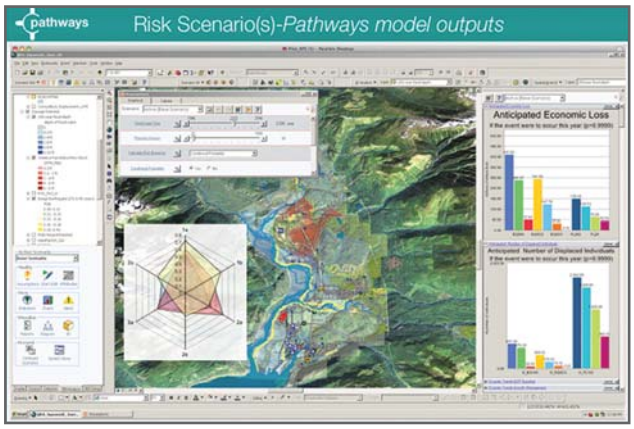
Building Safer Communities through Integrated Risk Assessment

Over the past 20 years, Canada has suffered more than 80 significant natural disasters, affecting hundreds of thousands of people and resulting in millions of dollars in economic losses. The 1997 Red River Flood alone caused $500 million in damages across the province of Manitoba. Just how safe are Canadians from impending natural disasters and how equipped are local government organizations to recover from an unexpected event? What are the tolerable thresholds of risk for a community and how are they negotiated?

Natural Resources Canada (NRCan) has initiated a long-standing research program aimed at answering these questions and empowering communities across the country to build risk assessment capacity. In partnership with the U.S. Federal Emergency Management Agency (FEMA) and supported by Defence Research and Development Canada, NRCan's Earth Sciences Sector has developed a risk assessment framework known as Pathways that aims to link natural hazard risk assessment with community planning.

Pathways is a standards-based system of processes, methods and tools that is aligned with and contributes to national policies and evolving best practices for disaster mitigation in Canada. It aims to assist local and regional authorities in prioritizing risk management objectives, analyzing changing conditions that may affect vulnerability over time, characterizing thresholds of risk tolerance and navigating decision pathways that promote national policy goals for disaster management and sustainability.



Methods and tools used in the Pathways framework transform knowledge about the risk environment into actionable mitigation scenarios.

"Communities face many challenges in risk-based planning and it is the focus of our research to strengthen mitigation and preparedness strategies across the country," said Nicky Hastings, Activity Coordinator, NRCan. "Planners and emergency managers need a common framework for risk assessment and mitigation planning – one that is standards-based and aligned with national policy goals."

Implemented as a spatial decision support system, Pathways is comprised of several integrated, standards-based tools that facilitate risk assessment, scenario modelling and decision analysis. At the heart of the framework is a powerful risk assessment software program known as Hazus. Developed by FEMA, Hazus is used to model, analyze and predict potential losses from floods, hurricane winds and earthquakes. It is an extension to ESRI's ArcGIS Desktop and runs calculations on the ESRI platform.

Through ArcGIS technology, Hazus can be used to visualize spatial relationships between populations and permanently fixed geographic assets or resources for a specific hazard scenario, which serves as a critical function in the pre-disaster planning process. It is used for mitigation and recovery as well as preparedness and response. It can also scale to a study area of any size, be it a region, community, neighbourhood or individual site. The methodology plays a key role in the assessment step of mitigation planning, which is a fundamental component of a community's ability to break the cycle of disaster damage.

Modelling Risk and Vulnerability on the West Coast

To adapt the tool for Canadian users, NRCan has engaged local groups to uncover operational requirements for risk-based planning in urban centres. For example, they worked with the District of North Vancouver to uncover potential flood risks in the area. Using the Hazus flood model, they developed spatial maps containing depths and extents of floodwater for floodprone creeks and rivers to help assess potential disaster loss due to riparian flooding.

Through a partnership consisting of District staff and the University of British Columbia's Earthquake Engineering Group, NRCan is also identifying and prioritizing community assets that would be at risk in the event of an earthquake. They are combining this data with assets that would help contribute to resilience, and using this information to formulate considerations for risk reduction strategies. NRCan and the District are also exploring policy responses that align with a range of identified risk scenarios that the community could face as it grows over the next thirty years. This project is aiding the District as it embarks on drafting a new Official Community Plan with an expanded focus on anticipated risks.

> "Users can visualize what a community might look like 5 years down the road, and map out scenarios that predict how infrastructure will likely be affected by natural disasters. As a result, emergency planners can make critical decisions based on facts and risk assessment becomes a key component of community planning."
>
> **Nicky Hastings, NRCan**

The District of Squamish has also benefited from NRCan's risk assessment framework. Known as the "Outdoor Recreational Capital of Canada," Squamish is nestled between Vancouver and Whistler and is geographically exposed to multiple natural-hazard threats. Located at the confluence of five major river systems and surrounded by a steep mountain landscape, the area is threatened by high consequence earthquakes and volcanic eruptions, a debris-flow landslide hazard, periodic flooding, storm surge threats in the downtown waterfront area and wildfire threats between built and natural environments.

In 2007, NRCan began working with Squamish to examine underlying system dynamics that drive conditions of natural hazard vulnerability and risk, (specifically floods, earthquakes and landslides), in the community. They applied the principles of Pathways to study how these conditions would change over time with ongoing growth and development.

"Users can visualize what a community might look like five years down the road, and map out scenarios that predict how infrastructure will likely be affected by natural disasters," said Hastings. "As a result, emergency planners can make critical decisions based on facts and risk assessment becomes a key component of community planning, which is something that simply didn't happen before."

To promote adoption of Pathways on a national scale, NRCan will continue to work with local government organizations and communicate the results of their research to inform ongoing strategies for national and regional risk assessment. In conjunction with FEMA, NRCan will release a North American version of Hazus across Canada and the United States, in the fall of 2011. ■