate Adaptation have been working independently with municipal governments to promote resilience to basement flooding, wildfire, and other hazards. Dozens of communities provide financial incentives to homeowners that invest in basement flooding protection. A growing number of communities provide incentives for wildfire protection. Some insurers and some brokers have become active in promoting municipal incentives to policyholders.

The award-winning Calgary resilient roofing rebate program is an example of the insurance industry working to encourage a community to establish, and then successfully implement, a resilience incentive program.[187,188] Following the 2020 hailstorm in Calgary, the city

175 Bénichou et al., "National Guide for Wildland-Urban-Interface Fires."
176 Canadian Standards Association, "CSA Group's Basement Flood Prevention Guideline Helps Canadians Adapt to a Changing Climate."
177 Stevenson, Kopp, & El Ansary, "Prescriptive Design Standards for Resilience of Canadian Housing in High Winds."
178 ICLR, "Protect Your Home from Basement Flooding."
179 ICLR, "Protect Your Home from Wildfire."
180 ICLR, "Protect Your Home from Hail."
181 ICLR, "Protect Your Home from Severe Wind."
182 Flood Re, "Flood Re Is Helping Insurers to Help Householders at Risk of Flooding."
183 Flood Re, "Build Back Better."
184 Federal Emergency Management Agency, "Eligible Mitigation Measures."
185 National Flood Insurance Program, "Rebuilding Safer and Stronger after a Flood."
186 Climate Proof Canada, "Protecting Canadians."
187 Toy, "City of Calgary Nationally Recognized for Resilient Roofing Rebate Program."
188 City of Calgary, "Resilient Roofing Rebate Program."

worked with the Institute for Catastrophic Loss Reduction, the Insurance Bureau, insurance companies, and brokers to design and implement an incentive program. Over 1,000 homeowners (1,382) used the $3,000 rebate to upgrade to an impact-resilient roof when completing repairs.[189] An additional 1,574 homeowners were on the waiting list when the program was closed because the full budget had been allocated.

In 2015, Intact Financial established the Intact Centre on Climate Adaptation at the University of Waterloo.[190] The centre created and championed the Home Flood Protection Program, a residential flood risk reduction educational program.[191] Also, the centre's Climate-Ready Infographics provide adaptation advice for home heat protection, apartment and condo heat protection, home flood protection, commercial real estate flood resilience, FireSmart homes, wildfire-ready communities, nature-based solutions for homes, and integrating extreme weather risks in institutional investing.[192]

In 2022, the Institute for Catastrophic Loss Reduction established a Climate Resilience Centre at Western University.[193] The centre includes hands-on displays to showcase climate protection best practices for home builders and homeowners. The program expanded in 2024 to include a Climate Resilience Centre in Winnipeg, plans for a centre in Toronto, and capacity for roadshows. Roadshows in 2024 were held in Toronto, Ottawa, Saskatoon, and Cambridge.[194]

Established in 2024, the Resilient Homes Task Force is a partnership between the Institute for Catastrophic Loss Reduction and the Canadian Homebuilders' Association to champion construction of climate-resilient homes.[195] The program includes pilot studies to refine estimates of the cost of adding climate resilience, development of technical guidance documents to support implementation by builders, and market studies measuring the value of resilience for home buyers and support for joint efforts to best communicate the benefits of resilience to homeowners.[196]

In 2013, Co-operators and Farm Mutual Re established the Partners for Action program at the University of Waterloo to promote awareness of flood risk and preparedness actions.[197] The program included research on preparedness, a risk awareness portal, community engagement, policy development, and resilience planning. Research team members have been providing advice for the development of a high-risk flood insurance program.

Following the 2016 wildfire in Fort McMurray, the Institute for Catastrophic Loss Reduction established the Resilience in Recovery program to partner with insurers and communities seeking to build back better following a major loss. This began with the Insurers Rebuild Stronger Homes program to work with participating insurers seeking to build resilience measures into product design and claims response for policyholders that experienced a covered loss.[198,199,200] It grew

189 MacVicar, "Calgary City Council Votes to End Resilient Roofing Program."
190 Intact, "Intact Announces $2.3 Million Commitment to Help Canadians Adapt to Climate Change."
191 Intact Centre on Climate Adaption, "Home Flood Protection Program."
192 Intact Centre on Climate Adaption, "Climate-Ready Infographics."
193 ICLR, "ICLR Climate Resilience Centre."
194 Gangcuangco, "Wawanesa-Backed ICLR Climate Resilience Centre Opens."
195 Canadian Home Builders Association, "Resilient Homes Canada Project."
196 Contant, "ICLR and Homebuilders' Association Team Up for Resilient Home Construction."
197 University of Waterloo, "Advancing Flood Resiliency in Canadian Communities."
198 ICLR, "Institute for Catastrophic Loss Reduction Releases 'Build Back Better' Guidelines for Fort McMurray."
199 Bora Insurance Brokers, "Wawanesa Stronger Homes."
200 Co-operators, "Co-Operators Reinforces Its Commitment to Community Resilience with New Property Insurance Coverage."

into support programs for Calgary, Barrie, Lytton, and Jasper in recovery from major losses in those communities.[201] The program will expand in 2025 with a national centre of excellence for recovery established jointly by the Institute and Public Safety Canada.

Industry action is beginning to influence government programs. Development of a national flood insurance program is expected to include commitments to invest in flood damage reduction. The Government of Canada recently modernized the Disaster Financial Assistance Arrangements program to support increased spending on risk reduction and building back better in recovery. The government is confident that a modest increase in spending after a loss over the next few years will result in a much larger reduction in future costs.

Several governments in Canada have introduced incentives or regulations to promote resilience in new construction and retrofits of existing buildings. Municipal governments are presently leading the way. In 1979, 45 years ago, Winnipeg was the first community in Canada to pass a bylaw to require a backwater valve in all new homes.[202] This is one of 120 case studies of successful municipal initiatives published by the Institute for Catastrophic Loss Reduction in its series Cities *Adapt—Celebrating Local Leadership*.[203] Many communities across the country now require basement flood protection or wildfire protection for new construction in zones of higher risk. Several dozen communities have enacted bylaws or provide financial incentives to property owners or builders that install basement flood protection, wildfire protection, severe wind protection, or hail protection.

Investments in seismic protection would reduce the expected damage from strong shaking and fire. Florida is appropriately proud that it successfully responded to Hurricane Andrew by establishing the best wind protection building codes in the world.[204] Research consistently finds much reduced damage to structures built after the codes were introduced compared to the significant damage experienced by older buildings that have not been retrofitted.[205] Large-scale investment in seismic protection should be part of a comprehensive program to manage seismic risk in British Columbia, Quebec, and eastern Ontario. But this requires significant funds and considerable time. For example, British Columbia has spent $1.9 billion, and committed an additional $1 billion, to retrofit schools across the province.[206]

## Implications for the insurance industry in Canada

Insurance is a promise. Before the 1980s, there was no effort by the insurance industry in Canada to measure catastrophe claims because they accounted for such a small share of claims paid. That has changed. Customers are increasingly judging the industry, insurance companies, and insurance brokers through a lens that includes their views about managing risk of loss from flooding, wildfires, severe storms, and earthquakes. The industry must ensure confidence in the capacity to pay claims. The industry must actively address a range of other issues that include affordability and availability.

Since the Fort McMurray wildfire in 2016, the insurance members of the Institute for Catastrophic Loss Reduction's Insurers Rebuild Stronger Homes implementation working group have been examining the purpose of property insurance. The historic focus on indemnification was designed to address concern about the risk of loss from an urban fire. The objective had been to rebuild to pre-loss conditions. However, rebuilding

201 ICLR, "Resilience in Recovery Program."
202 Ibid.
203 ICLR, *Cities Adapt.*
204 Kaste, "Tougher Building Codes Contribute to Florida Mitigating Damage from Latest Hurricanes."
205 Burns & Wilcox, "Featured Solutions."
206 Government of British Columbia, "Seismic Mitigation Program."

a home destroyed by flood or wildfire, or damaged by wind and hail, to pre-loss conditions will reintroduce the demonstrated risk of loss. Insurance companies are finding that they can redesign the claims process to add resilience measures and reduce expected future losses.[207] A small increase in the cost of resolving a claim significantly reduces the future risk of loss.

Moreover, pricing and coverage terms of some insurance companies have also begun to reward policyholders that invest in proven protective actions.[208,209,210] A natural next step may be increased integration of public and private incentives. The Government of Canada, for example, introduced a $10,000 incentive for homeowners in Lytton to add wildfire resilience during reconstruction, with the intention to build this into the process insurers used to support policyholder recovery. Brokers and insurers can be more active in promoting awareness of the risk of loss and share knowledge about proven risk reduction solutions.

Progress will involve collaboration. Municipal governments began working on these issues many years ago. Modernization of the federal Disaster Financial Assistance Arrangements established a foundation for increased action by provincial governments. Creation of the National Adaptation Strategy is a foundation to better advance federal, provincial, and local action. A national flood insurance program will include flood mitigation. The insurance industry's efforts to address fire prevention, road safety, and auto theft involved collaboration with governments and other stakeholders, a partnership approach that is also required to achieve aggressive increases in risk reduction investments.

Bold insurance industry action to champion investment in proven resilience measures is critical to helping Canadians cope with the expected increase in the frequency and severity of extreme climate hazards.

## Recommendations for the insurance industry

Insurance and reinsurance are essential to make modern society possible. Earthquakes, hurricanes, severe storms, flooding, wildfires, and other hazards have the potential to present risks beyond the great fires of the past. Catastrophe financing is an essential risk management responsibility for the insurance industry to ensure that Canadian policyholders are confident in the capacity of insurers to pay claims.

The insurance industry initially built its reputation in Canada on the successful provision of fire insurance. Fire coverage is comprehensive, and insurance is the mechanism to support a full recovery for those experiencing loss or damage. In recent decades auto insurance came to the forefront in defining how the insurance industry serves Canadians in their time of need. Catastrophe risk management will likely replace fire insurance and auto insurance over the next 10 or 20 years as the defining role of insurance in Canada.

207 Co-operators, "What's Covered under Home Insurance?"
208 Wawanesa, "Climate Adaptability Coverages."
209 Intact, "We're Launching a New Service to Better Protect Customers' Homes from Wildfires in Alberta and British Columbia."
210 Contant, "Desjardins' Weather Alerts: Sign of a Preventative Insurance Model?"

Here are four recommendations for the Canadian insurance industry with respect to catastrophe financing:

1. **Over the next 10 years, senior management in most insurance companies should spend more time addressing the growing importance and complexity of catastrophe financing and the broader implications for the company.** Annual catastrophe claims paid by the industry in Canada 15 or 20 years ago were about $1 billion a year. Catastrophe claims over the next 10 years are expected to be much higher. More claims result in more capital at risk and require more reinsurance coverage. An appropriate reinsurance program may become more difficult to design and perhaps even to secure. Some years there will be rate increases that are discovered after annual budgets have been completed. Unanticipated increases in reinsurance costs may have consequences across the company, like concern about rate adequacy, while higher retentions increase earnings volatility.
2. **If needed, the insurance industry must be prepared to take action if the availability or affordability of reinsurance is threatened.** The Canadian insurance market has been attractive to global reinsurers. Affordable reinsurance capacity has been available to meet the needs of the Canadian insurance industry at a cost that has been attractive to insurers and reinsurers. Industry pricing and coverage commitments have created an expectation that affordable reinsurance will remain available. Nevertheless, the insurance industry should be prepared to act if concerns arise about the availability and cost of reinsurance, as this would represent a threat to the industry. Availability of coverage from some reinsurers was significantly curtailed during World War II. Canada and several other markets considered regulations to require reinsurers to significantly increase the capital retained in each market, contrary to the design and purpose of global risk sharing. Inappropriate design of public reinsurance has the potential to displace current providers. Further consolidation may reduce the capacity of insurers to diversify their risk.

3. **There are limits in the financial capacity of the insurance industry to respond to a very large catastrophe, so it is important to formalize the role of the government to provide a liquidity backstop to address this systemic risk.** The insurance industry has demonstrated its financial capacity to respond to large hazards. It is unlikely at any point in time—yet inevitable over the longer term—that circumstances will arise with the potential to overwhelm the financial capacity of the insurance industry. A known risk involves a very large earthquake in Montreal or Vancouver. The industry has acknowledged the risk and presented a solution. The need is to secure a commitment from the federal government to provide a liquidity backstop if required.
4. **Significant investment in seismic and climate resilience is a core strategy for the insurance industry to manage catastrophe financing over the longer term.** First, those who benefit from asset owner investments in loss reduction—governments, insurers, asset owners, lenders, and others—must work together to develop coordinated financial incentives that are effective in securing increased resilience investments by homeowners, businesses, and infrastructure owners. If bold actions are not taken, current trends could lead to a crisis of insurance affordability and availability. Second, the insurance industry must integrate seismic and climate resilience in all aspects of its work—redesigning coverage to add resilience when responding to claims, communicating with policyholders to share resilience knowledge and proven protection practices, and pricing coverage to appropriately reward those who are resilient. Most Canadians remain at risk. Industry efforts to promote resilience have not been sufficient. Larger gains require partnership. Municipal governments have been the first to take action. Ultimately, the resilience solution to the catastrophe financing challenge will involve significant investments in preparedness by homeowners, businesses, and builders empowered by awareness, directed by regulations, and encouraged by financial incentives.

# Bibliography

Accenture. "Satisfaction with Insurance Claims Settlements Not Enough to Keep Customers Loyal, According to Accenture's Global Insurance Customer Survey." https://newsroom.accenture.com/news/2014/satisfaction-with-insurance-claims-settlements-not-enough-to-keep-customers-loyal-according-to-accentures-global-insurance-customer-survey

Acera Insurance. "Alberta Home Insurance Rate Increase FAQ." https://acera.ca/alberta-home-insurance-rate-increase-faq/

AIR Worldwide. "Study of Impact and the Insurance and Economic Cost of a Major Earthquake in British Columbia and Ontario/Québec." Insurance Bureau of Canada. https://a-us.storyblok.com/f/1003207/x/230e3d3d4f/ibc-eq-study-full.pdf

Artemis. "Fort McMurray Reinsurance & Retrocession Price Rises Filter Through: MSA." https://www.artemis.bm/news/fort-mcmurray-reinsurance-retrocession-price-rises-filter-through-msa/

Artemis. "Legacy of Hurricane Katrina—Reinsurance Capacity Bubble." https://www.artemis.bm/news/legacy-of-hurricane-katrina-reinsurance-capacity-bubble-moodys/

Axxima. "Ultimate Guide to Treaty Reinsurance." https://www.axxima.ca/blog/treaty-reinsurance-what-it-is-and-how-it-works/

Bénichou, N., Adelzadeh, M., Singh, J., Gomaa, I., Elsagan, N., Kinateder, M., Ma, C., Gaur, A., Bwalya, A., & Sultan, M. "National Guide for Wildland-Urban-Interface Fires: Guidance on Hazard and Exposure Assessment, Property Protection, Community Resilience and Emergency Planning to Minimize the Impact of Wildland-Urban Interface Fires." National Research Council Canada. https://nrc-publications.canada.ca/eng/view/ft/?id=3a0b337f-f980-418f-8ad8-6045d1abc3b3

Bernstein, J. "What's a Derecho and Why Is It so Destructive? The Science behind This Powerful Storm." CBC News. https://www.cbc.ca/news/science/derecho-causes-havoc-in-canada-1.6464409

Bora Insurance Brokers. "Wawanesa Stronger Homes—Home Insurance Coverage." https://borainsurance.com/wawanesa-stronger-homes-home-insurance-coverage/

Burns & Wilcox. "Featured Solutions: Residential Property." https://www.burnsandwilcox.com/insights/post-hurricane-assessments-reveal-importance-of-florida-building-code-updates/

Business Insurance. "Lasting Effects of Hurricane Andrew." https://www.businessinsurance.com/catastrophe-modeling-in-the-wake-of-hurricane-andrew/

Cambell, Alister. "The Price of Protection: Benchmarking Canada's Property & Casualty Industry Against its Global Peers." C.D. Howe Institute. https://www.cdhowe.org/sites/default/files/attachments/**research**_papers/mixed/Commentary_601.pdf

Cambell, Alister. "The High Price of Prudence: Benchmarking Canada's Property & Casualty Industry Against its Global Peers." C.D. Howe Institute. https://www.cdhowe.org/public-policy-research/high-price-prudence-benchmarking-canadas-property-and-casualty-industry

Calabrese, D. "Insurance—A Promise Made and Kept." *Cleaner Times*. https://www.cleanertimes.com/insurance-a-promise-made-and-kept/

Cambridge Dictionary. "Catastrophe." https://dictionary.cambridge.org/dictionary/english/catastrophe

Canadian Climate Institute. "FACT SHEET: Climate Change and Flooding." https://climateinstitute.ca/news/fact-sheet-climate-change-and-flooding/

Canadian Council of Insurance Regulators. "Climate Change, Natural Catastrophes and Consumer Awareness." https://www.ccir-ccrra.org/Documents/View/3910

Canadian Council of Insurance Regulators. "Natural Catastrophes and Personal Property Insurance." https://www.canadianunderwriter.ca/insurance/osfi-softens-stance-in-new-reinsurance-guidelines-1004217525/

Canadian Encyclopedia. "Halifax Explosion (Plain Language Summary)." https://www.thecanadianencyclopedia.ca/en/article/halifax-explosion-plain-language-summary

Canadian Home Builders Association. "Resilient Homes Canada Project: ICLR and CHBA Collaborate to Advance Resilient Home Construction." https://www.chba.ca/2024/06/04/resilient-homes-canada-project-iclr-and-chba-collaborate-to-advance-resilient-home-construction/

Canadian Mortgages Inc. "Flood Reinsurance: Wading into the Deep End." https://thecmigroup.ca/press-room/flood-reinsurance-wading-into-the-deep-end/

Canadian Standards Association. "CSA Group's Basement Flood Prevention Guideline Helps Canadians Adapt to a Changing Climate." https://www.csagroup.org/article/csa-groups-basement-flood-prevention-guideline-helps-canadians-adapt-changing-climate/?srsltid=AfmBOorPdBJE_4K95WIbn7SDj2s1lqlEHrpGVndafrDgIsRAerxYkihH

*Canadian Underwriter*. "Impact of Fort McMurray Wildfire Softened by Reinsurance Risk Sharing: DBRS." https://www.canadianunderwriter.ca/catastrophes/impact-fort-mcmurray-wildfire-softened-reinsurance-risk-sharing-dbrs-1004112417/

*Canadian Underwriter*. "Insurers Should Ensure Consumers Are 'Better Able to Understand' Home Insurance Policies: CCIR." https://www.canadianunderwriter.ca/insurance/insurers-ensure-consumers-better-able-understand-home-insurance-policies-ccir-1004118899/

*Canadian Underwriter*. "OSFI and Insurers Working on Updating Canadian Earthquake Guidelines." https://www.canadianunderwriter.ca/insurance/osfi-and-insurers-working-on-updating-canadian-earthquake-guidelines-1000386043/

*Canadian Underwriter*. "OSFI Release Final Earthquake Exposure Guideline." https://www.canadianunderwriter.ca/features/cc-osfi-release-final-earthquake-exposure-guideline/

CanInfra. "Estimates of Canada's Infrastructure Deficit Vary Widely." https://www.caninfra.ca/insights-6

Cassels. "OSFI Releases Draft Guideline B-3: Sound Reinsurance Practices and Procedures." https://cassels.com/insights/osfi-releases-draft-guideline-b-3-sound-reinsurance-practices-and-procedures/

CatIQ. "Canada's Loss and Exposure Indices Provider." https://public.catiq.com

City of Calgary. "Resilient Roofing Rebate Program." https://www.calgary.ca/council/ward-14/articles/resilient-roofing-rebate-program.html

Clark, K. "The Evolution of Catastrophe Modeling Since Hurricane Andrew." *Insurance Journal*. https://www.insurancejournal.com/magazines/mag-features/2022/05/16/667461.htm

Climate Proof Canada. "Protecting Canadians." https://www.climateproof.ca

Co-operators. "Co-Operators Reinforces Its Commitment to Community Resilience with New Property Insurance Coverage." https://newsreleases.cooperators.ca/2024-06-10-CO-OPERATORS-REINFORCES-ITS-COMMITMENT-TO-COMMUNITY-RESILIENCE-WITH-NEW-PROPERTY-INSURANCE-COVERAGE

Co-operators. "What's Covered under Home Insurance?" https://www.cooperators.ca/en/insurance/home/home-insurance-basics/what-is-covered

Conservation Ontario. "Building Resilient Watersheds to Prevent Flooding." https://conservationontario.ca/policy-priorities/flood-management/conservation-authority-flood-management

Contant, J. "2017 Cat Bond Issuance Reaches Record Levels." *Canadian Underwriter*. https://www.canadianunderwriter.ca/insurance/2017-cat-bond-issuance-reaches-record-levels-1004125797/

Contant, J. "Desjardins' Weather Alerts: Sign of a Preventative Insurance Model?" *Canadian Underwriter*. https://www.canadianunderwriter.ca/insurance/desjardins-weather-alerts-sign-preventative-insurance-model-1004128871/

Contant, J. "ICLR and Homebuilders' Association Team Up for Resilient Home Construction." *Canadian Underwriter*. https://www.canadianunderwriter.ca/construction/iclr-and-homebuilders-association-team-up-for-resilient-home-construction-1004247076/

Contant, J. "Is It Time for a New Reinsurer to Enter the Market?" *Canadian Underwriter*. https://www.canadianunderwriter.ca/reinsurance/is-it-time-for-a-new-reinsurer-to-enter-the-market-1004239381/

Contant, J. "Reinsurance Reset." *Canadian Underwriter*. https://www.canadianunderwriter.ca/features/reinsurance-reset/

Cooley, P. "Home Insurance Was Once a 'Must.' Now More Homeowners Are Going Without." *Washington Post*. https://www.washingtonpost.com/business/2024/05/27/home-insurance-dropped-coverage/

Delalleau, Patrick. "The History of Reinsurance—Patrick's Masterclass." CCR Re. https://info.ccr-re.com/history-of-reinsurance

DiSabatino, A. "Brokers, Insurers Differ on the Value of Numerous Flood Products for Home Owners." *Canadian Underwriter*. https://www.canadianunderwriter.ca/brokers/brokers-insurers-differ-on-benefit-of-competition-in-flood-mapping-1004235396/

Emergency Management BC. "Provincial Earthquake Immediate Response Strategy." https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/plans/peirs.pdf?utm_source=north%20shore%20news&utm_campaign=north%20shore%20news%3A%20outbound&utm_medium=referral

Federal Emergency Management Agency. "Eligible Mitigation Measures." https://www.fema.gov/pdf/plan/floodplain/fema301_section5.pdf

Federal Emergency Management Agency. "Guide for All-Hazard Emergency Operations Planning." https://www.fema.gov/pdf/plan/slg101.pdf

Federal Insurance Office, "The Breadth and Scope of the Global Reinsurance Market and the Critical Role Such Market Plays in Supporting Insurance in the United States." U.S. Department of the Treasury. https://home.treasury.gov/system/files/311/FIO%20-Reinsurance%20Report.pdf

FireSmart. "FireSmart." https://firesmartcanada.ca

Fletcher, T. "Premier Says Logan Lake Wildfire Prevention a Model for B.C." *Williams Lake Tribune*. https://www.wltribune.com/news/premier-says-logan-lake-wildfire-prevention-a-model-for-b-c-5535541

Flood Re. "Build Back Better." https://www.floodre.co.uk/buildbackbetter/

Flood Re. "Flood Re Is Helping Insurers to Help Householders at Risk of Flooding." https://www.floodre.co.uk/about-us/

Fraser Basin Council. "Lower Mainland Flood Management Strategy Initiative." https://www.fraserbasin.bc.ca/water_flood.html

French, J. "Alberta Finance Minister Instructed to Address Rising Auto, Home Insurance Costs." *CBC News*. https://www.cbc.ca/news/canada/edmonton/alberta-finance-minister-instructed-to-address-rising-auto-home-insurance-costs-1.6906556

Gallagher Re. "Reinsurance Market Report." https://www.ajg.com/gallagherre/-/media/files/gallagher/gallagherre/news-and-insights/2024/september/gallagherre-reinsurance-market-report-half-year-2024.pdf

Gambrill, D. "$30-Billion Sticker Shock for OSFI's Proposed Reinsurance Rules." *Canadian Underwriter*. https://www.canadianunderwriter.ca/reinsurance/30-billion-sticker-shock-for-osfis-proposed-reinsurance-rules-1004168784/

Gambrill, D. "How Record-High Cat Season Will Impact Reinsurance Renewals." *Canadian Underwriter*. https://www.canadianunderwriter.ca/brokers/how-record-high-cat-season-will-impact-reinsurance-renewals-1004251111/

Gambrill, D. "OSFI Softens Stance in New Reinsurance Guidelines." *Canadian Underwriter*. https://www.canadianunderwriter.ca/insurance/osfi-softens-stance-in-new-reinsurance-guidelines-1004217525/

Gambrill, D. "What to Expect of the Reinsurance Renewal Season in 2025." *Canadian Underwriter*. https://www.canadianunderwriter.ca/catastrophes/impact-fort-mcmurray-wildfire-softened-reinsurance-risk-sharing-dbrs-1004112417/

Gambrill, D. "Would a Cat Bond Work for Major Flooding? ILS Expert Weighs In." *Canadian Underwriter*. https://www.canadianunderwriter.ca/catastrophes/would-a-cat-bond-work-for-major-flooding-ils-expert-weighs-in-1004248568/

Gangcuangco, T. "Wawanesa-Backed ICLR Climate Resilience Centre Opens." Insurance Business. https://www.insurancebusinessmag.com/ca/news/environmental/wawanesabacked-iclr-climate-resilience-centre-opens-513015.aspx

Goda, K., F. Wenzel, & J. Daniell. "Insurance and Reinsurance Models for Earthquake." *In Encyclopedia of Earthquake Engineering*, 1–24. New York: Springer, 2014.

Goda, K., Wilhelm, K., & Ren, J. "Relationships between Earthquake Insurance Take-Up Rates and Seismic Risk Indicators for Canadian Households." *Science Direct*. https://www.sciencedirect.com/science/article/abs/pii/S2212420920312565

Government of British Columbia. "Seismic Mitigation Program." https://www2.gov.bc.ca/gov/content/education-training/k-12/administration/capital/seismic-mitigation

Government of Canada. "Adapting to Rising Flood Risk." https://www.publicsafety.gc.ca/cnt/rsrcs/pblctns/dptng-rsng-fld-rsk-2022/dptng-rsng-fld-rsk-2022-en.pdf

Government of Canada. "Canada's Changing Climate Report 2019." https://changingclimate.ca/site/assets/uploads/sites/2/2020/06/CCCR_FULLREPORT-EN-FINAL.pdf

Government of Manitoba. "Flood Fighting in Manitoba." https://www.gov.mb.ca/asset_library/en/spring_outlook/flood_fighting_2013.pdf

Guy Carpenter. "Facultative or Treaty and Why the Need for Hybrid Solutions: Part I." https://www.guycarp.com/insights/2019/04/facultative-or-treaty-and-why-the-need-for-hybrid-solutions-part-i.html

Holland, D. "A Brief History of Reinsurance." Society of Actuaries. https://www.soa.org/globalassets/assets/library/newsletters/reinsurance-section-news/2009/february/rsn-2009-iss65-holland.pdf

Holland, D. "Reinsurance: A Brief History." https://www.theactuary.com/archive/old-articles/part-3/2012/09/21/reinsurance-brief-history

Holzheu, T., & Lechner, R. "Economic Insights: Surge in Catastrophe Bond Issuance Stablises Transfer of Mounting Peak Risks." Swiss Re Institute. https://www.segurostv.es/data/informes/2023-12-sri-economics-insights-catastrophe-bond-issuance.pdf

Institute for Catastrophic Loss Reduction. "An Impact Analysis for Mitigating Wildland-Urban Interface Fires—Overview." https://www.iclr.org/wp-content/uploads/2021/05/WUI-NRC-Summary_2021_E2.pdf

Institute for Catastrophic Loss Reduction. *Cities Adapt.* https://www.iclr.org/citiesadapt/

Institute for Catastrophic Loss Reduction. "The First 25." https://www.iclr.org/wp-content/uploads/2022/11/ICLR_25th-Anniversary-2.pdf

Institute for Catastrophic Loss Reduction. "Fort McMurray Wildfire: Learning from Canada's Costliest Disaster." https://www.iclr.org/wp-content/uploads/2019/10/Fort-McMurray-Wildfires_Canadian-Copright.FINAL-2_One-Page.pdf

Institute for Catastrophic Loss Reduction. "HailSmart." https://www.hail-smart.com

Institute for Catastrophic Loss Reduction. "On-Site Damage Assessment Finds Much of the Destruction from the Angus Tornado Could Have Been Prevented." https://www.newswire.ca/news-releases/iclr-on-site-damage-assessment-finds-much-of-the-destruction-from-the-angus-tornado-could-have-been-prevented-514492411.html

Institute for Catastrophic Loss Reduction. "ICLR Climate Resilience Centre." https://www.iclr.org/wp-content/uploads/2023/11/ICLR-Climate-Resilience-Centre_Nov-2023.pdf

Institute for Catastrophic Loss Reduction. "Institute for Catastrophic Loss Reduction Releases 'Build Back Better' Guidelines for Fort McMurray." Canadian News Wire. https://www.newswire.ca/news-releases/institute-for-catastrophic-loss-reduction-releases-build-back-better-guidelines-for-fort-mcmurray-579795261.html

Institute for Catastrophic Loss Reduction. "Protect Your Home from Basement Flooding." https://www.iclr.org/wp-content/uploads/PDFS/protect-your-home-from-basement-flooding.pdf

Institute for Catastrophic Loss Reduction. "Protect Your Home from Hail." https://www.iclr.org/wp-content/uploads/2018/02/ICLR_Hail_2018.pdf

Institute for Catastrophic Loss Reduction. "Protect Your Home from Severe Wind." https://www.iclr.org/wp-content/uploads/PDFS/ICLR_Severe-wind_2018.pdf

Institute for Catastrophic Loss Reduction. "Protect Your Home from Wildfire." https://www.iclr.org/wp-content/uploads/PDFS/protect-your-home-from-wildfire.pdf

Institute for Catastrophic Loss Reduction. "Resilience in Recovery Program." https://www.iclr.org/resilience-in-recovery-program/

Insurance Bureau of Canada. “Earthquakes.” https://bac-quebec.qc.ca/en/insurance-issues/earthquakes/

Insurance Bureau of Canada. “Glossary.” https://www.ibc.ca/insurance-basics/glossary

Insurance Bureau of Canada. “Section 1: Canada’s P&C Insurance Industry, All Sectors.” https://a-us.storyblok.com/f/1003207/x/5117e554ef/ibc-2023-facts-section-one.pdf

Insurance Bureau of Canada. “Summer 2024 Shatters Records for Severe Weather Damage: Over $7 Billion in Insured Losses from Floods, Fires and Hailstorms.” https://www.ibc.ca/news-insights/news/summer-2024-shatters-records-for-severe-weather-damage-over-7-billion-in-insured-losses-from-floods-fires-and-hailstorms

Insurance Information Institute. “Background on Reinsurance.” https://www.iii.org/article/background-on-reinsurance

Insurance Information Institute. “The San Francisco Earthquake of 1906: An Insurance Perspective.” https://www.iii.org/article/san-francisco-earthquake-1906-insurance-perspective

Insurance Institute. “Feds Commit $15 Million to Flood Insurance Backstop. Is It Enough?” https://www.**insuranceinstitute.ca**/en/Insights-And-Publications/CanadianUnderwriterArticles/items/2024/04/18/Feds-commit-15-million-to-flood-insurance-backstop-Is-it-enough

Intact. “Intact Announces $2.3 Million Commitment to Help Canadians Adapt to Climate Change.” https://www.intactfc.com/press-releases/1/intact-announces-dollar-23-million-commitment-to-help-canadians-adapt-to-climate-change

Intact. “We’re Launching a New Service to Better Protect Customers’ Homes from Wildfires in Alberta and British Columbia.” https://www.intactfc.com/stories/wds

Intact Centre on Climate Adaption. “Climate-Ready Infographics.” https://www.intactcentreclimateadaptation.ca/climate-ready-infographics/

Intact Centre on Climate Adaption. “Home Flood Protection Program.” https://www.intactcentreclimateadaptation.ca/programs/home_flood_protect/

Intergovernmental Panel for Climate Change. *Climate Change 2021: The Physical Science Basis.* https://www.ipcc.ch/report/ar6/wg1/resources/climate-change-in-data/

JTL Re. “Catastrophe Models: In the Eye of the Storm.” https://content.naic.org/sites/default/files/inline-files/cipr_topic_catastrophe_models_JLTRe.pdf

Kaste, M. “Tougher Building Codes Contribute to Florida Mitigating Damage from Latest Hurricanes.” National Public Radio. https://www.npr.org/2024/10/15/nx-s1-5151844/tougher-building-codes-contribute-to-florida-mitigating-damage-from-latest-hurricanes

Kelly, G. “How Big Is Too Big?” PACICC. https://www.pacicc.ca/wp-content/uploads/WIF_The-Tipping-Point-2021-EN-2.pdf

Kelly, G., & Peng, Z. “When, Where and How Often Insurers Fail.” PACICC. https://www.pacicc.ca/wp-content/uploads/When-Where-and-How-Often-Insurers-Fail-Introducing-the-Global-Failed-Insurer-Catalogue-2023.pdf

Kelly, G., Peng, Z., & Campbell, I. “When It Rains … It Pours.” PACICC. https://www.pacicc.ca/wp-content/uploads/WIF-2024-Analyzing-Failure-Clusters.pdf

Kochenburger, P. "Claim Optimization and the Insurance Promise." University of Connecticut School of Law. https://content.naic.org/sites/default/files/national_meeting/Claim%20Optimization%20and%20the%20Insurance%20Promise%20-%20Peter%20Kochenburger%20-%20D%20Committee%20August%2016%202021.pdf

Kopf, E. "Notes on the Origin and Development of Reinsurance." https://www.casact.org/sites/default/files/database/proceed_proceed29_29022.pdf

Kovacs, P. "Ice Storms Lessons Learnt." *Canadian Underwriter*, February 1, 1999. https://www.canadianunderwriter.ca/features/ice-storm-lessons-learnt/

Kovacs, P., & Sandink, D. "Best Practices for Reducing the Risk of Future Damage to Homes from Riverine and Urban Flooding." ICLR, September 2013. https://www.iclr.org/wp-content/uploads/PDFS/best-practices-for-reducing-the-risk-of-future-damage-to-homes-from-riverine-and-urban-flooding.pdf

*Laval News*. "Financial Assistance for Disaster Victims of Tropical Storm Debby." https://lavalnews.ca/financial-assistance-for-disaster-victims-of-tropical-storm-debby/

Leadbetter, D., Kovacs, P., & Harries, J. "Guaranteeing Public Confidence." *Canadian Underwriter*. https://www.canadianunderwriter.ca/features/guaranteeing-public-confidence/

Le Pan, N. "Fault Lines: Earthquakes, Insurance, and Systemic Financial Risk." C.D. Howe Institute. https://a-us.storyblok.com/f/1003207/x/9df23d18f2/cdhowe-institute-fault-lines.pdf

MacVicar, A. "Calgary City Council Votes to End Resilient Roofing Program." *Global News*. https://globalnews.ca/news/8825584/calgary-city-council-resilient-roofing-program/

Madge, C., & Smith, R. "Hurricanes and Climate Change in Atlantic Canada." Climate Data. https://climatedata.ca/hurricanes-and-climate-change-in-atlantic-canada/

Mahdavi, D. "Why Winter Storms Are Becoming Bigger and Badder around the Great Lakes—And What It Means for Those at Risk." *CBC News*. https://www.cbc.ca/news/canada/hamilton/lake-effect-climate-change-ontario-1.6712232

Maldeniya, N., Brady, E., Da Costa, R., Felicio, M., Goodman, G., LaPalme, L., & Reeve, B. "OSFI Shakes Up Earthquake Exposure Sound Practices." Mondaq. https://www.mondaq.com/canada/insurance-laws-and-products/223670/osfi-shakes-up-earthquake-exposure-sound-practices

Mallarino, A. "The Difference in Price of Home with a Finished Basement vs. Homes without a Finished Basement." In Black & White Real Estate Team. https://www.inbw.ca/b/blog/the-difference-in-price-of-homes-with-a-finished-basement-vs-homes-without-a-finished-basement.html

Marsh. "Catastrophe Modeling: Why All the Fuss?" https://www.marsh.com/pr/en/services/property-risk-management/insights/catastrophe-modeling.html

McChristian, L. "Hurricane Andrew and Insurance: The Enduring Impact of an Historic Storm." Insurance Information Institute. https://www.iii.org/sites/default/files/paper_HurricaneAndrew_final.pdf

McClearn, M. "Canada's Disaster Aid System Is Overwhelmed, Leaving Victims to Rebuild on Their Own." *Globe and Mail*. https://www.theglobeandmail.com/canada/article-natural-disaster-relief-payments/

McIntyre, J., & M. Desormeaux. "Canada's Earthquake Risk: Macroeconomic Impacts and Systemic Financial Risk." The Conference Board of Canada. https://www.conferenceboard.ca/wp-content/uploads/woocommerce_uploads/reports/8349_EarthquakeRisk-RPT.pdf

Mohleji, S., & Pielke, R. "Reconciliation of Trends in Global and Regional Economic Losses from Weather Events: 1980–2008." *ASCE, 15*(4). https://ascelibrary.org/doi/abs/10.1061/(ASCE)NH.1527-6996.0000141

Moorcraft, B. Modelling—An Important Tool in Canada's Natural Disaster Resiliency." Insurance Business. https://www.insurancebusinessmag.com/ca/news/catastrophe/modelling--an-important-tool-in-canadas-natural-disaster-resiliency-322503.aspx

Moody's Insurance Solutions. "Catastrophe Models and Risks." https://www.rms.com/models

Moorcraft, B. "Modelling—An Important Tool in Canada's Natural Disaster Resiliency." Insurance Business. https://www.insurancebusinessmag.com/ca/news/catastrophe/modelling--an-important-tool-in-canadas-natural-disaster-resiliency-322503.aspx

National Association of Insurance Commissioners. "Notes on the Origin and Development of Reinsurance." https://content.naic.org/insurance-topics/reinsurance

National Centers for Environmental Information. "Billion-Dollar Weather and Climate Disasters." https://www.ncei.noaa.gov/access/billions/

National Flood Insurance Program. "Rebuilding Safer and Stronger after a Flood." Federal Emergency Management Agency. https://agents.floodsmart.gov/sites/default/files/fema_nfip-rebuilding-safer-stronger-after-flood-guide-12-2022.pdf

National Institute of Building Sciences. "National Hazard Mitigation Saves: 2019 Report." https://www.nibs.org/projects/natural-hazard-mitigation-saves-2019-report

Office of the Superintendent of Financial Institutions Canada. "Climate Risk Management." https://www.osfi-bsif.gc.ca/sites/default/files/import-media/guidance/guideline/2023-04/en/b15-dft.pdf

Office of the Superintendent of Financial Institutions. "Earthquake Exposure Sound Practices." https://www.osfi-bsif.gc.ca/sites/default/files/import-media/guidance/guideline/2021-06/en/b9.pdf

Office of the Superintendent of Financial Institutions. "The Importance of Managing Risk." https://publications.gc.ca/collections/collection_2010/bsif-osfi/IN1-2010-eng.pdf

Pande, M. "The State of the Reinsurance Property Catastrophe Market." Swiss Re. https://www.swissre.com/risk-knowledge/mitigating-climate-risk/state-of-reinsurance-property-cat-market.html

Perry, R. W. "What Is a Disaster?" *In Handbook of Disaster Research,* edited by H. Rodriguez, E. L. Quarantelli, and R. R. Dynes, 1–15. New York: Springer, 2007.

Perry, R. W., and E. L. Quarantelli. *What Is a Disaster? New Answers to Old Questions.* Bloomington, IN: Xlibris, 2005.

Pielke, R., Jr. "Misdefining 'Climate Change': Consequences for Science and Action." *Science Direct.* https://www.uvic.ca/**research**/centres/globalstudies/assets/docs/publications/RPielke.pdf

Pielke, R., Jr., & Sarewitz, D. "Bringing Society Back into the Climate Debate." Colorado University. https://sciencepolicy.colorado.edu/admin/publication_files/resource-1688-2005.25.pdf

Porado, P. "What's Keeping Reinsurance Renewals Steady?" *Canadian Underwriter*. https://www.canadianunderwriter.ca/reinsurance/whats-keeping-reinsurance-renewals-steady-1004235495/

Porter, K. "A Benefit-Cost Analysis of Impact-Resistant Asphalt Shingle Roofing." ICLR. https://www.hail-smart.com/wp-content/uploads/2022/05/Benefit-cost-analysis-of-Impact-resistant-asphalt-shingle-roofing2.pdf

Porter, K. "High-Wind Design of New Wood Frame Houses Has an Average Benefit-Cost Ratio of 6:1 in Canada." ICLR. https://www.iclr.org/wp-content/uploads/2024/01/ICLR-Study-High-Wind-Design-has-a-Benefit-Cost-Ratio-of-6-to-1-in-Canada-Part-A-Dec-2023.pdf

Property and Casualty Compensation Corporation. "About Us." https://www.pacicc.ca/who-we-are/about-us/

Property and Casualty Compensation Corporation. "Past Insolvencies." https://www.pacicc.ca/what-we-do/past-insolvencies/

Qualman, D. "Home Grown: 67 Years of US and Canadian House Size Data." https://www.darrinqualman.com/house-size/

Sanders, D. "When the Wind Blows: An Introduction to Catastrophe Excess of Loss Reinsurance." https://www.axxima.ca/blog/treaty-reinsurance-what-it-is-and-how-it-works/

Sansone, M. "Remembering Hurricane Andrew's Lessons, 30 Years Later." https://axaxl.com/fast-fast-forward/articles/remembering-hurricane-andrews-lessons-30-years-later

Sitole, D. "Basics of Facultative Reinsurance." Munich Re. https://www.munichre.com/content/dam/munichre/contentlounge/website-pieces/documents/Basics-of-Facultative-Reinsurance-Daphne-Sitole.pdf/_jcr_content/renditions/original./Basics-of-Facultative-Reinsurance-Daphne-Sitole.pdf

Solá, A. "Home Prices Rose 2.4 Times Faster Than Inflation since 1960s, Study Finds. What That Means for Homebuyers." https://www.cnbc.com/2024/03/19/why-home-prices-have-risen-faster-than-inflation-since-the-1960s.html

Standards Council of Canada. "Affordable Solutions Proven to Significantly Reduce Wind Damage to Canadian Homes." https://scc-ccn.ca/resources/news/affordable-solutions-proven-significantly-reduce-wind-damage-canadian-homes

Statistics Canada. "Archived: Population Estimates, July 1, by Census Metropolitan Area and Census Agglomeration, 2016 Boundaries, Inactive." https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710013501

Statistics Canada. "Canada's Population Clock (Real-Time Model)." https://www150.statcan.gc.ca/n1/pub/71-607-x/71-607-x2018005-eng.htm

Statistics Canada. "Population by Census Metropolitan Area, 1971, 1991, 2001 and 2011." https://www150.statcan.gc.ca/n1/pub/16-201-x/2016000/c-g/c-g02-1-eng.htm

Statistics Canada. "Population Estimates, July 1, by Census Metropolitan Area and Census Agglomeration, 2021 Boundaries." https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710014801

Stevenson, S., Kopp, G., & El Ansary, A. "Prescriptive Design Standards for Resilience of Canadian Housing in High Winds." *Frontiers*. https://www.frontiersin.org/journals/built-environment/articles/10.3389/fbuil.2020.00099/full

Strasser, S. "In Wake of Another Devastating Hailstorm, Should the City Revive Its Resilient Roofing Program?" *Calgary Herald,* August 7, 2024. https://calgaryherald.com/news/local-news/in-wake-of-another-hailstorm-should-council-revive-rooftop-rebate-program

Swiss Re. "How Big Is the Protection Gap from Natural Catastrophes Where You Are?" https://www.swissre.com/risk-knowledge/mitigating-climate-risk/natcat-protection-gap-infographic.html#/country/Canada/open

Swiss Re. "Insurance-Linked Securities Market Insights," Edition XXXV. https://www.swissre.com/dam/jcr:bb189e59-a15f-49df-a250-07b2c6b2d9bd/2024-02-sr-ILS-market-insights-feb-2024.pdf

Toy, A. "City of Calgary Nationally Recognized for Resilient Roofing Rebate Program." *Global News.* https://globalnews.ca/news/9197595/calgary-resilient-roofing-rebate-program-national-recognition/

United Nations Office for Disaster Risk Reduction. "Sendai Framework Terminology on Disaster Risk Reduction." https://www.undrr.org/terminology/disaster

University of Waterloo. "Advancing Flood Resiliency in Canadian Communities." https://uwaterloo.ca/partners-for-action/

University of Waterloo. "Flood Risk & Homeowner Awareness." https://uwaterloo.ca/partners-for-action/past-projects/flood-risk-homeowner-awareness

Verisk. "Catastrophe Risk Modeling Solutions." https://www.verisk.com/solutions/extreme-event-risk/risk-models/

Wallis, S. "Fort McMurray Wildfire Costs to Reach Almost $9B, New Report Says." *CBC News,* January 17, 2017. https://www.cbc.ca/news/canada/edmonton/fort-mcmurray-wildfire-costs-to-reach-almost-9b-new-report-says-1.3939953

Wawanesa. "Climate Adaptability Coverages." https://www.wawanesa.com/canada/insurance/coverage/climate-adaptability-coverages

Wikipedia. "Halifax Explosion." https://en.wikipedia.org/wiki/Halifax_Explosion

World Economic Forum. "The Global Risks Report 2024." https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2024.pdf

World Weather Attribution. "Climate Change More Than Doubled the Likelihood of Extreme Fire Weather Conditions in Eastern Canada." https://www.worldweatherattribution.org/climate-change-more-than-doubled-the-likelihood-of-extreme-fire-weather-conditions-in-eastern-canada/

Zyl, S. "Earthquake's First-Step Budget." *Canadian Underwriter.* https://www.proquest.com/docview/224990467?sourcetype=Trade%20Journals

## PROFESSIONAL DESIGNATIONS

Chartered Insurance Professional (CIP)
Fellow Chartered Insurance Professional (FCIP)

## CERTIFICATE PROGRAMS

Advanced CIP (ACIP)
Acord Certified Expert
Adjusters' Training & Education Series
Associate Customer Service
Canadian Managing General Agent (CMGA)
Commercial Insurance
General Insurance Essentials (GIE)
Instructor Certification
Rehabilitation Benefits Administration
Risk Management

## INSURANCE LICENSING & CE CREDITS

Brokers & Agents
Independent Adjusters
CE OnDemand

## PROFESSIONAL DEVELOPMENT

Business/Management
Insurance/Technical
Interpersonal/Communications

## NETWORKING & CAREER DEVELOPMENT

Seminars, Symposium, Special Events Connect the Industry
Career Connections Provides Introduction to Careers in Insurance

## INDUSTRY INSIGHT & RESEARCH

Demographics of the P&C Insurance Industry in Canada
Emerging Issues Research Series
- Cyber Risks: Implications for the Insurance Industry in Canada
- Automated Vehicles: Implications for the Insurance Industry in Canada
- Sharing Economy: Implications for the Insurance Industry in Canada
- A Changing Workforce: Implications of Technological Disruption for the Insurance Industry in Canada
- Climate Risks: Implications for the Insurance Industry in Canada
- AI and Big Data: Implications for the Insurance Industry in Canada
- Managing Risk: Implications for the Insurance Industry in Canada
- Political Risk: Implications for the Insurance Industry in Canada

**The Insurance Institute of Canada**
18 King Street East, 6th Floor
Toronto, ON M5C 1C4

TOLL FREE: 1-866-362-8585
PHONE: 416-362-8586
FAX: 416-362-1126

**iicmail@insuranceinstitute.ca**

**EMPOWERING INSURANCE CAREERS**

**insuranceinstitute.ca**

Insurance Institute

CIP SOCIETY