Cat tales

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# Bridging science and society

## Gordon McBean, director of policy at ICLR, recently received the Order of Canada for his research on climate change

**By Vanessa Mariga, Canadian Underwriter**

Gordon McBean, director of policy at the Institute for Catastrophic Loss Reduction (ICLR), has dedicated much of his professional life to researching a perceived disconnect between natural catastrophes and the socio-political consequences of such major events. He has spent years studying the vulnerability of people in disaster situations. But recently (and unintentionally), his studies entered the realm of practical application.

McBean (pronounced Mc-BAIN) was in Paris chairing an international committee, the Integrated Research on Disaster Risk (IRDR), when Iceland's Eyjafjallajökull volcano erupted on April 14, sending a cloud of ash into the atmosphere. The cloud drifted over Europe and ground air travel to a halt, stranding travellers for one week. McBean was caught in the centre of the chaos, featuring scores of people scrambling to find temporary accommodations while their flights were grounded for safety reasons.

Pre-dating this social disruption, roughly two weeks earlier, on April 7 in Ottawa, McBean became a member of the Order of Canada for his "contributions in atmospheric and climate sciences [that] have enhanced Canada's stature on the world stage."

McBean, a self-described "climate guy," has been researching climate and severe weather since the 1970s. In 1990, the United Nations declared the decade to be the international decade for natural disaster reduction. McBean joined the national Canadian committee, where he met Paul Kovacs, executive director of the ICLR.

Throughout the 1990s, McBean worked in the public sector. He became the assistant deputy minister of the atmospheric environment service for Environment Canada in 1994. Six years later, he decided to ►

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resign from the public sector. Around the same time, Kovacs and Alan Davenport -- ICLR's former director of research up until Davenport's passing in July 2009 -- were in the process of establishing ICLR. They offered McBean a faculty position.

Since that time, McBean has continued to sit on a number of national and international research bodies, including the Intergovernmental Panel on Climate Change. The panel shared a Nobel Peace Prize in 2007 with former U.S. vice president Al Gore. And yet, despite the Nobel Peace Prize already hanging on his office wall, McBean says having the Order of Canada medal pinned on him by the Governor General has meant a lot to him. The award is national and recognizes peoples' contributions to Canadian society from across the spectrum. McBean sees the attention around the medal as an opportunity to further spread his message that climate change research and awareness must be linked to the socio-political (or human) dimensions of the problem.

"When do scientists cross from being scientists to being advocates? I think it's important that we do it and still at the same time maintain our credibility," he says. "If top scientists don't speak out on these issues who will the media listen to?"

Climate change is more than just an "emissions reduction game," he says. "The reality is that with climate change, it's inevitable that we'll have more storms, floods and droughts. Storms, floods and droughts kill people. They cause economic damage. They cause insurance companies to have to pay out big amounts of money and we have to see this as part of the over all package of disaster risk reduction. Climate change is not a separate topic."

Roughly two years ago, McBean began chairing the IRDR, which is sponsored by the International Council for Science, the International Social Science Council and the UN International Strategy for Disaster Reduction.

The 2004 Boxing Day Tsunami in the Indian Ocean sparked the group's formation, he explains. But although McBean and the committee were able to find abundant research on physical events, weather and climate, not a lot of work was being done to include social issues. "For example, how do governments, right down to the individuals, make the choices that make themselves more or less vulnerable?" he says. "How do they keep informed? What information do they have? What features are dominant in their thinking process?"

Wealthy people, who are presumed to be smart, still insist on having large homes on cliffs overlooking beaches, he notes. And in other areas, poor populations have no choice but to live in shantytowns on hillsides, or on the banks of major rivers. "How does a society function in such a way that it doesn't provide any opportunities or support, so that these people are so vulnerable?" he wonders aloud.

McBean recalls a trip to Venezuela roughly 10 years ago. As he was driving to the airport with two other colleagues, they looked out the cab window and noticed a town "with houses stacked one on top of the other" perched on the hillside. "It was pouring rain and we simultaneously said: 'That's a disaster waiting to happen.' One week later it did. The whole town just slid down the hillside. They don't know how many people died. It was in the tens of thousands."

McBean expressed hope the legacy of IRDR will be that it has saved lives. "When a similar tragic hazard happens -- like a volcano, a flood or a hurricane -- we'll be sure that fewer people die. There will be fewer economic costs and less interruption." [This is assuming, of course, that governments implement the committee's findings and recommendations, he says.] "It's not just the earthquake or the hurricane," he adds. "It's about working to make ourselves less vulnerable."

McBean says being stranded by the volcano for a week served as a reminder to him that impoverished people are not the only ones vulnerable to natural catastrophes. The volcano "brings home in your own mind that these things happen to everyone, including us." The episode is a perfect example of the vulnerability of our society, he says. "We as a society just assume that things will work."

He draws a parallel to the 2003 electricity blackout that affected large swaths of Ontario, Quebec and the northeastern United States. "No ATMs, no credit card systems, no one had $5 in their pocket," he observes of that event. "I don't remember the last time I talked to a bank teller. Wherever I am, I just assume that I will electronically be able to access money.

"I just assume that I can be in Paris, get on a flight in the morning and be home for dinner with my wife. When this thing comes up, it hits you that you can't. It really brings home the vulnerability that we all have because we have set ourselves up in a very technologically dependent society. And this technology is not 100%. It will be impacted by things in ways that we don't usually think about."

Events such as the blackout or the Icelandic volcano create uncertainty, he continues, and the uncertainty creates difficulty in making decisions. "That's another part of disaster risk reduction -- to have a thought or thinking process that allows individuals, governments, organizations and insurance bureaus to determine how to make decisions when faced with uncertainty."

# ICLR retrofits a Jasper home against wildfire.



The Institute for Catastrophic Loss Reduction (ICLR) on May 5 rolled out a Jasper, Alberta home retrofitted to mitigate against wildfire. As part of the insurance industry's ongoing commitment to educate Canadian homeowners about disaster safety, the Institute once again chose Emergency Preparedness Week (May 2-8) to unveil its latest home retrofit project.

Paul Kovacs, Executive Director of ICLR, was on hand to conduct a media tour of the home. Said Kovacs: "With more people choosing to live in the wildland/urban interface, more residential properties are exposed to the threat of wildfires. Homeowners living in such interface areas, indeed families across Canada that are vulnerable to natural hazards, can prepare now for perils that will inevitably strike in the future."

The Jasper home retrofit included:

- Cedar roof shingles replaced with asphalt shingles
- Cedar siding replaced by stucco
- Coniferous bushes replaced with deciduous plants
- Reduction of surrounding ladder and forest litter/fuels
- Reduction of forest litter/fuels behind property
- Wood pile moved away from the home.

The Institute also provided the homeowner with a disaster preparedness kit.

The retrofit is based on the *FireSmart* program. *FireSmart* was developed by *Partners in Protection*, and is endorsed by governments across Canada, the insurance industry, and many other stakeholders as Canada's national program for promoting wildfire safety.

"We commend and encourage programs like *FireSmart* because we believe it's a step in the right direction to help communities adapt to climate change," said Don Forgeron, President and CEO, Insurance Bureau of Canada. "We have had a very mild and dry winter and predictions are for a dry summer which means an increased risk of wildfire," he added. "Additionally, we are pleased to support ICLR's work to raise awareness about these very simple steps that homeowners can take to protect properties everywhere."

IBC produced a Video News Release (VNR) and informational video about the retrofit to help bring the story to life. The video can be seen on YouTube at http://www.youtube.com/watch?v=1VZWwC0PhUk

This year, many communities across Canada are vulnerable to an elevated risk of wildfire due to the mild and dry winter. Actions to protect homes and property should be taken early, and follow a comprehensive strategy like that set out in the *FireSmart* program.

In 2003, Canada's most expensive wildfires struck British Columbia. Over 2,500 blazes swept more than 260,000 hectares of wildlands in the province that year, aided largely by very dry conditions and ignited by human as well as natural sources. Three people were killed, more than 45,000 were evacuated, and fire destroyed a total of 334 homes and many businesses. All told, there was more than $200 million in insured damage.

According to Kovacs: "Many of the steps homeowners can take to protect their homes from wildfire require nothing more than the right information and a little bit of elbow grease. Moving woodpiles away from the home, cutting back or removing trees, and cleaning the property of dry leaves and branches are just a few examples."

This is the eighth year that Canada's insurers, through ICLR, have showcased a retrofitted home as part of Emergency Preparedness Week. In 2009 a home in Toronto was retrofitted to protect against wind, winterstorm and blackout and in 2008 a home in Montreal was retrofitted to protect against winter storm and earthquake. In 2007 a home in Edmonton was retrofitted to protect against tornado and winter storms and in 2006, a home in Ottawa was made more resilient to earthquakes and winter storms. In 2005, a home in Vancouver was made more resilient to earthquakes, and in 2004, a Halifax home was protected against hurricanes. In 2003, a home in London was made more resilient to tornadoes.

# First ICLR textbook in print



The first ICLR textbook, on a "Systems Approach to management of Disasters," has been completed by Prof. Slobodan Simonovic of the University of Western Ontario's engineering department. Dr. Simonovic is ICLR's Director of Engineering Studies and is a professor at UWO.

The manuscript is being edited by the publisher – John Wiley & Sons, Inc., New York – and the book will be in stores on November 1. The main goal of the text is to introduce the systems approach to the disaster management community as an alternative approach that can provide support for inter-disciplinary activities involved in the management of disasters.

The systems approach draws on the fields of operations research and economics to create skills in solving complex management problems. A primary emphasis of systems analysis in disaster management as presented in the book is on providing an improved basis for decision-making. A large number of analytical, computer-based tools, from simulation and optimization to multi-objective analysis, are presented for formulating, analyzing and solving disaster management problems.

The text is organized into four parts and eight chapters. Part I provides an introductory discussion and sets the scene. In Chapter 1 there is a brief overview of Prof. Simonovic's personal experience, which provided the motivation for writing the text.

The main terms used in integrated disaster management are defined in Chapter 2. Part II is devoted to the introduction of systems theory, mathematical formalization and classification of methods. The material presented in this section should be of practical relevance during the process of formulating disaster management problems as a systems problem and selecting an appropriate tool for the solution of a problem.

In Chapter 3 the focus is on systems thinking as a philosophical background of the systems approach, and provides a formal introduction of the systems approach, definitions of systems terms and looks at how they are applied in disaster management. This Chapter ends with a set of system formulation examples from the disaster management domain.

Chapter 4 introduces systems tools and techniques and provides their main characteristics. Part III is technical in nature and it is aimed at disaster management practitioners.

Chapter 5 concerns the simulation approach. It provides a detailed description of system dynamics simulation. Development of system dynamics simulation models is illustrated with two examples: a simple epidemic model and a more complex epidemic model with recovery. The chapter ends with a real application of system dynamics to flood evacuation simulation.

Optimization is addressed in Chapter 6, with a focus on one of the most widely used techniques – linear programming. In addition to the introduction of linear programming and simplex method for its solution this chapter presents two special types of linear programming problems that have great application potential in disaster management – transportation problems and network problems. Appropriate algorithms for the solution of special problems are presented, including transportation simplex method, shortest path method, minimum spanning three method and the maximum flow method. The chapter ends with the presentation of the linear programming application to optimal placement of casualty evacuation assets.

Chapter 7 focuses on a multi-objective analysis. A very practical approach is taken to the material in this Chapter. Because it approaches multi-objective analysis from an application point of view, it deals with a number of important issues in addition to the selection of an appropriate technique. Two deterministic multi-objective analysis techniques are presented for single and group decision-making. The first one, the weighting method, is a technique for generating non-dominated solutions. The second one, the Compromise programming, is a technique for ranking discrete sets of solutions and identifying ones that provide the best compromise between the set of criteria used in evaluation. The chapter ends with an example application in selection of flood management alternatives.

The book ends with the presentation of Prof. Simonovic's vision for the future of disaster management. In Part IV, Chapter 8 presents this view. This section also provides additional references for readers with a deeper interest in some of the concepts discussed.

The application of methodologies introduced in the book is supported through a set of computer programs contained on the accompanying CD-ROM. The state-of-the-art simulation software Vensim PLE (Personal Learning Edition) is enclosed for the implementation of system dynamics simulation. This program was developed by Ventana Systems, which has kindly given permission for its use in this context. The CD-ROM includes two more original computer programs developed in the user-friendly Windows environment, for the illustration and implementation of ►

the methods outlined in this book. They are: LINPRO, a linear programming optimization tool; and COMPRO, for the implementation of the multi-objective analysis tool of compromise programming. The software component of the book is not intended as a commercial product. It has been developed to illustrate the application of the methodological approaches presented in the book, and to allow the solution of real disaster management problems. However, the responsibility for its appropriate use is in the hands of the user.

This text and the accompanying CD-ROM have four main purposes:

1) They provide material for an undergraduate course in disaster management. A course might be based on Chapters 1 through 4, and possibly parts of Chapters 5, 6 and 7.
2) They also provide support for a graduate course in disaster management, with an emphasis on analytical aspects of application of systems approach to management of disasters. Such a course might draw on Chapters 1 through 4, and details of Chapters 5, and/or 6 and/or 7. Both undergraduate and graduate courses could use the computer programs provided on the CD-ROM.
3) Disaster management practitioners should find the focus on the application of the methodologies presented to be particularly helpful, and could use the programs for the solution of real disaster management problems. There is discussion of a number of specific applications in Chapters 5, 6 and 7 that may be of assistance.
4) Specific parts of the book can be used as a tool for specialized short courses for practitioners. For example material from Chapter 5 and parts of Chapter 4 could support a short course on: 'System dynamics simulation and integrated disaster management'. A course on 'System analysis for emergency management optimization' could be based on Chapters 3, 4 and parts of Chapter 6. Similarly, material from Chapter 7 and parts of Chapters 3 and 4 could be used for a short course on 'Multi-objective analysis in management of natural disasters'.

Slobodan P. Simonovic, Director of Engineering Studies and Professor at UWO.

# Above-average hurricane season forecasted

The Colorado State University forecast team has predicted an above-average 2010 North Atlantic hurricane season based on the premise that El Nino conditions will dissipate by this summer and that anomalously warm tropical Atlantic sea surface temperatures will persist.

The team predicts 15 named storms to form in the Atlantic basin between June 1 and November 30 with eight expected to be hurricanes and four developing into major hurricanes (Saffir/Simpson category 3-4-5) with sustained winds of 111 mph or greater.

Long-term averages are 9.6 named storms, 5.9 hurricanes and 2.3 major hurricanes per year.

"Based on our latest forecast, the probability of a major hurricane making landfall along the U.S. coastline is 69 percent compared with the last-century average of 52 percent," William Gray said. "While patterns may change before the start of hurricane season, we believe current conditions warrant concern for an above-average season."

Precursor factors to this year have a number of similarities to early April conditions that preceded the hurricane years of 1958, 1966, 1969, 1998 and 2005. All five of these seasons had above-average activity, especially the seasons of 1969, 1998 and 2005. Phil Klotzbach and Gray predict the 2010 season will have slightly less activity than the average of these five earlier years.

The team predicts tropical cyclone activity in 2010 will be 160 percent of the average season. By comparison, 2009 witnessed tropical cyclone activity that was about 70 percent of the average season.

The team also predicts a 58 percent chance of a major hurricane tracking into the Caribbean (the long-term average is 42 percent).

# New ICLR collaboration with the International Flood Initiative and UNESCO



**By Slobodan P. Simonovic, Director of Engineering Studies and Professor at UWO**

UNESCO has decided to provide its contribution to the International Flood Initiative through tight collaboration with the ICLR. Professor Slobodan Simonovic has been asked to lead the publication project for UNESCO under the title *Management of Floods in a Changing Climate*.

The project proposed by Professor Simonovic and approved by UNESCO includes preparation and publication of a monograph series that will provide significant contribution to flood disaster management theory and practice. The main theoretical contribution will be focused on the introduction of climate change considerations into flood disaster management practice. The practical contribution of the proposed monographs series will be through the presentation of contemporary tools and techniques for management of flood disasters including remote sensing, spatial precipitation analysis, distributed hydrologic modeling and fuzzy risk analysis, among others. Best practices around the world and state-of-the- art knowledge will be presented together with a set of computational tools for practical applications.

Proposed working titles for the publications within a monograph series with brief descriptions are:

***1. Extreme precipitation and climate change – author Prof. Ramesh S.V. Teegavarapu***

The book will examine and document the impacts of climate change on extreme precipitation events in an effort to: enhance our understanding of the impacts of climate change on extreme precipitation events; quantify the uncertainties associated with extreme precipitation events; and develop procedures and guidelines for risk-based decision-making in the presence of the impacts of climate change. Practical tools for spatial precipitation analysis and simulation (like weather generators, spatial interpolation of missing data, use of multiple sensors in estimating precipitation and others) will be included in the book.

***2. Hydrologic modeling of floods – authors Prof. Pradeep P. Mujumdar and Prof. Nagesh D. Kumar***

This book presents methodologies for hydrologic modeling of floods and for assessing climate change impacts on flood magnitudes and frequencies. The following topics are covered with a view to train the reader in the use of hydrologic models, with climate change scenarios: (i) physical processes that transform precipitation into flood runoff, (ii) flood routing, (iii) assessing likely changes in flood frequencies and magnitudes under climate change scenarios and (iv) use of remote sensing, GIS and DEM technologies in modeling of floods to aid decision making.

***3. Flood inundation modelling – author Prof. Giuliano Di Baldassarre***

Floodplain mapping and spatial analyses of flood impacts require hydraulic modeling tools that convert hydrological conditions into water elevation. The proposed monograph will present hydraulic tools in public domain and focus attention on the use of GIS technology for floodplain mapping.

***4. Flood risk management – author Prof. Slobodan P. Simonovic***

This monograph presents an investigation of different methodologies for flood risk management. The characteristics of flood risk management are addressed through the following steps: (i) identification of feasible alternatives and associated risks; (ii) assessment of all impacts associated with various risk levels; (iii) selection of acceptable options; and (iv) implementation of the optimal choice.

The innovative aspects of this book include: (i) parallel use of probabilistic and fuzzy set approaches to water related disaster risk management; (ii) the concept of adaptive risk management as a system that is capable to learn, adapt, prevent, identify and respond to new/ unknown threats in critical time; and (iii) the notion of integrated risk management based on joint consideration of objective and subjective uncertainty and the use of risk communication to link together risk assessment, risk management and the decision-making process. Simulation, optimization and multi-objective analysis algorithms are presented for risk-based management and computational tools will be developed and included with this publication.

Professor Simonovic serves as the Editor-in-chief for the monograph series and the author of book 4 on “Flood risk management.” The project has been initiated by a meeting of the authors at UNESCO’s Paris office in April and books will be ready for publication by the end of 2011. Cambridge University Press has been selected by UNESCO to be the publisher of the monograph series.

# ICLR makes three building code submissions to Ontario government

**By Grant Kelly, Director, Climate Change Adaptation Projects, ICLR**

In May 2010, ICLR made three submissions to Ontario's Ministry of Municipal Affairs and Housing suggesting changes to the Ontario Building Code. ICLR's recommendations are based on feedback from our Insurance Advisory Committee and research conducted at the University of Western Ontario.

Our submissions are:

***1) Require sewer backflow valves on all new homes built in Ontario***

All provincial building codes are based on the model National Building Code of Canada (NBCC). Sewer backflow valves are required under the NBCC if there is a possibility that the home will be at risk of flooding. Most provinces, with the important exception of Ontario and British Columbia, have determined that every new home is at risk of flooding. In Ontario and British Columbia, the decision that a home is at risk of flooding is left to the municipality. This has meant that sewer backflow valves are the exception rather than the rule in the two provinces. ICLR recommends that Ontario interpret the National Building Code the same way as the other provinces. Every new home is at risk of flooding and needs a sewer backflow valve.

***2) Put more nails to hold down roof panels.***

The Building Code currently requires roof panels to be nailed down every six inches on the end and 12 inches across the middle of the panels. This translates to 33 nails in a typical size of 1.22 m × 2.44 m (i.e., 4'×8') roof panel. ICLR recommends nailing all sides of the roof panel every six inches. This is 12 extra nails per roof panel.

Research at the University of Western Ontario estimates that these 12 extra nails will increases the roof's capacity to handle wind risks (like tornadoes) by 50 percent. A strong roof is essential to ensure the safety of inhabitants and prevent excessive damages to light-frame wood structures. Disaster literature (*FEMA/NIBS (2010) HAZUS-MH*) suggests that the majority of damage to property and contents are caused by failure of roof panels. The ingress of rain could also cause health hazard due to possible mould growth.

This will also assist in minimizing the impact of nails that are improperly fastened or simply missed. For a typical roof sheathing panel, at the IRLBH test house, there is at least one nail missing or improperly fastened. The quality of construction of the test house is similar to those found in practice according to surveys completed by building inspectors. This missing nail translates to a decrease of about 5 percent to 10 percent in the mean uplift capacity.

***3) Tied down roof to walls in garages***

Require hurricane straps to connect the roof and walls of any garage that is not integral to the home. (This means the garage sits in front of or beside the house.) One of the key findings from the Vaughan tornadoes was that garage roofs were particularly vulnerable. The wind blows the garage door down or breaks a window, and creates tremendous internal pressure that lifts the roof. The airborne roof is now debris that damages other homes and could kill people in the neighbourhood. Loss of roof structure is usually the precursor to wall collapses, and such wall collapses are often the cause of death or injury in wind storms. Therefore, it is critical to keep the roof structure on for these reasons.

This recommendation does not apply when there is an integral (to the house) second floor structure above the garage, as the weight of the second floor structure is sufficient to mitigate the elevated internal pressures in the garage.

The Ontario Ministry of Municipal Affairs and Housing will include these ideas, along with code-improvement ideas from other stakeholders in a fall 2010 consultation paper. These discussions will continue in 2011 with the objective view of a new Ontario Building Code in 2012.