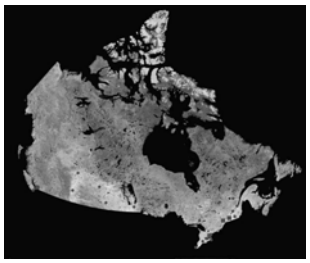
The Canadian Disaster Experience: Driving Forces

UNFCCC Workshop on Insurance and Risk Assessment in the Context of Climate Change and Extreme Weather Events

Environment Canada | Environnement Canada

Adaptation & Impacts Research

Facts about Canada



- 2nd largest country in world (9.99 M km^2)
- Northern location
- Population ~ 30 M (2001 data)
- Longest coastline in the world
- About 80% of population lives within 300 km of Canada-USA border
- About 60% of population is concentrated in largest 25 cities
- Subject to a large variety of natural hazards

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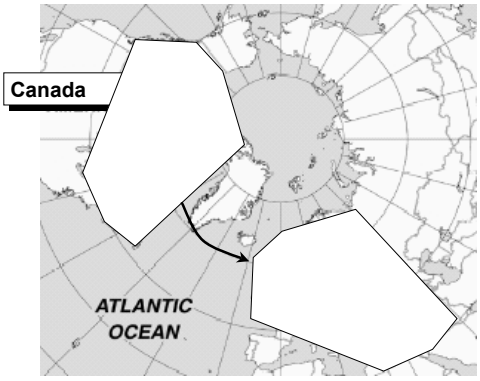

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Atmospheric Hazards in Canada

- flood
- drought
- tornadoes
- hail
- lightning
- fog
- strong winds
- heat and cold waves
- blizzards
- snow and ice storms
- hurricanes
- storm surge
- fire

Risk is very unevenly distributed throughout Canada

MOST EXPENSIVE CANADIAN NATURAL DISASTERS (TOTAL ESTIMATED ECONOMIC IMPACT)

Date of occurrence	Disaster	Location	Estimated Total Cost (billion 2000$)
1980	Drought	Prairie provinces	$5.8
1998.01.06	Freezing rain	Ontario to New Brunswick	$5.4
1988.07	Drought	Prairie provinces	$4.1
1979	Drought	Prairie provinces	$3.4
1984	Drought	Prairie provinces	$1.9
1996.07.19	Flood	Saguenay region, Québec	$1.6
1950.05.05	Flood	Winnipeg, Manitoba	$1.1
1954.10.15	Hurricane	Toronto and southern Ontario	$1.1
1931-1938	Drought	Prairie provinces	$1.0
1989	Drought	Prairie provinces	$1.0

Source: OCIPEP

Drought of 2001/2002 - $5 billion (?)

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Coping Mechanisms

- *Risk Reduction*
  - modify the hazard
  - reduce vulnerability through mitigation, preparedness, and building capacity in response and recovery
- *Risk Sharing or Transference*
  - private insurance
  - government financial disaster assistance
  - non-profit

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COSTS OF NATURAL DISASTERS TO THE INSURANCE INDUSTRY, IN EXCESS OF $100,000,000*
(Major multiple-payment Occurrences)

Note: single event accounts for 51% of top 11 insured disaster costs

Type	Date	Location	Cost (millions of 2002 dollars)
Ice Storm	Jan. 1998	Quebec / Ontario	$1818
Hail	Sept, 1991	Calgary, Alta	$ 412
Hail	Sept, 1999	Calgary, Alta	$ 386
Flood	July 1996	Saguenay, Quebec	$ 218
Tornado	July 1987	Edmonton, Alta	$ 215
Flood	July 1993	Winnipeg Man.	$ 215
Flood/Hail	July 1996	Winnipeg, Man .	$ 164
Tornado	May 1985	Barrie Ontario	$ 133
Hail	July 1996	Calgary, Alta	$ 133
Snowstorm	Jan. 1999	Southern Ontario	$ 130
Storm	May 2000	Southern Ontario	$ 107

* ranked by cost
Of this list, the January 1998 Ice Storm accounts for 51% of the total list costs of $3.6 billion. Like Table 1, it reflects the characteristic of disasters to be 'top- heavy'.
(Source: ICLR, data 1983 - Dec. 2001)

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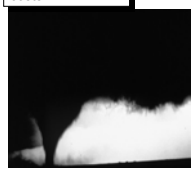
COSTS OF NATURAL DISASTERS TO THE INSURANCE INDUSTRY, BY TYPE
(Major multiple-payment occurrences)

Type of Event	No. Events	Cumulative Cost (millions 2002$)	Per cent of Total
Ice storm	1	$1,818	35%
Hail	18	$1,091	21%
Flooding	17	$758	14%
Storms	18	$506	10%
Tornado	7	$488	9%
Wind	8	$279	5%
Flood/Hail	1	$164	3%
Snowstorms	1	$130	2%
Windstorm	1	$15	0.3%
Wind/hail	1	$2	0.0%
total	**73**	**$5,253,509**	**100%**

Note: single event accounts for 35% of insured disaster costs



Cost to the Canadian insurance industry of natural disasters. Types ranked by cumulative cost. (Source: ICLR, data 1983 - Dec. 2001). Drought and residential flood costs are not included. Commercial flood costs are insurable and included.

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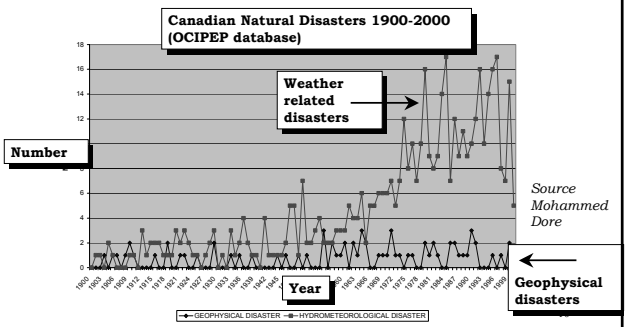
Weather vs. Geophysical



Source Mohammed Dore

Flood Compensation (1975-2000)

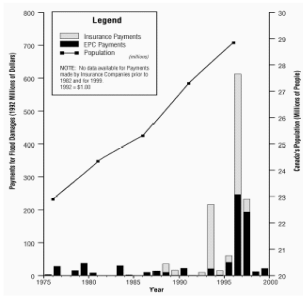


Figure 2.2 – Flood damage payments from Disaster Financial Assistance Arrangements (DFAA) and the insurance industry along with Canada's population since 1975. Costs standardized to 1999 dollars and show both federal and provincial/territorial contributions. Note that these figures do not include costs of provincial assistance to sub-DFAA threshold events (i.e., less than $1 per capita provincial population) (Shrubsole, 2000).

Why, in spite of all we know and all we continue to learn, are we apparently experiencing a continued increase in the number and costs of natural disasters?

Science assessments do not support the idea that it is because there has been an increase in the number of extreme atmospheric events.

The answer, therefore, is most likely to lie within the area of **vulnerability**.

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Vulnerability

- Vulnerability is decreasing in some ways, but increasing in others
- Few risk studies incorporate vulnerability - most are impact studies
- However, consider: (a) Winnipeg Floodway, (b) Flood Damage Reduction Program (FDPR)

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Flood Protection - The Winnipeg Floodway.
Used 22 times since 1950, with an estimated savings of around $7 (estimate) Billion CDN

1950 Red River flood at the University of Winnipeg

Floodway - example of major structural mitigation

FDRP: a program of mixed success

•Moved from funding structural flood control initiatives on an ad-hoc basis to a partnership with the provinces and local municipalities, to address the damage caused by flooding in a more sustainable way.

•Three step approach:

(1) the identification of flood hazards,

(2) mapping and designation of the flood hazard areas,

(3) the introduction of governing policies.

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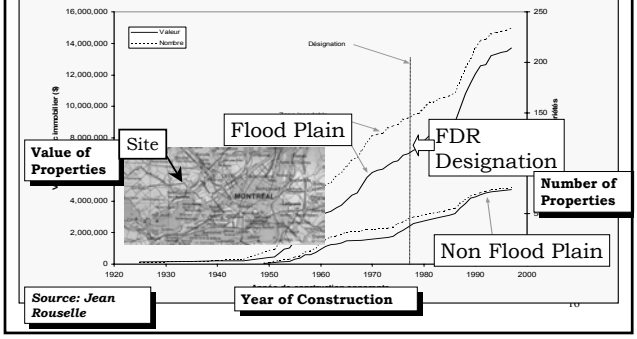
Flood Plain Development in Saint-Eustache, Quebec



Value of Properties

Number of Properties

Year of Construction

Source: Jean Rouselle

Three Underlying Themes Contributing to Vulnerability

- 'Top-heavy' impacts and biased perceptions of risk → Risky Behavior
- Environmental degradation
- Values and '*The Common Good'*.

US BILLION DOLLAR WEATHER DISASTERS (NCDC)
(http://lwf.ncdc.noaa.gov/oa/reports/billionz.html)

Hazard Type	Year	Damage (US$ billions) 1998 dollars
Drought/Heat Wave	1988	56
Drought/Heat Wave	1980	44
Hurricane Andrew	1992	32
Midwest Flooding	1993	23
Hurricane Hugo	1989	13
Southern Drought/Heat Wave	1998	9
Texas/Oklahoma/Louisiana/Mississippi Severe Weather and Flooding	1995	7
Storm /Blizzard	1993	7
Hurricane Floyd	1999	6
Hurricane Georges	1998	6
Hurricane Alicia	1983	5
Hurricane Fran September	1996	5
Southern Plains Severe Drought	1995/96	5
Northern Plains Flooding	1997	4
Florida Freeze	1983	4
Hurricane Opal	1995	3
California Flooding	1995	3
Southeast Ice Storm	1994	3
Oakland Firestorm	1991	3

Top 11% of disasters account for 60% of total costs (N=47)

*Of a list of 47 disasters, the top 5 disasters (11% by number) cost $168 billion (60% of the cost) while the bottom 42 disasters (89% by number) cost $113 billion (40% of the cost). This illustrates the characteristic of disasters, that impacts tend to be 'top-heavy'.

Hypothesis #1:

Estimates of risk for rare extreme events, both objective (often) and subjective (usually) tend to be biased.

•For many regions, the data series are relatively short compared to return periods of interest, and may not include high end extremes.

•People tend to discount rare but extreme risks, as a result of denial and avoidance.

•People put too much faith in technology (the 'levee effect')

•Economic discounting gives little value to rare events that may not occur until far into the future.

•The actual impact of events are not well represented by the statistics we tend to use to represent them.

•Probabilities rely unduly upon hindsight, due to unavoidable uncertainties in predictive ability.

Consider:

(i) Risk Homeostasis: the tendency for people to maintain a certain level of risky behavior.

(ii) Studies show that people tend to act in riskier ways, if their '*perceived level of risk*' is less than what they consider to be an '*acceptable level of risk*'.

(iii) Hypothesis #1

⇩

Hypothesis #2:

Since the risk of rare but extreme events tends to be discounted, peoples level of risk-taking behavior is disproportionate to a more realistic measure of risk.

Environmental Degradation

Such as:

- urbanization (floods, urban heat island),
- slope de-vegetation (landslides),
- climate change (flood, drought, system flip)

Hypothesis #3:

Our (ab)use of the environment without adequate stewardship, combined with population / urban growth and industrial development, leads to continued environmental degradation. This degradation has the effect of making many hazards progressively worse.

Values

The '*greatest good for the greatest number'* versus '*individual rights'*. For example, OCIPEP has noted that their DFAA program has (at times) contributed towards flood plain development. Similar statements have been made about the USA National Flood Insurance Program.

'Tragedy of the Commons' (Hardin, 1968) - "*Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all* "

Hypothesis #4:

The tragedy of the commons is being enacted on global and local scales.

Climate Change and Risks of Extreme Atmospheric Events

- Flood
- Drought
- Sea-level rise and storm surge
- Heat waves and urban air pollution

In ways that are difficult or impossible to quantify, climate change is altering the context within which risks must be assessed.

Hypothesis #5: The number and costs of natural disasters will likely increase markedly in the future as a result of climate change.

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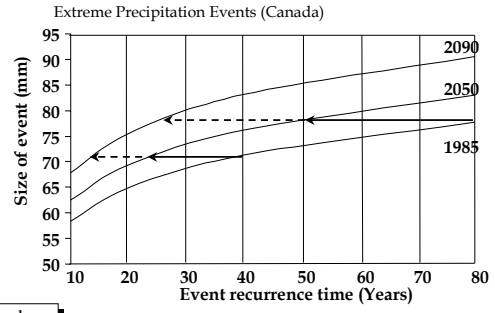
Use of climate model in multi-year scenarios (with clock fixed) can give statistics
Projected changes in extreme precipitation



Source: Gord McBean

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Questions

- How can risk sharing / transference strategies be used to increase resilience to atmospheric extremes?
- What characteristics differentiate successful from unsuccessful programs?
- To what extent does climate change matter, in terms of whether or not to develop such strategies?

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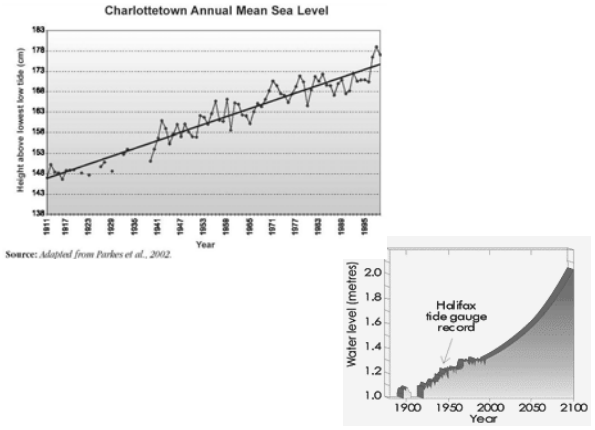
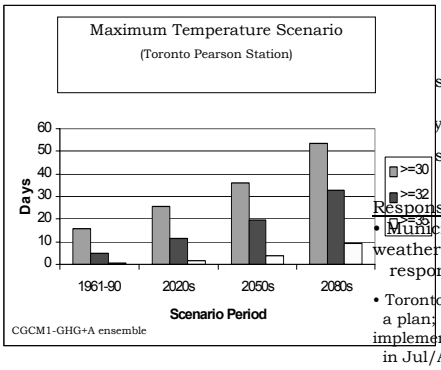
The End





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Response

- Municipal hot weather response plans
- Toronto developed such a plan; it was implemented in Jul/Aug 2001

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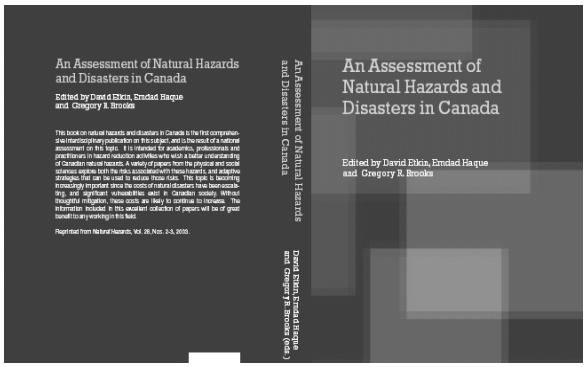

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An Assessment of Natural Hazards and Disasters in Canada

Vision

To create a society more resilient to natural disasters, where sustained planning, investment and action results in more sustainable communities.

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Key Messages

•The damage and misery caused by natural disasters can be substantially reduced through good planning and mitigation.

•The solution to disaster reduction, like society, is complex and requires long-term thinking, and an inter-disciplinary, multi-sectoral approach. Particularly, it should be noted that the causes of natural disasters are rooted in human behavior that creates vulnerable communities.

•Though Canadians have suffered significantly from natural disasters in the past, we have 'dodged the bullet' thus far, and a disaster of far greater magnitude than we have seen awaits us at some uncertain time in the future.

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•In some ways Canadian society is becoming better adapted to natural hazards, but in other ways less so. The observed trend of increasing disaster costs may well continue, particularly due to environmental degradation, urbanization and climate change.

•Investments made to mitigate the risk of natural disasters show positive benefit/cost ratios. In addition, there are many non-quantifiable benefits.

•There are important linkages between mitigating the risk of natural disasters, reducing environmental degradation and adapting to climate change. Reducing vulnerability to natural disasters can serve multiple goals, by enhancing the environment and increasing societies' capacity to adapt.

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•Exposure to hazards and community vulnerability varies widely across Canada, and there are no simple prescriptive solutions that can be universally applied. There are, however, important principles (such as sustainable development) that must be considered by all who undertake to address the natural disaster issue.

•The cornerstone of any program to reduce disaster losses should be community level hazard identification and risk & vulnerability analyses that are integrated into community planning and decision-making.

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