

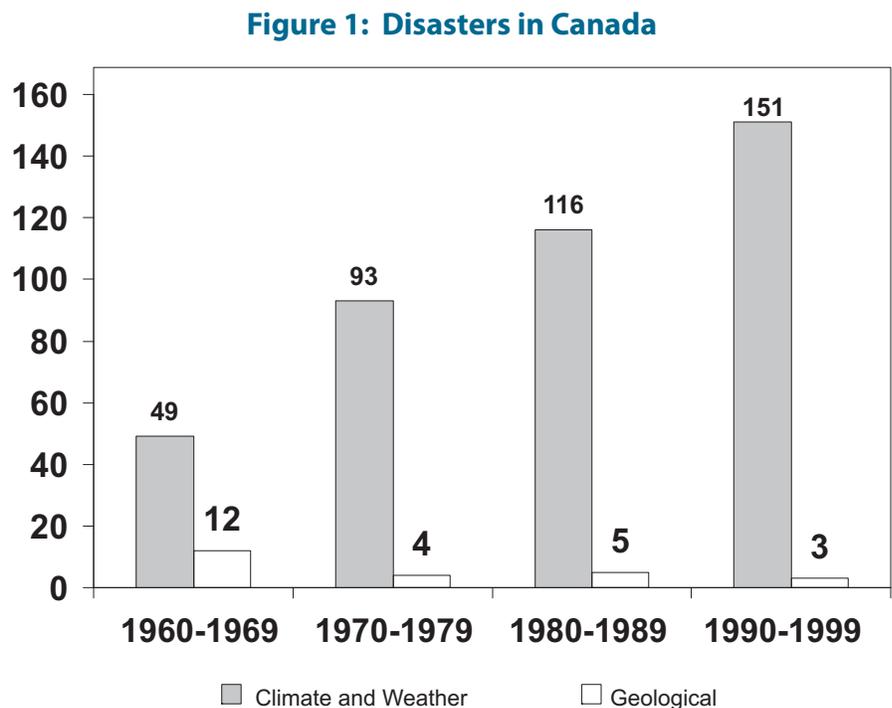
Planning for disasters, climate change, and sustainable development

Dan Sandink and Chrystal Fuller

Disaster mitigation occurs largely at the municipal level. Municipal planners can play a substantial role in reducing disaster impacts through ensuring that communities are developed in a way that limits their vulnerability to natural hazards. Planners also have a responsibility to ensure development occurs in a way that addresses vulnerable groups within our communities. Integrating disaster mitigation into the design and development of communities will help municipalities adapt to increasing severity and frequency of natural hazards caused by climate change, and will support long-term sustainable development objectives, not to mention protecting the safety and property of their residents.

Disaster Trends in Canada

Government and insurance industry data show that natural disasters in Canada are increasing in frequency and severity. Canada has experienced a three-fold increase in the number of climate and weather related disasters between the 1960s to the 1990s (Figure 1). Canadian insurance industry data show an increasing trend in pay-



Source: Public Safety Canada 1960s to 1990s.

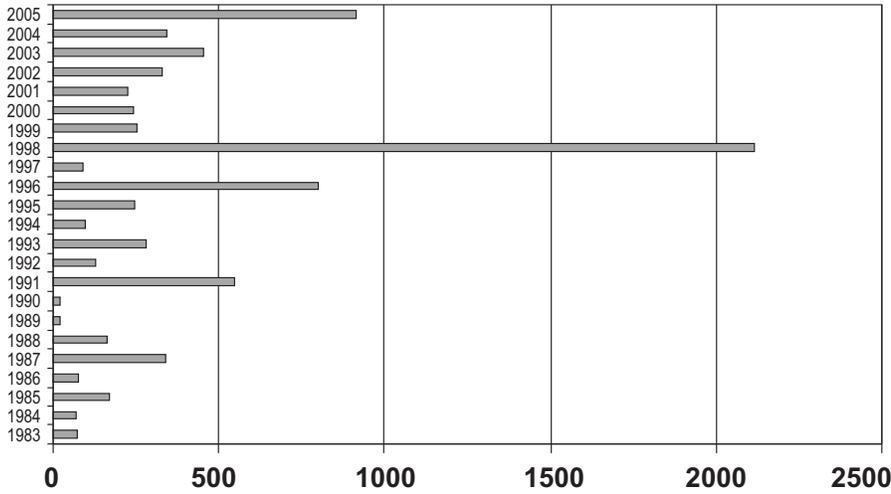
outs from large disaster events since 1983 (Figure 2). Many of the most significant disaster events in Cana-

dian history have happened recently, and include the 1998 Ontario-Quebec ice storm (with insured damages of \$1.95 billion), the 2005 heavy rainfall event in Ontario, and flooding events in Alberta (with insured damages of \$509 million and \$306 million respectively), as well as Hurri-

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Figure 2: IBC Total Insured Cost of Major Payout Events



Major payout events include disaster events with a total insurance payout of at least \$688,000 with at least 81 individual claims. Source: Insurance Bureau of Canada.

cane Juan in the Maritimes, and severe wildfire damages in British Columbia in 2003.

Disaster losses are expected to grow as climate change impacts the frequency and severity of extreme climatic events. The Intergovernmental Panel on Climate Change’s 2007 report suggests climate change impacts in Canada could affect wind and storm intensity, extreme precipitation, drought conditions, and will lead to an increase in the number of hot days.

Disasters, Hazards, and Vulnerability

A “disaster” occurs when a community has suffered substantial impacts or interruptions in its normal processes, causing a situation where the community is unable to cope on its own. Natural disasters can essentially be broken down into two components: hazards and vulnerability. A *hazard* is a natural event that has the potential to cause damage to human systems or that represents a threat to human health and safety. Examples of hazards include floods and hurricanes. *Vulnerability* is

the propensity of a system (community, individual, ecosystem) to suffer loss from a hazard event, or the degree to which a system is susceptible to hazards.

Many of the inherent characteristics of urban communities create vulnerability, as natural hazards can affect a large number of people and destroy or alter the built environment. Aging infrastructure and increasing wealth can also enhance vulnerability and disaster losses. Further, low income households, single parent families, individuals with lower education, individuals who are socially isolated and those with lower access to resources are more vulnerable, and can suffer greater impacts from natural hazards. Rural communities that have lower access to emergency infrastructure, less experience with emergency situations, more dispersed development patterns, and a smaller tax base may be more vulnerable and have less capacity to recover from disaster events.

The characteristics of development have a substantial impact on vulnerability. Exposure to hazards through

development in hazard-prone areas, including floodplains and wildland-urban interface areas, significantly enhances vulnerability. Also, impermeable surfaces increase stormwater flow rates, which can exceed the capacity of stormwater management systems and cause urban flooding. Rural areas may have a similar problem with the removal of vegetative cover increasing overland water flows.

Emergency Management and Disaster Mitigation

Emergency management is based on four pillars: mitigation prevention, preparedness, response and recovery (see table above). All orders of government are in some way involved in emergency management. At the federal level, Public Safety Canada sets the tone for emergency management in Canada, and has provided financial assistance for emergency preparedness and disaster recovery. Provinces set emergency management legislation, and delegate responsibilities for emergency management. The majority of the responsibility for emergency management is delegated to local authorities. Municipalities are generally required under provincial legislation to develop and implement emergency management plans including planning for mitigation where appropriate.

Though various provincial and federal programs have promoted disaster mitigation, federal and provincial emergency management has largely been focused on responding to disasters and returning affected individuals and buildings back to pre-disaster conditions (i.e. recovery). There are generally no incentives provided for municipalities to reduce their vulnerabilities during the recovery period (for example, reducing vulnerabilities in rebuilt structures and infrastructure), and therefore vulnerabilities are maintained. Although some of the literature regarding climate change adaptation does provide some guidance to municipalities, no program exists to support proactive disaster mitiga-

Four Pillars of Emergency Management

Emergency Management Component	Description
Mitigation/Prevention	Proactive, sustained actions to reduce or eliminate the long-term impacts and risks associated with natural disasters
Preparedness	Preparing for response and recovery; developing policies, procedures, and plans for managing emergencies
Response	Actions taken immediately before, during, or after an emergency occurs (eg., First responders)
Recovery	Efforts taken to repair and restore communities up to an acceptable level, following a disaster event

tion at the local level. Further, the benefits of mitigation measures may not be experienced for many years, as extreme natural events are relatively rare occurrences; thus, public and political interest is often focused on day-to-day issues rather than mitigation.

Role of Municipal Planning

Disaster mitigation is proactive: it uses either experience from hazard impacts or risk assessments to identify vulnerabilities, and then applies strategies to reduce vulnerabilities to ensure that impacts from future disasters are reduced or eliminated. Land use planning is also proactive: it is concerned with anticipating future needs, rather than responding to yesterday's problems. Therefore, municipal planners can have a direct and effective impact on vulnerability in Canadian communities and are, in many ways, on the "front lines" of disaster mitigation, as the design of our cities and communities has a large impact on vulnerability.

Planners can educate decision makers on the importance of disaster mitigation at the local level and foster disaster resilience in communities through:

- ▶ accounting for the relationship between development and natural events (hazards);
- ▶ accounting for disaster risk in development and redevelopment patterns;
- ▶ accounting for extreme hazard events and the impacts of climate change for the configuration and scale of public infrastructure;
- ▶ factoring vulnerability reduction and mitigation into neighbourhood and commercial district design;
- ▶ integrating hazard mitigation and vulnerability reduction into long-term community planning;
- ▶ promoting vulnerability reduction during the disaster recovery process; and
- ▶ viewing the community at the macro level, and understanding and accounting for the relationships between various components and systems in communities to reduce vulnerabilities.

Some specific examples of how land use planning has been used for mitigation include:

- ▶ restricting or managing development in flood-prone areas;
- ▶ adjustments including fire-resistant building practices, fuel breaks and set-backs in developments adjacent to wildland areas;
- ▶ ensuring development patterns and building practices in coastal areas reflect hazard risks; and
- ▶ managing earthquake risk

through restriction of development in areas subject to ground failure, and ensuring buildings are designed to handle earthquakes.

Planners can also advocate measures that protect natural systems and allow nature to deal with extreme weather events, including preservation of wetlands and riparian areas to help manage flooding. Ensuring critical facilities including hospitals, city halls, and emergency management offices are not in hazard-prone areas is essential.

There is also a need for planners, through their participatory practices, to engage a variety of stakeholders during the planning process to foster disaster mitigation. Stakeholders may include local community groups involved in environmental management and experts from local universities and government agencies. Planners should also work with emergency management staff in their own communities to receive advice and guidance on local hazards, and to ensure that planning practices do not create new or exacerbate existing vulnerabilities.

Finally, planners have powerful tools at their disposal, including geographic information and mapping abilities that allow for in-depth analysis. Planners also have the ability to work with developers to alter developments in small ways to reduce vulnerabilities while still at the conceptual stage.

If It's Vulnerable, It's Not Sustainable

Communities are increasingly considering sustainable development, with a focus on reducing resource and energy use, promoting sustainable transportation and infrastructure, diverting waste, and reducing greenhouse gas emissions. That is, communities are realizing the importance of considering how our actions affect the environment. As the trend of increasing disaster damages suggests, we should also consider more carefully how the environment affects us.

Planners can educate decision makers on the importance of disaster mitigation at the local level and foster disaster resilience in communities by integrating hazard mitigation and vulnerability reduction into long-term community planning.

Communities must consider and re-evaluate their vulnerabilities as the climate changes, population grows, demographics shift, and urbanization intensifies to ensure that vulnerabilities are limited in new development and reduced in existing development. Losing substantial amounts of property and money, and continuously rebuilding after disaster events, is not environmentally, socially, or economically sustainable.

All orders of government should

shift away from the primary focus of response, recovery, and preparedness, and incorporate disaster mitigation and prevention into communities.

There has been some increased interest in disaster mitigation at the federal level, and as of January 2008, the federal government can now provide an amount of support for mitigation through its Disaster Financial Assistance Arrangements during recovery.

Municipal governments have the greatest knowledge and understand-

ing of local hazards and vulnerabilities, and disaster mitigation planning should continue to occur at the municipal government level. Land use planning, combined with disaster resilient building practices, disaster resilient or resistant engineering practices, structural options where appropriate, and public education can effectively reduce disaster risk, help us adapt to climate change, and help promote sustainable development. *MW*

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