Adaptation is resilience

Assessing physical climate risk in Canada's provinces and municipalities

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Natural disasters such as droughts, storms, floods, and wildfires are occurring more often and worsening in intensity, with steepening human and economic costs globally. Along with the United States, Canadian cities and provinces have also borne their share of North America's extreme wildfires and floods over the past few years—a trend that we believe is likely to persist.

In our view, this should be a topic of keen interest to fixed-income investors on the lookout for portfolio risks and opportunities. Consider how a city struck by a catastrophic natural disaster might then face formidable budgetary challenges from disaster-relating spending, perhaps causing its bond yield to temporarily spike in the municipal bond market. Under such a scenario, investors could benefit from having a dependable tool at their disposal to help them decide if, and to what degree, the abnormal yield (and price) volatility might present an investment hazard. Our latest research undertaking set out to develop just such a tool.

The study: what we set out to accomplish

Prior research studies have examined corporations' and financial institutions' state of readiness for natural disasters, but how well prepared are Canada's provinces and municipalities? We worked closely with our partners at Concordia University and the Emerging Risks Information Center (ERIC) to address that evermore timely question. Our joint effort produced an in-depth qualitative and quantitative analysis through which we assessed exposures to and preparedness for natural disasters across Canada. This abridged version highlights our key research findings and conclusions, including some significant data gaps we uncovered that can help inform investors' portfolio decisions and investment approaches.

Canada: in the crosshairs of climate change

The long-term phenomenon of climate change poses mounting risks worldwide, as evidenced by the rising frequency and severity of natural disasters across the globe. Canada is no exception and, indeed, has in recent years witnessed a notable uptick in the number and ferocity of such disasters. These calamities have inflicted substantial economic and noneconomic harm throughout the country, disrupting communities, compromising infrastructure systems, siphoning off government resources, weakening provincial/municipal economies, and driving up property and casualty insurance costs.

According to the Insurance Bureau of Canada, in 2024:

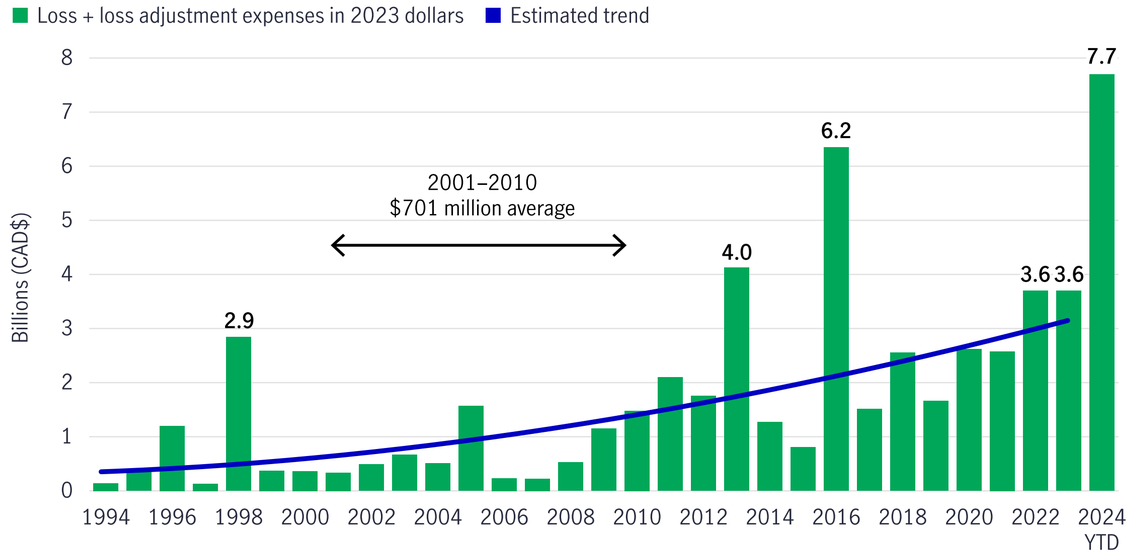
- Total damage from natural disasters in Canada reached an all-time yearly high of $8.5 billion—roughly triple the amount recorded in 2023.
- A January deep freeze across Western Canada resulted in over $180 million in insured losses, $30 million in Alberta alone.
- In July, unprecedented rainfall and flash flooding in Toronto triggered an estimated $940 million in insured damages.
- Also in July, wildfires in Alberta ravaged huge swaths of land and were responsible for an estimated $880 million in insured losses.

An analysis of these events, combined with observed longer-term trends, highlights the increasingly heavy financial toll of Canada's climate-related disasters on the insurance industry. Annual insured losses from extreme weather in Canada between 1983 and 2024 reveal year-to-year fluctuations but a steady upward trajectory over time: While property and casualty insurers paid out an average of around $700 million a year from 2001–2010, 2024 insured losses were over 10x that figure. And the financial materiality of natural disasters goes beyond property and casualty insurers. The short-term response and recovery costs

to governments, as well as many private businesses, can be staggering. Longer term, among other adverse impacts, the cumulative costs can strain government balance sheets and impede local economic growth.

It's important to recognize the scope of uninsured losses, which exceed insured losses and may be poised to soar rapidly if property and casualty insurers opt to walk away from high-risk, disaster-prone regions. By way of illustration, a rule of thumb known as the insurance gap suggests that for every $1 in insured losses incurred from natural disasters, there may be $3–$4 in uninsured and indirect damages that must be shouldered by governments, businesses, and individuals/households. For the latter cohort, the hit to their financial well-being can be crippling, but governments at all levels are often on the hook for a large portion of uninsured losses.

Insured losses due to extreme weather events in Canada (1994–2024)



Source: Insurance Bureau of Canada, CatIQ (Catastrophe Indices and Quantification Inc.), as of September 24, 2024.

An urgent need for resilience and adaptation

These stark realities underscore Canada's urgent need to build greater climate resilience at the federal, provincial, and municipal levels. Increased, targeted investment in climate adaptation—strategies aimed at adjusting to the effects of long-term climate change—could go a long way toward easing the economic burden and human suffering wrought by natural disasters in Canada.

Investing in climate adaptation may yield meaningful positive returns by preventing extensive damage and reducing the often-sizable costs of post-disaster repairs and recovery. In fact, every dollar directed toward climate adaptation can potentially save multiple dollars down the road. The benefit-to-cost ratio may be as high as 15:1 in some instances, such as certain floods and wildfires, where proactive adaptation may dramatically cut ensuing GDP losses. (See also the Investment takeaways and implications section.) A compelling argument can therefore be made for not only boosting government spending on climate adaptation infrastructure, but also for encouraging private sector investment in adaptation projects.

Historically, generous resources from both public and private sectors have been allocated to disaster relief and to climate mitigation strategies, such as lowering carbon emissions and transitioning to renewable forms of energy. By contrast, public and private investments in climate adaptation strategies remain modest relative to the estimated $5.3 billion required annually in Canada's case. We anticipate the funding shortfall to narrow over time as the economic and other advantages of climate adaptation become more apparent to governments and other stakeholders. Admittedly, adaptation may be expensive, but inertia could prove much costlier in the long run.

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Challenges: imperfect databases and research gaps

Canada is a vast country comprising a diverse range of climates and physical landscapes, as well as distinct political and economic environments. Accordingly, its provinces and municipalities exhibit differing degrees of both exposure and resilience to the natural disaster threats arising from climate change. We believe these differences must be accounted for so that governments and other stakeholders can effectively craft and tailor climate adaptation strategies. It's imperative, in our opinion, that all provinces and municipalities adopt standardized metrics for assessing natural disaster exposure and preparedness.

However, due to the flaws and limitations inherent in Canada's natural disaster databases (including a lack of consistent, standardized reporting), not all of the natural disasters that take place nationwide are reported by governments and data vendors, impairing the quality and reliability of the data. In addition, municipal and provincial reports that provide some granularity on local governments' mitigation and adaptation strategies for natural disasters vary widely in terms of reporting quality and data disclosures, making it difficult to fully assess local preparedness.

These challenges were compounded by shortcomings in the relevant body of research and literature, which to date hasn't fully explored the natural disaster risk preparedness of Canada's individual provinces and municipalities. Consequently, a clear and objective measurement rubric that can accurately reflect each locale's particular situation and circumstances does not appear to exist.

Natural disasters databases: problems for researchers and decision-makers

Problem	Examples
Differences in data collection and criteria	Definitions and thresholds, data sources
Inconsistent reporting and updating	Update frequency, lack of standardization (e.g., damages)
Variation in coverage	Geographical focus, historical gaps
Economic impact assessments	Estimation methods, currency conversion
Challenges in capturing secondary impacts	Underreporting, biases, and resource constraints

Source: Concordia University. For illustrative purposes only.

Our solution: create a natural disaster preparedness index

Our joint research endeavor with Concordia and ERIC set out to fill what we saw as a sizable data void. The chief goal of our study was to develop a solution for assessing and quantifying the natural disaster preparedness levels of Canadian provinces and municipalities compared with their own regional risk profiles. To that end, we employed a proprietary, research-driven framework and methodology:

- We identified and ranked the top three natural disaster threats faced by each province and municipality, based on both their historical frequency of occurrence and their overall economic impact on the region (as measured by total estimated monetary damages).
- We collected a variety of publicly disclosed information from governments and other sources to allow us to measure the extent to which the provinces and municipalities have taken proactive steps to minimize the future ramifications of climate-related disasters.

This process enabled us to create a composite natural disaster preparedness index derived from both quantitative and qualitative indicators. Specifically, we constructed the index from five evaluation criteria, each of which is a crucial component of natural disaster readiness: government budgets, implementation timelines, local/regional integration, action plans, and education. These criteria were selected to provide a more holistic portrait of preparedness, considering both financial commitments already made and strategic planning initiatives. The underlying data was gleaned from various types of reports disseminated through each government's website.

Evaluation criteria for purposes of the natural disaster preparedness index

Budget	Timeline	Local and regional integration	Action plan	Education
How many relevant accounts do they have?	Do they have time-oriented goals?	Do they understand the communal risk profiles?	Do they have clear initiatives and are they realistic?	Do they educate residents?
Are the amounts diluted among other nonrelevant items?	How granular is the timeline; how many years do they forecast?	Are they in touch with their communities?	Does the action plan address their risk profile?	Does the province/ municipality consult with experts?

Source: Concordia University. For illustrative purposes only.

Key findings and conclusions

Using this relative index-based approach, we graded the natural disaster preparedness levels of Canada's provinces and municipalities, assigning each of them a score on a scale of 1 to 100 (with the latter being a perfect score). A higher preparedness score signifies that the province or municipality is better equipped than its lower-scoring counterparts to withstand natural disasters and navigate the attendant risks. The top scorers among those evaluated have generally formulated detailed, well-structured action plans to defend against climate risk and have usually earmarked at least adequate financial resources toward making their communities more resilient to natural disasters.

We believe preparedness scores can be a powerful tool to help policymakers and investors alike gauge how disaster-ready different jurisdictions *really* are—and to adapt as necessary.

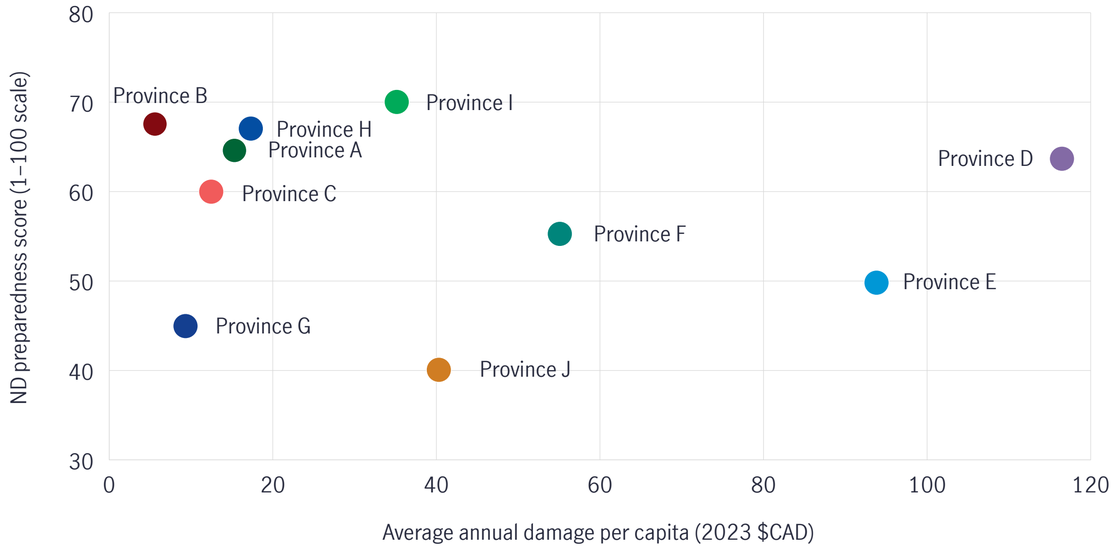
Calculated preparedness scores of Canadian provinces and municipalities

Region	Natural disasters preparedness score (%)	Level of preparedness
Municipalities		
Municipality B	100	Very high
Municipality D	80	High
Municipality C	73	High
Municipality E	55	Moderate
Municipality F	50	Moderate
Municipality A	45	Low
Provinces		
Province I	70	High
Province B	68	High
Province H	67	High
Province A	65	Moderate
Province D	64	Moderate
Province C	60	Moderate
Province F	55	Moderate
Province E	50	Moderate
Province G	45	Low
Province J	40	Low

Source: Concordia University, as of July 2024. For illustrative purposes only. Based on an analysis of publicly available data on approximately 90% of Canada's public debt market, but inclusive only of such data that was deemed to be relevant and material for purposes of this research project.

The scatter plot below depicts the output of our research on the pivotal relationship between provincial preparedness scores and average annual disaster damage per capita from 2000 to 2020. Each province is represented by a unique marker and identified with a label. The chart includes x-axis reference lines at intervals of 20 (0–120) for average annual damage per capita, and at y-axis intervals of 10 (30–80) for the preparedness scores. These benchmarks facilitate an interpretation of each province's relative standing versus other provinces in terms of its financial vulnerability and/or resilience. Among other findings, use of the scatter plot allowed us to identify provinces that are characterized by an elevated risk profile coupled with a medium or low preparedness score—a potentially worrisome combination.

Risk exposures by province: preparedness scores vs. average annual disaster damage per capita



Source: Canadian Disaster Database (CDD), Statistics Canada; reflects reported damages and population estimates for each province based on July 2024 provincial population estimates. ND refers to natural disaster.

After performing a similar exercise for Canadian cities, we found variations in disaster preparedness levels across provinces and municipalities. A pattern emerged where municipalities tended to demonstrate superior climate resilience versus provinces, with most provinces at moderate to low levels of readiness. Provinces with heightened risk profiles tend to be better prepared, but not without exception. Cities and towns are typically first in line to respond as swiftly as possible to emergencies in their own jurisdictions, which may explain municipalities' generally higher levels of preparedness. However, we would emphasize that all provinces and municipalities should prioritize the pursuit of optimal preparedness as a means of safeguarding their communities and fostering a more future-ready Canada.

Investment takeaways and implications

We believe judicious use of the natural disaster preparedness index itself can help guide investors' asset allocation, risk management, and stewardship decisions. Moreover, investors can leverage the metric as part of their due diligence, incorporating climate resilience into their credit analysis and decision-making while also requesting more transparency and accountability from provincial/municipal issuers. As investors have influenced corporate behavior and reporting standards in the past, their proactive involvement with issuers in this context could lead to improvements in data quality and accelerate progress toward enhanced climate preparedness.

Investors may also be incentivized to use the metric for purposes of their own investment analysis and risk management. With regard to investing in Canadian provincial and municipal bonds, long-term fixed-income investors can look to the preparedness index for valuable insight into which provinces and cities have advanced further down the path toward greater climate adaptation and resilience. Knowing that these provinces/cities may be well positioned to experience a substantially lower cost of capital, through the preparatory groundwork they have laid, discerning strategic allocators may choose to favor them over others as likely to offer lower-risk, more economically stable portfolio investments for the long run.

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From a tactical portfolio standpoint, our study may have salient implications for investors in Canadian provincial and municipal bond issuers. In the aftermath of a hurricane, for example, a province's or municipality's budget may be pressured by increased capital outlays in response to a natural disaster, potentially pushing its bond yield sharply higher amid elevated market concerns about credit default or downgrade risk. Along with other available tools, the natural disaster preparedness index may help the investor more easily determine how best to navigate and/or respond to this abnormal yield (and price) volatility and the investment risk it might pose.

Built into the preparedness score would be insight into matters that the investor would otherwise have to independently research and weigh in order to make a sound judgment, such as:

- Given the financial impact of the disaster, will the province or municipality be able to repay its debt on schedule?
- How likely is it that credit rating agencies would downgrade the quality of the province's/municipality's debt in light of perceived higher credit risk?
- What role might broader macro factors, like the prospect of slower economic growth and a pullback in infrastructure investment, play here?
- What effect might this event and its financial fallout have on the debt issuer's ability to affordably access investor capital going forward?

Green/sustainable bonds

We looked at green and sustainable bond issuance across Canada and discovered that the proceeds from these instruments are being funneled predominantly into climate mitigation strategies, with comparatively smaller allocations to climate adaptation. While both are mission critical, given the escalating risks associated with natural disasters, we believe some provinces and municipalities should consider revisiting their capital deployments within these financing programs. Using green/sustainable bond proceeds to fund both mitigation and adaptation projects could help slow the pace of global climate change, while simultaneously bolstering local disaster readiness levels.

A deliberate division of resources in this manner would also better align with many investors' evolving preference for more comprehensive climate solutions and stronger portfolio resilience.

Canadian provincial and municipal allocation of green/sustainable bond proceeds

Province/ municipality covered	Period (as of February 17, 2025)	Total proceeds from green/sustainable bonds (CAD$)	Total proceeds allocated to climate change adaptation projects (CAD$) from green/sustainable bonds	% of total proceeds allocated to climate change adaptation projects
Ontario, Quebec, Toronto, Vancouver, Ottawa	2014–2024	$28.39B	$0.79B	2.79%

Source: Manulife Investment Management, as of February 17, 2025.

Looking to the future: final thoughts

Against a backdrop of ever-growing natural disaster risk, proactive climate adaptation will become even more essential to protecting Canada's future, including both the physical safety and financial health of its cities and provinces. While most Canadians appear to understand the magnitude of the threat, we believe there's still work to be done in educating and spurring stakeholders to move more forcefully on that front. Robust solutions will call for collaborative, coordinated efforts among federal, provincial, and municipal authorities, together with the private sector and local advocates, to ensure long-term resilience.

For our part, our research on these pressing issues will continue. While this study focused solely on Canada, we believe the research framework within which it was conducted is broadly applicable elsewhere globally. Along with our partners at Concordia University and ERIC, we remain committed to raising awareness around the vital importance of climate adaptation.

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Potential areas of focus and opportunity going forward

- Perform additional research to gain more precise insight into the provinces' and municipalities' natural disaster exposure and preparedness levels
- Promote collaboration and coordination among government agencies, standard-setters, and third-party vendors to improve datasets available to investors
- Define and elevate the role of investors through their engagements with the provinces and municipalities—an area where we've begun making strides

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