Natural Hazards and the Canadian Insurance Industry

Mark Baker
Administrative Services Supervisor
State Farm Insurance Companies

December 2002

ICLR Research
Paper Series – No. 25

ISBN 0-9732213-3-X

The Institute for Catastrophic Loss Reduction (ICLR) was established in 1998 with the mission to reduce the loss of life and property caused by severe weather and earthquakes through the identification and support of sustained actions to improve society's capacity to adapt to, anticipate, mitigate, withstand and recover from natural disasters.

For Further Information, please contact:
Institute for Catastrophic Loss Reduction
151 Yonge Street, Suite 1800
Toronto, Ontario, Canada M5C 2W7
Telephone: **(416) 362-6112 ext 4352**
Fax: **(416) 361-5952**
E-mail: info@iclr.org www.iclr.org

1) Introduction

Natural hazards have always been a major concern for the insurance industry. They are the primary cause of disasters that produce both human suffering and economic hardship. Both Canadian and international insurers recognize that they are vulnerable to these catastrophic events. Therefore, it is not surprising that the insurance industry are leaders in the study of natural hazards and their effects both on insurers and their clients.

Catastrophes have the possibility to have a significant adverse impact on a company or the insurance industry as a whole. Reinsurance was developed largely to protect the industry in total and deal with natural hazards. Non-catastrophic losses from natural hazards also produce large numbers of claims and are therefore of interest as they contribute to disaster loss payments by insurers.

2) Structure of Industry

To appreciate how natural hazards affect the insurance industry it is necessary to understand its structure.

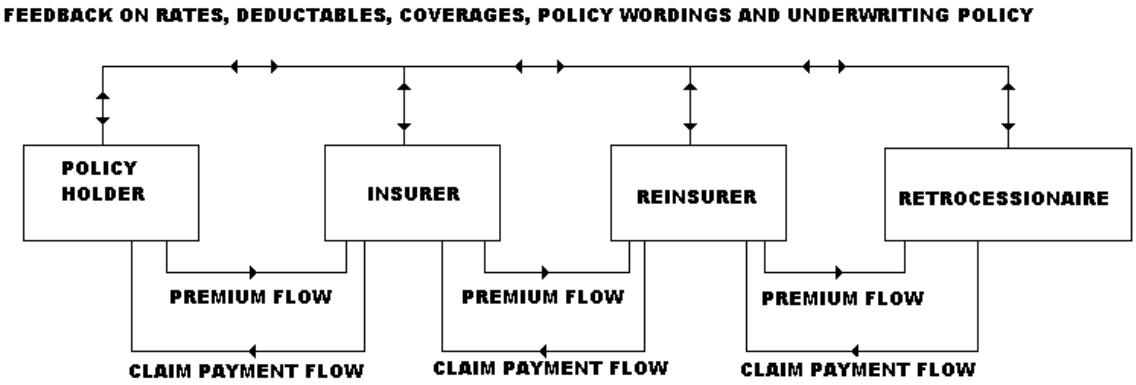
"Insurance is the method of sharing the losses of the few individuals who suffer them among the many in the group who do not"[1]. The losses of the few are paid for by the premiums of the many.

It should be noted that insurance by itself is not a risk mitigation strategy but rather a risk transfer strategy. A mitigation strategy is one that reduces risk. Insurance merely transfers risk from one party (the insured) to another party (the insurer) for a premium. That being said, the insurance industry is heavily involved in trying to stimulate mitigation, as it is in both the industry's and its client's interests to participate in the mitigation process.

The insurance industry is a diverse, decentralised sector of the economy with many players of various sizes. It is also an important part of the economy as no business can operate without it. It should also be noted that many parts of an individual person's life (e.g. driving a car), are intertwined with insurance and thus this sector touches all citizens in one way or another.

The general structure of property and casualty insurance industry can be seen in the following model.

SIMPLE MODEL OF THE PROPERTY AND CAUSALITY INSURANCE SECTOR



Source: Canada Country Study Volume VII[2]

Premiums are paid by the policy holder to the insurer. Insurers who then wish to spread the risk further beyond themselves, purchase reinsurance from a reinsurer. Reinsurers may further spread the risk by reinsuring themselves through retrocessionaires. In this way reinsurance can spread risks internationally, balancing losses across nations.

Claims are paid from the insurer to the policyholder. The insurer then claims from the reinsurer. There is no direct legal relationship between the reinsurer or retrocessionaires and the policy holder. Interaction between all parties produces feedback that influences rates, deductibles, policy wordings, coverages, underwriting and all aspects of the policy contracts involved.

3) The Canadian Insurance Industry and the World

Insurers in Canada are both Canadian and foreign owned, while reinsurers are primarily foreign held. Not only are there a large number of insurers, but also there are many different types. These can range from mutual corporations and joint stock companies, to various different types of pools. In addition, the industry has seen the entrance of banks into the insurance market [3]. There are more than 230 companies actively competing in the property and casualty insurance industry, along with about 40 reinsurers. The following table shows how decentralised the industry is. The ten largest insurers control less than 60 percent of the Canadian market.

Top 10 Company Groups, Private P&C Insurers by Net Written Premium

Company	Direct Premiums Written	% of total Business	Net Written Premium	Share of P&C Market
CGU Group Canada	2,241,081	9.22%	1,957,128	8.67%
ING Canada	2,191,782	9.01%	1,890,195	8.37%
Co-operators General Insurance	1,512,770	6.22%	1,379,024	6.11%
Royal & Sun Alliance	1,453,229	5.98%	1,342,777	5.95%
Economical Insurance Group	1,191,049	4.90%	1,101,628	4.88%
Lloyd's Underwriters	786,741	3.24%	918,196	4.07%
Groupe Desjardins	936,169	3.85%	915,284	4.05%
AXA Canada Inc.	988,805	4.07%	903,639	4.00%
State Farm Ins. Companies	886,489	3.65%	885,250	3.92%
Zurich North America Canada	1,019,799	4.19%	841,258	3.73%

Source: Canadian Underwriter May 2002[4]

The Canadian property and casualty insurance market takes in approximately $16 billion per year (approximately 2.24% of GDP)[5]. Of this, approximately $1.3 billion of this is reinsured. The surplus (net worth) is approximately $11 billion. Of the $16 billion total approximately $6.49 billion is exposed to catastrophe. (All dollar amounts are as of 1993). The industry's profitability was $800 million after taxes or 7% in 1993 [6].

The insurance industry can be looked at as a capital pool. Capital in the world today is very mobile. This mobility facilitates the spread of risk by both reinsurers and insurers world-wide. About 60 percent of the industry is foreign owned, so international views of the frequency and severity of natural hazards are very important to the Canadian industry. On a positive side this means that any costs experienced by Canada will be spread around the world. However, the Canadian insurance industry is affected not only by events within its own borders but also by events throughout the world. Canada is not perceived as being catastrophe prone from a natural hazards point of view (catastrophe being the area that the industry is specifically concerned about), especially when compared with the United States. From an absolute point of view even the flood and ice storm losses in Quebec and Ontario as well as the flood losses in Manitoba pale in comparison to those produced by Hurricane Andrew in Florida. However if one takes into account the fact that the Canadian economy is roughly 1/10 of the United States, it can be seen that from a relative point of view Canada may not be as catastrophe free it is thought to be.

4) General Effects of the Interaction between Natural Hazards, the Insurance Industry and Society.

It should be noted that the effects of natural hazards on the insurance industry are influenced by changes in the demographics and infrastructure of the areas of society that are insured, as well as changes in the industry itself. These general factors are summarized below.

a) Growth of cities - There has been substantial increase in population and size of cities over the last 20 years. In addition, populations in general have moving into catastrophe prone areas, especially those of recreation or retirement communities.

b) Insufficiency of infrastructure - Often urban growth does not include an increase in needed improvements in infrastructure. An example is inadequate increase in sewer and storm sewer capacity. This can lead to greater sewer back up claims.

c) Poor planning – Unfortunately many Canadians work and live in vulnerable areas due, for example, to construction in flood plains.

d) Inadequate or poorly enforced building codes - This is a concern as it is estimated that 25 percent of the insurance payments of Hurricane Andrew could have been prevented through better compliance with the local building code [7].

e) Post loss inflation - Unwarranted increases in costs of building materials and labour in the wake of a major catastrophe significantly add to repair costs.

f) Fraud - Unfortunately, some people will try to take advantage of an extreme event situation. For example - not repairing hail damage paid for on an auto claim and then putting in a subsequent claim after a second hail storm.

g) The susceptibility of structures to damage - The widespread use of aluminium siding in hail-prone areas is an example.

h) The increasing use of insurance payment of maintenance losses - An example would be a worn out roof that is not replaced until a storm damages it. The roof should be replaced as part of general maintenance to the building. Instead an attempt may be made to have it replaced under an insurance claim.

i) The ability of insurers to respond – Smaller insurers may not have the ability to transfer claim personnel in to a disaster site to settle claims increasing the risk of excessive claims [8].

j) The broadening of coverages available in the last 20 years - With more coverage come more claims and more payouts.

k) Climate change – The general consensus among the industry is that the frequency and severity of extreme weather events is rising, contributing to an increase in claims and costs. In Canada this might mean an increase in mid latitude cyclonic events, producing more winter storms and hail.

5) Options used by the Insurance Industry in Responding to Natural Hazards

There are many mitigation strategies open to the industry in general. These must be effective as insurance is one of society's major methods in dealing with the severe weather and therefore many of the aspects of climate change. The insurance industry is by nature practical and needs practical methods for mitigation [9].

A comprehensive list of all options open to the industry include:

a) Attempts to alter the climate itself. There is validity to this approach. Two examples are

   i) Political involvement in reducing greenhouse producing gases. This has often been suggested by major European reinsurance companies including Munich Reinsurance[10] and Swiss Reinsurance[11].

   ii) Funding weather modification activities (an example of this is cloud seeding in the prairies, which has been a successful Canadian approach)[12].

b) Attempting to Alter the Social Infrastructure

   i) Funding research into improved building materials and construction methods as well as lobbying for improved building codes. This is a popular risk management style approach for the insurance industry as it has had much experience doing this sort of activity in concert with other industries and sectors of the economy.

   ii) Limiting exposure -As this only limits the exposure of the individual insurance company, it is not really a mitigation strategy for society as a whole. It should also be noted insurers are always reluctant to limit coverage. Market withdrawal is the harshest option.

c) Limiting the numbers of policies written dollar coverage provided in a specific geographic area.

d) Reducing policy limits.

e) Increasing deductibles.

f) Changing payment terms (i.e. paying on an actual cash value basis vs. replacement cost basis).

g) Changing underwriting rules as to what risks can be accepted.

h) Market withdrawal (Never a popular option).

i) Purchase reinsurance, further spreading the risk. Reinsurance does spread risk over a larger pool of capital, but again without other strategies does not really mitigate the risk for all of society.

j) Financial mitigation

There are two direct methods of financial mitigation.

iii) Tax relief for reserves earmarked for catastrophic payment. This creates a pool of capital that protects the company's policyholders[13].

iv) Rate increases to generate further premium. (Again, this is not a method that the industry often wishes to employ).

It should be noted that the Canadian tax situation makes it difficult to set up reserves. Thus, sometimes money is transferred out of the country to allow the creation of reserves[14]. There are many mechanisms to do this, often involving the setting up of captive companies. This option is open not only to insurers but also to any company wishing to deal with a risk via a captive or a pool[15].

The pool concept is being looked at around the world, even at the international level, with groups of small nations looking to set up their own insurance pools for catastrophe[16].

Finally, there is the need for co-operation between all levels of government, the insurance industry and policyholders in all areas involving natural hazards. Not only must there be practical, sustainable attempts at mitigation, but education of all parties of the various aspects of the problem. This is a problem that affects all of society and will require all society's resources to solve.

6) The Effects of Selected Major Natural Hazards in Canada

c) Earthquake

i) The Threat

Earthquakes are one of the most destructive natural events that can occur. A single event could cause severe financial stress to much of the industry. For example a study by the

Munich Reinsurance Company of Canada examined the insurance consequences of an earthquake of the magnitude 6.5 at 123^0 W, 49^0N and 10 km in depth, below the Strait of Georgia in southwestern British Columbia. The estimated Modified Mercalli intensity of this hypothetical earthquake ranged from MM=X to MM=VII-VIII in the municipalities of Richmond and the Delta and the city of Vancouver. Insured losses were estimated at C$6.7 to C$12 billion.[17]

While the frequency of damaging earthquakes in Canada has been low, the potential severity is as great here as in any other country. It is this potential severity that concerns the industry.

Destructive earthquake potential in Canada exists in several areas: the Lower Frazer valley in BC; in Quebec along the St. Lawrence valley, especially Montreal; in the Ottawa Valley and finally in the Eastern areas of New Brunswick. The risk is not only due to ground shaking but also to fire following. In fact, the damage from fire following an earthquake may be greater than that from damage due to earth movement. Fire following is most often caused by gas line rupture.

Generally there are three fundamental questions that an insurance company's underwriters ask about earthquake.

(a) What is the probable maximum loss to individual buildings and structures in the event of a maximum probable earthquake?

(b) What is the aggregate probable maximum loss in the event of a maximum probable earthquake?

Probable maximum loss is a smaller loss than one that would occur under the most unfavorable circumstances, however it is the worst loss that will probably happen. A few losses will exceed the probable maximum loss, and a larger number will be at or near probable maximum loss, however, the majority will be less than probable maximum loss.

(c) What is the size and shape of the insured loss area in the event of the maximum probable earthquake? In short, how is the earthquake zone determined and what is its size? [18]

ii) Mitigation

(a) Proper rating is critical in dealing with the threat of earthquakes. Earthquake is not covered under basic policies. In general coverage is added by endorsement. The cost of this coverage depends upon several factors.

(i) Location - The higher the risk, the higher the cost of coverage. This means that insurance costs more, closer to an active seismic area. An endorsement in Vancouver for example, costs more than the same coverage in Toronto. In addition, the nature of the ground is taken into account. For example, international experience shows man-made landfill is very susceptible to liquefaction, a process by the structure of the ground breaks down under stress. An insurer may seek to limit its exposure in one location by only insuring a limited number of buildings in a single block or postal code. It should be noted that there is a trend toward microzonational modes that may rate according to a single block or postal code.

(ii) Building structure - Different building structures have different susceptibilities to earthquake. Knowledge of and rating according to the national and local building codes is critical to correct rating. Canada has had seismic loading provisions in the National Building Code since the first edition in 1941[19]. The Insurers' Advisory Organization has produced a set of earthquake tariffs, structural ratings, deductibles and co-insurances that help the underwriter determine which rating class a building would fall in. These ratings are similar, but somewhat simplified, from various American ratings. In addition the resistance of the building to the potential of fire is considered.

All of the above will be taking into account in actuarial based models which determine the final price insurance companies charge.

Reinsurance takes a somewhat different course on looking at earthquake as it examines an insurance companies total book of business rather than a single building. Reinsurance companies are increasingly looking to models that are more predictive than simple actuarial tables, in order to take into account changes in population, building structure and general societal changes. In short, there is some movement from a deductive to a more inductive type of model.

(b) The industry also encourages mitigation via building codes, construction practices and government policy. The Institute for Catastrophic Loss Reduction has been very active in attempting to educate and work the industry itself and with government to encourage community based mitigation. This is done through seminars, workshops and conferences [20] In addition the industry often participates in research projects designed to further the basic science and engineering knowledge of earthquake effects[21]

(c) Recommendations to government on policy have also been considered. In general Canada's insurers recommend;

- *create a culture of disaster prevention;*
- *build resilient communities; and,*
- *carry disaster prevention principles into Canada's work abroad.*[22]

In these ways in the industry seeks to help itself by helping others, as well as creating a culture of mitigation that reduces losses.

d) Hurricanes

i) The Threat

Hurricanes are also one of the most destructive threats to the insurance industry in the United States and to the insurance industry in general. Ever since Hurricane Andrew they have been one of the most discussed natural disasters. In the United States, especially Florida, they have forced major changes to the insurance market. The Florida Wind Authority, a specific company underwritten by the State Government, has taken the responsibility for hurricane damage and now underwrites much of the hurricane risk in the state. Insurance companies administer the claims themselves.

In Canada, the east coast has suffered from hurricanes from time to time. However, as the area traditionally has dealt with various severe storms, its vulnerability to hurricanes is often perceived as being limited. A hurricane is merely treated as a more dangerous version of a storm. As the buildings and the infrastructure are built to handle such events, damage potential is perceived to be limited. Research done by the Institute for Catastrophic Loss Reduction has shown this assessment to be somewhat optimistic. A severe hurricane that made landfall on the east coast would potentially cause major problems in terms of storm surge. If this happened at the time of greatest tide the damage could be considerable in terms of flooded and washed away homes. While direct damage from storm surge would not be covered for residential polices, business polices would in many cases would provide coverage. In addition, sewer backup endorsements for both commercial and residential polices would apply.

Probably the most well know and studied case of Hurricane damage in Canada was that of Hurricane Hazel, which struck Ontario in October 1954. It was the highest level of precipitation recorded in a 12-hour period anywhere in Ontario. Centered over the Humber River watershed it affected a 30,000 square kilometer area, dumped over 280 mm of rain and caused 81 deaths[23]. This hurricane did much damage in the Toronto area. Most of the damage done by Hazel resulted from flood rather than wind. Thus, under

today's policies for residential policies much of this damage would have been excluded. (It should be noted that that there are various policy provisions that state that damage by flood is covered if a home is first damaged by wind and opened to the elements). In many ways, in terms of policy provisions and losses, hurricane damage could be considered the same manner as flood damage.

It is quite possible that flood events from hurricanes similar to Hazel could still occur. Hurricane Floyd in Sept 1999 could be considered a near miss. The potential damage of such an event has been modeled in excess of C$640 million. Of that over C$400 million would be from sewer back up losses[24]. It should be noted that sewer backup is covered under present policies. Excellent floodplain management has acted to potentially reduce such losses, however, the effectiveness of this has been reduced by problems with municipal infrastructure with a lower original design capacity as well as building practices such as direct basement connections to storm and/or combined storm sewer systems. In addition there has been an increase in population density as well as the tendency of people to furnish their basements, thus putting large amounts of property at risk, especially in respect to sewer back up claims.

ii) Mitigation

Mitigation with respect to hurricanes in Ontario was established immediately after Hurricane Hazel, and involved the creation of the various conservation authorities. These acted to reduce the potential for riverine related flood damages by implementing flood plain management programs restricting development or the rebuilding of flood damaged structure in flood hazard areas. In addition, zoning was restricted. Finally, there were numerous flood control structures and dams constructed as well as public education and research.

The insurance industry mitigates several ways. Individual insurers can decide to restrict sewer back up coverage. There is also the possibility of legal action through subrogation in the case of sewer backup, when an insurer feels that local infrastructure is not adequate. Rating is generally done through standard actuarial processes based on historic experience, and is not as comprehensive in its assumptions as earthquake rating is. There is movement afoot, led by the reinsurance industry and supported by research organizations like the Institute for Catastrophic Loss Reduction, to move from actuarially-based deductive models using historic records to more predictive inductive modeling.

In general the industry has also acted to sponsor research through the Institute for Catastrophic Loss reduction that recommends the following for Ontario.

(a) Adoption of best management practices for storm water management.

(b) Similar design levels of protection throughout at risk areas

(c) Adoption of consistent technical and calculation design procedures, which should include consideration of the potential impact of climate change.

(d) Replacing combined sewers with separate sanitary and storm sewer systems.

(e) Upgrading existing drainage systems (e.g. storage systems, inlet restrictions and retrofitting with backwater valves, etc.)

(f) Eliminating weeping tile connections to storm sewers.

(g) Discharging roof leaders to the ground surface instead of to the sewer system.

(h) Increasing regular maintenance and inspection programs to avoid drainage system blockages, especially in older developments.

(i) Funding should be made available to municipalities and conservation authorities to help undertake mitigation programs such as improvement of sewer systems updates to floodplain mapping, land acquisition in flood hazard areas and updating of flood control facilities

(j) Flood and water damage losses should be assembled in a consistent format by a single agency using a single information database.

Thus it can be seen that the industry acts in its classic manner of working with government and policyholders to mitigate potential losses both the industry and its clients. Limitations of policies, such as sewer backup exclusions, are seen only as a last resort.

e) Tornadoes

i) The Threat

Tornadoes are extremely destructive events that can cause substantial damage to property and grievous loss of life. The largest tornadoes in Canada are usually on a lesser scale of destruction than the earthquakes and floods. In the US there have been exceptions to this, as the Oklahoma tornadoes in 1998 proved. However, in Canada potential tornado damage is significant but not quite on this scale. Tornadoes are, however, in the top 10 of Canadian disasters with the Barrie tornado May 1985 causing approximately C$125 million in claims and that of Edmonton in July 1987 causing approximately C201 million in damages[25].

Tornadoes in Canada are most commonly observed in the southern prairies and southern Ontario region. This is due to the population density in those areas, as well as climatology . There are concerns in the industry over erroneous information that circulates within the industry about tornadoes being unable to strike large cites due to presence of large buildings that would disrupt them. Coverage is provided to damage done by tornadoes under standard policies.

ii) Mitigation

The rating of these events is done in a standard actuarial manner with past losses being the main factor in the prediction of future losses. Thus, the location of the insured is the most significant factor. In addition, there are rating adjustments for structure. Most of these adjustments are applicable to manufactured (mobile homes) and include reductions for permanent homes, or homes on foundations and especially for tie-downs and other methods of attaching a structure to the ground.

In addition some insurers attempt to inform their clients on the dangers involved with Tornadoes by providing, free of cost, literature on methods of surviving a Tornado strike. In addition there is other such literature available on how to improve their home with respect to tornado resistance.

Finally, the industry sponsors research into structures, materials and their vulnerability to tornadoes as well as research into tornadoes themselves. It is hoped that this research will translate into more effective building codes as well as new and better use of building materials to further resist tornado damage[26].

f) Flood

i) The Threat

Flood is an interesting conundrum for the insurance industry. Many insurance professionals feel that the industry is not exposed to flood, as this peril is excluded from residential policies. The essence of the Canadian insurance industries thinking is that flood is not considered a fortuitous event. For risks on a flood plain, the question is not if there will be a flood, but when. If the risk is not on a flood plain then there is little need to purchase insurance against this event. However, it should be noted that there is significant exposure to flood as coverage is available under commercial policies, not only for property loss but also for business interruption, and there is always coverage under automobile policies. In addition in many areas there is coverage available for sewer backup, an event related to flood, either via the standard policy or an endorsement.[27] Claims made under this provision may be considerable. For example C$185 million was paid out to residents in Winnipeg as a result of damages due to sewer backups.[28]

Relief for the homeowner is provided under the auspices of the Office of Critical Infrastructure Protection and Emergency Preparedness under the Disaster Financial Assistance Arrangements program. This is a per capita cost-sharing program used to provide disaster relief between the provincial and the federal governments. These range from 0% Federal share for the first dollar, 50% for the second and third dollar, 75% for the fourth and fifth dollar and 90% above the fifth dollar.[29]

The DFAA generally defines eligible costs as those related to restoring public works to pro disaster conditions, and replacing and repairing basic or essential personal property.

Thus the industry is exposed to flood losses. The magnitude of those losses can be great. The 1996 Saguenay floods caused an insured loss of C$207 million [30], and was one of the top 10 insurance disasters in Canada. This was due in no small part to three commercial property claims totaling C$108 million.

ii) Mitigation

For business insurance as well as sewer, the industry in general statistically calculates its flood exposure in the standard actuarial manner. It has traditionally mitigated its loss by withdrawing flood coverage for sewer backup when necessary. It also mitigates its exposure by not covering flood under residential policies. Finally, the industry has been active in again promoting its Natural Disaster Reduction Plan to the federal government as well as sponsoring further research

g) Hail

i) The Threat

Hail is a high frequency event for the insurance industry. While most hailstorms are not catastrophic some can be of high severity, due to the fact that one event can damage a large number automobiles, homes and crops. As there is not usually loss of life and homes are rarely made inhabitable, as in an earthquake, the public does not generally consider hail a catastrophic event. The fact is that of all weather-related events hail is the second most costly. From the period 1984 to 1996 the industry paid out more than C$750 million. This is more than paid out for tornadoes, flooding, storm and wind and in fact is of the same magnitude as the ice storm of 1998 at $1.4 billion.[31] While individual events tend to be concentrated in the west, especially around Calgary, Alberta (the worst being in 1991 at $342.7 million), there have been catastrophic events in Montreal, Quebec in 1986 (costing C$45.4) and 1987 (costing C$24.8 million). There have also been events in Drummondville, Quebec in 1999 at C$20.5 million. [32]

ii) Mitigation

The insurance industry deals with hail risk in several ways. It rates hail risks in the standard actuarial manner, using past losses to predict the future.
It uses reinsurance to spread the risk over other companies and around the world. Neither of these methods actually mitigates the risk, it merely spreads the risk over a larger monetary pool.

However, the industry uses true mitigation as well. Firstly, many companies will offer discounts or change their rating systems for hail resistant roofing. In this case they are offering financial incentives for policyholders to improve their property. In effect they are entering into a partnership with their clients to reduce possible damage, and therefore payouts.

The insurance industry also will enter into various partnerships with other industries such as the roofing industry. In this manner it helps to promote more resistant roofing materials and reduce damage. These materials can then be promoted by the financial incentives discussed in the previous paragraph.

The final and most exciting mitigation method developed by the insurance industry is the attempt to alter the weather itself. The Insurance Industry through the Insurance Bureau of Canada has promoted Alberta Hail Suppression project[33]. In this plan the industry has funded the equipping use of several aircraft to distribute silver iodide into potential hail bearing clouds. These clouds are identified by Doppler weather radar operated by Atmospheric Environment Service of Environment Canada. There are several methods of delivering the silver iodide, either trailing a stream of the chemical via pressurized canisters or by small rockets. The theory, while admittedly scientifically unproven, is that the silver iodide will produce more condensation nuclei resulting in more but smaller hailstones. This method has been used in an attempt to protect the Calgary region.

Previous to this project Calgary was hit by several hailstorms of major severity. While it is too soon to be statistically sure at a high level of confidence, since the project there have been no major storms and the industry may have saved itself a significant amount of money at a low cost.

h) Severe Winter Weather

i) The Threat:

Severe winter weather is considered a hazard and includes the damage done by all storms during the winter season. This damage can range from that done by ice storms, flooding due to ice damming, sleet and rain creating accidents through to black ice and

poor visibility and wind damage in general. While storms can and do cause damage in the summer, it appears that during the winter the large-scale damage is at its most severe.

The most well known of these storms is the ice storm of 1998. This storm did extensive damage in Quebec and Ontario as well as the United States[34]. The damage was the greatest of any event in Canadian history, with 28 deaths, causing over 1.6 million households and businesses to lose power, incurred insurance losses in excess of $1.4 billion CDN and a total economic loss of approximately $6.4 billion CDN[35]. If one makes the assumption that, in general, the US economy is 10 times the size of the Canadian one, it can be seen that the ice storm was on the same magnitude as major hurricanes in the US. Furthermore, the nature of the damage due to power failures and direct damage due to ice came as an almost complete surprise to the industry. Thus, the large payout generated concern that the industry and Canadian society in general could be vulnerable to such a large unknown threat, especially one that most would have thought that the social infrastructure was well prepared for.

Other winter storms have done damage due to sleet and snow, as can be seen from the ice storms of Feb 1961 in Montreal , January 1968 in Ontario, March 1983 in Winnipeg, April 1984 in St. John's Newfoundland and in 1986 in Ontario/Quebec. However nothing came as close to shutting down large parts society as the 1998 ice storm did.

ii) Mitigation.

Rating of the risk is done through standard actuarial principles. In fact, the very nature of damage from severe winter storms is that is that they, in general, lend themselves to standard statistical practices. However there are exceptions, as very large storms may create anomalies due to their long return periods and therefore may not lend themselves to actuarial analysis. This would be true of the 1998 ice storm. There has been research to model future ice storm effects in this case[36].

There have been many studies as well as mitigation efforts by governmental agencies, however in terms of that done solely by the insurance industry, it must be remembered that insurers have no public policy or policing authority. They must attempt to reduce the risk by using their persuasive powers, and by educating policyholders and government. In addition they can work with various businesses associations, advocating stronger building codes and power grids, sponsor research and use their knowledge and expertise relating to loss elimination, reduction and control to help others. In dealing with severe winter weather, there is little that the industry can do totally by itself. It must adopt more of a holistic paradigm, to evaluate the risks that are present and provide an indication of potential loss frequency and severity facing citizens, businesses and governments, as well as looking at the cost and benefits involved in dealing with new materials and

technologies. The insurance industry has to be looked at as one piece of a total risk management picture, rather than the absolute and only solution.

Further research is also being done into other aspects of winter storms, especially with respect to black ice. An example would be safety research done on automobiles, black ice and other related issues[37].

i) Wildfires

i) The Threat:

At present wildfires are not a large problem in Canada to the insurance industry, either in terms of severity or frequency. In the United States, they cause more apprehension, causing concerns in California and other states from time to time. Recent wildfires in Australia have also underscored the potential concern. Thus, it is not present trends but the future that is a concern to the industry. Fire is a hazard that the industry understands well; in fact, it was the first hazard that it insured against. In the 1950's almost all payouts were for fire damage and the first fire polices were issued just after 1666 the great fire of London.[38] Thus there is a deep and wide knowledge base.

42% of Canada's 997.1 million hectares of land is forested. As the population of Canada increases, the infrastructure will move to greater degree into areas that are at risk. Fire risk will always be present, as there are both natural fires and controlled burns. It should also be noted that climate change will most likely increase fire frequency and severity.[39]

There is therefore, a real danger of an increase in both the frequency and severity of this hazard.

ii) Mitigation

The rating for fires wild or otherwise is done via standard actuarial methods. As this risk is well know, this is no surprise and these methods will probably remain the same in the near future. A major change in methodology would be considered if present methods were proven to be insufficient. .(climate change is expected to make this hazard much worse)[40]

The industry mitigates the fire hazards as in three ways.

(a) Education – In this case the insurance industry, either by itself, or with various government agencies try to educate the public and its policyholders in the dangers of wildfire and the various methods by which risk may be reduced. It

does this through pamphlets, seminars and discussions through agents and insurance brokers at point of sale.

The industry also promotes and supports research on wildfires themselves. In addition, research is done on building methods and materials that reduce risk.

The insurance sector can also promote its own industry awareness of this risk.

(b) Land Use Planning – The industry can promote wise land use planning. This would reduce or prevent the risk of building in a high-risk area. In addition it would require the construction of proper fire prevention infrastructure such as water mains or fire stations. The industry can also act as an advocate for sufficient resources for forest fire control such as water bombers, fire fighting personnel and equipment.

(c) Financial Incentives – The industry can and does offer financial incentives such as premium reductions, to its policyholders who act to reduce their own risk. Examples range from using fire resistant materials in construction to having sprinkler systems and alarms, to having a fire hydrant in close proximity to the insured property.[41]

j) Climate Change

i) The Threat

Climate change is interesting in that it is not a hazard in itself, however it may act to increase the risk of other hazards. Climate change itself is now fairly well accepted in the scientific community however, there is disagreement about when, how much and where climate change will affect other hazards. Some of the following effects have been postulated:

(a) Winter storms may increase in the frequency and severity.

(b) Flooding may become more severe and frequent.

(c) Tornadoes may become more frequent.

(d) Heat waves will probably become more common

(e) Wildfires may become more frequent and severe due to dryness.

(f) There is disagreement about Hurricanes, with some postulating that there may be an increase in severity but not frequency.

In general, the climate zones of North America may move northward and thus the climate of the populated areas of Canada may come to resemble that of the many areas of the North Central US. As these areas include zones of drought and "tornado" ally, this is not a comforting scenario.[42]

ii) Mitigation

As climate change is probably happening in the present and will continue into the future, there is little short-term mitigation that the industry can undertake that specifically deal with this, however over the long term there are options:

(a) Political involvement in reducing greenhouse producing gases. The European reinsurance companies such as Munich Reinsurance[43] and Swiss Reinsurance[44] have often suggested this.

(b) Increased education of the industry members as well as policyholders into the effects of greenhouse gases upon natural hazards and therefore upon premiums.

(c) Funding further research into the effects of climate change.

(d) Partnering with government both in education and research

(e) Increased lobbying for tax breaks for financial pooling to handle more frequent catastrophic losses.

(f) The recognition that this is a general societal issue and therefore cooperation is needed with all areas of industry, government and private citizens. There is no way for the insurance industry to "go it alone".

Climate change is one those issues that is going to affect the industry for a lengthy period. Like it or not, the industry is in for the long haul.[45]

7) The Future

In the future natural hazards will continue to produce both large numbers of claims as well as high payouts in Canada. This is to be expected, for as the population grows, larger numbers of people and increasing amounts of social infrastructure will be placed at risk. In addition, climate change may increase the frequency and severity of many of the climatic events themselves, again increasing losses.

One of the most interesting industry responses will probably be a gradual shift away from standard actuarial models. The industry has always felt that the past is the key to the future. This

is only true if conditions in future remain the same as in the past. With the many changes in society and the potential changes in climate, this will no longer hold true. Thus the industry may move to a more inductive set of models to create rates. This may be a more difficult “sell” to policyholders as the rate creation system becomes more complex and difficult to justify.

The industry will continue to become involved in research and partnerships with various building and construction industries and associations. In this way it hopes to produce tougher and longer lasting materials, mitigate its own losses and at the same time help its policyholders to better cope with their risks.

Finally, the industry will continue to partner with government policymaking and try to develop an overall mitigation policy. In this way it helps to truly mitigate risk rather than merely spread it. The policy statement of the Insurance Bureau of Canada on Natural Disasters exemplifies this:

> “In 1999, IBC launched a multi-year Natural Disaster Reduction Plan (NDRP) that will seek to improve Canada's resilience to natural disasters and ensure recognition of insurers' leadership on this file. The plan includes three key elements:
>
> **Natural disaster protection fund**
> Some large projects can be accomplished only with government funding. Over the past three years, governments have spent an average of $500 million per year on disaster response and recovery. Governments should reduce this liability by investing, on a regular basis, some proportionate amount of these funds to reduce Canada's long-term vulnerability to natural hazards. An investment of $100 to $150 million per year would make a meaningful difference over time. This could be done independently or in connection with a new national infrastructure program. The federal, provincial and municipal governments would share the creation and allocation of this fund. Canada's premiers endorsed a significant investment in Canada's infrastructure at their annual meeting in 1999.
>
> **Modified response and recovery**
> The current programs of disaster relief and recovery operated by the provincial and territorial governments, and supported by the federal government through the Disaster Financial Assistance Arrangements (DFAA), do not include any provisions for mitigation. They have as their goals to provide the essentials of life and livelihood to the victims, and to restore public infrastructure to pre-disaster condition. Public and political will to protect against the next natural disaster is strongest immediately after an event; the recovery and rebuilding often provide an opportunity to add loss-mitigation measures at relatively small incremental cost. In the U.S., disaster assistance programs also include a provision that allows an extra 15% of disaster recovery costs to be made available for mitigation -- providing financial incentives at an opportune time. Canadian governments should also invest 15% of recovery costs in mechanisms to prevent the recurrence of extreme events.
>
> i) **Risk assessment and loss mitigation**
> Each project that a government decides to fund should include risk assessment as an

additional criterion of development. Projects that reduce the vulnerability of Canadians to natural disasters should be given priority over projects that do not. This will help to foster a culture of mitigation and reduce future vulnerabilities in Canada through the integration of mitigation activities and costs into departmental mandates, business plans and budgets. A national mitigation secretariat would give stakeholder groups facing similar hazards an opportunity to exchange information, discuss options and priorities and agree on implementation roles and targets. Through such a forum, technical and research groups could create best practices guidelines and performance indicators. IBC believes the Institute for Catastrophic Loss Reduction can supply the core support for this effort."[46]

The insurance industry recognizes that its traditional role of spreading risk has to be augmented by helping both its policyholders and various levels governments that service them, to mitigate and reduce their risk. It will continue to do that by helping with research and policy development both within the private and public sector. The industry will continue to help itself by helping others.

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