

3.] THE ROLE OF MEDIA IN DISASTER RISK REDUCTION

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DRRPathways.ca

CO-CREATING NEW KNOWLEDGE FOR UNDERSTANDING RISK AND RESILIENCE IN BC



This article is part of the Resilience Pathways Report. The report has the following objectives: a) to share knowledge about existing practices and recent advances in understanding and managing disaster and climate risk in BC, including some information on relevant federal programs, and b) to provide insights on gaps and recommendations that will help build pathways to resilience in BC.

This article belongs to *Chapter 3 Climate and Disaster Risk Management: Enabling Action.* To read all articles in the report, see DRRPathways.ca.

The Resilience Pathways Report is a project of Natural Resources Canada.

3.1 THE ROLE OF MEDIA IN DISASTER RISK REDUCTION

BY:

Johanna Wagstaffe, CBC

EDITORS:

Sahar Safaie, Sage On Earth Consulting

Shana Johnstone, Uncover Editorial + Design



ABOUT THE MEDIA

OVERVIEW

The Canadian media plays an integral role in the resilience of British Columbians. At its very core, the media is the collection of communication outlets and tools used to deliver information to the public, delivering programming content that reflects an audience's interests and needs. Canada receives top marks for prioritizing freedom of expression and the press, which means we are steps ahead of many other countries around the world when it comes to the relationship between the public and the media. The organization **Reporters Without Borders compiles** an annual ranking of countries based upon the organization's assessment of their Press Freedom Index. In 2021, Canada ranked 14 out of 180.¹ The Government of Canada recognizes that "people need free media to provide them with accurate information and informed analysis to hold governments to account."2 This has been more vital than ever in recent years following the COVID-19 pandemic and back-to-back weather disasters in BC in 2021. However, there are still hurdles and gaps when

it comes to communicating important information as well as opportunities to strengthen the relationship between the audience and the media.

In Canada, the media landscape is incredibly diverse. Canadian media contains both regional and domestic coverage. Canada has several major national newspapers (print and digital) as well as several national television and radio networks. In addition, there are hundreds of local digital publications that service a hyper-local audience. The linguistic policies of the *Broadcasting Act* are followed.

For British Columbians, access to this content is channeled through television, radio, print, digital, social media, streaming services and apps. Through experience, market research, and a two-way conversation with audiences, the media understands how Canadians are accessing and consuming news. While market research continues to show accelerated trends in audiences moving towards digital and on-demand services to obtain their news, the core service of media in communicating risk, no matter the platform, remains stronger than ever.

In the context of disaster and climate risk management, the media can be thought of as a clearing agency for information. The media relays information from experts and government officials and delivers it out to the public before, during, and after a disaster (Figure 1). Canadian media is far-reaching, with the ability to connect with most of the



Figure 1: Reporter in the field (Photo: Johanna Wagstaffe, CBC).

population either directly or indirectly through word of mouth and social media sharing capabilities. This holds enormous weight in getting a message of resilience to the public.

The Government of Canada recognizes that "people need free media to provide them with accurate information and informed analysis to hold governments to account." This has been more vital than ever in recent years following the COVID-19 pandemic and back-to-back weather disasters in BC in 2021.

Organizations independently advise media of new risk information, and the media will independently "check in" with various organizations as pertains to news "hooks" or special projects. Our aim overall is to inform the public of immediate disaster risk, public safety information on how to navigate an unfolding crisis, the potential for risk in the future, accountability after a disaster, and what initiatives are in the works.

ALIGNMENT WITH THE SENDAI FRAMEWORK

Media is one of the stakeholder groups mentioned in the Sendai Framework with an important role as "enabler in providing support to States, in accordance with national policies, laws and regulations, in the implementation of the present Framework at local, national, regional and global levels. Their commitment, goodwill, knowledge, experience and resources will be required."³ More specifically, the role of media is outlined in paragraph 36(d): "Media to take an active and inclusive role at the local, national, regional and global levels in contributing to the raising of public awareness and understanding and disseminate accurate and non-sensitive disaster risk, hazard and disaster information, including on small-scale disasters, in a simple, transparent, easy-to-understand and accessible manner, in close cooperation with national authorities; adopt specific disaster risk reduction communications policies; support, as appropriate, early warning systems and life-saving protective measures; and stimulate a culture of prevention and strong community involvement in sustained public education campaigns and public consultations at all levels of society, in accordance with national practices."4

UNDERSTANDING AND REDUCING RISK

For decades, the media has helped deliver the message of public safety during an unfolding crisis. But the format is constantly changing—from waiting by the radio for breaking bulletins, tuning into the six o'clock evening news for updates or opening the morning newspaper for details of impact to our current landscape, to getting push notifications of alerts on our smart phones and checking twitter for live updates. Journalism across platforms and agencies has helped to connect the message from experts and decision makers to the



public which, in turn, has helped make our communities more resilient.

It is the mandate of the media to provide relevant information to the public. Increasingly, individual newsrooms are making the awareness of risk, particularly as it is connected to climate change, a part of the coverage. A lot of this shift has come audience pressure as communities are increasingly impacting by extreme weather.

Individual newsrooms adhere to their own codes of conduct. The CBC's *Journalistic Standards and Practices*, for example, is available to the public and contains guidance on how to conduct fair journalism through disaster: "When a natural disaster strikes, we provide useful information and context, especially for those most directly affected. The information we provide helps the audience understand a fluid and chaotic situation, so that it can assess the impact and potential danger. We will sometimes receive conflicting information from credible sources. We may choose to report this, making clear the circumstances of the situation and citing the sources while we work to reconcile the information in light of the reality on the ground."⁵

The role of the data journalist is becoming more and more prominent in newsrooms—an important note to share with those compiling raw data, that the media is becoming more interested in source material. With access to information requests available to the public, newsrooms are dedicating more time to sifting through data and providing relevant analysis. Figure 2 is an example of journalists using publicly available data to find trends in urban sprawl in Canadian cities and create original visualizations to tell the story.⁶



Figure 2: Journalists are visualizing data to tell a story about urban sprawl and climate change (Photo capture from work by Naël Shiab and Isabelle Bouchard).

ROLE IN DIFFERENT STAGES OF DISASTER RISK REDUCTION

Media plays a role in every stage of disaster and climate risk management and uses different approaches and tools to deliver the intended information.

Figure 3 is from a BBC Media Action Insight report in 2021 that sums up the role and tools of media across our Canadian landscape.⁷

RISK MITIGATION

Journalists can help break down complex ideas when it comes to understanding both risk information and risk management measures. This applies to scientific studies, making sure the ideas about how new information from studies may apply to individuals, as well as to finding ways to spark discussion and feedback from the public about this information. The media can help provide a platform for the work of universities and institutions when it comes to furthering our understanding of personal risk, and it can share safety recommendations, initiatives and incentives from government officials when it comes to application.8

The media can also invoke change. By sharing stories of individuals who have taken ownership of personal resilience, or who have put the pressure on for change from above, media can help to create a shift in the perspective of the masses. Inspiration is a powerful tool.



HOW MEDIA CAN HELP PEOPLE IN THE MOST AFFECTED COUNTRIES TO ADDRESS CLIMATE CHANGE AND PROTECT THE ENVIRONMENT



Conducting research



Strengthening media and non-media partners



Producing content



Supporting outreach

MORE TRUSTED, INCLUSIVE, INDEPENDENT, AND ENGAGING MEDIA & COMMUNICATION **EMPOWERS** CONNECTS **INFLUENCES INDIVIDUALS** PEOPLE POWER **INTERMEDIATE CHANGES** and influence those Self-efficacy New skills attitudes and beliefs Newly imagined futures • Inspiration • Motivation • Innovation LONGER TERM CHANGES More responsive and inclusive Individual and collective action All sections of society better to restore and protect ecosystems, connected with others, participating in the decisions that affect their lives governance systems to mitigate climate change and adapt to it **CONTRIBUTING TO** All life on Earth is healthy, valued and protected

Figure 3: How media can help enable positive shifts to protect the environment and address climate change (Graphic: BBC).

Figure 4 is an artist's illustration showing how an earthquake could devastate a Vancouver elementary school. The image was created when UBC seismic engineers and psychologists wanted to test whether



the image would be more effective than statistics for communicating earthquake risk. Their study demonstrated that people who viewed the image were more likely to sign a petition to fast-track seismic upgrades (77.3% compared to 68.0%) than people who only saw statistics.⁹ The image and story were published by UBC News and further picked up by other news outlets.

EMERGENCY PREPAREDNESS AND RESPONSE

Arguably, the media has historically been most imperative during an unfolding crisis. Before the full roll-out of the National Public Alerting System to wireless service providers, media was the primary form of accessing life-saving information. Other methods of information dissemination are far and few between but include. in addition to word of mouth, emergency response crews going door-to-door with information, or individuals taking the initiative to set up alert systems provided by individual agencies (Environment and Climate Change Canada, for example)

or Twitter alerts for accounts like @EmergencyInfoBC.

During a crisis, such as a tsunami, earthquake, wildfire, flood, or cyclone, where time is of the essence, the media has the ability to break into programming on all platforms to provide life-saving information—such as who is under the warning, the timing of events, what to do, when danger has passed, and where to go for more information. Most smartphone users will also receive automatic push notifications for breaking news events.

This is also when the media can directly connect experts and scientists to the public—offering forums, debates, town halls, and live question-and-answer sessions (Q&As) to allow the public to hear firsthand what is happening. This format has been very effective during the ongoing pandemic. For example, CBC Rundown¹⁰ offers a live Q&A every night, taking viewers' questions, and CBC Vancouver ran a Q&A about the wildfire smoke from the 2021 fire season.¹¹

RECOVERY/BUILD-BACK-BETTER

Ongoing access to information on the state of infrastructure and updates from officials on the timing and plans of recovery are part of the news reporting that will help communities



Figure 4: Artist illustration of potential earthquake damage at an elementary school in Vancouver (Photo/illustration: UBC News).



recover with resilience. Media can provide information on resources and processes for accessing support during the recovery phase. This is also where journalists hold those in power accountable by assessing how effective the flow of information was, the transparency of decision making, how much and where recovery money will be going—essentially by asking the "tough questions" to all levels of government.

AVAILABLE TOOLS

The media has the following tools available for communication flow:

Breaking news: Communication during a crisis is what many media organizations do best. The media has the ability to break into regularly scheduled television programming with warnings (tornado warnings during a non-news show, for example), issue alerts on smartphones about breaking news, turn website landing pages into breaking-news information hubs, and create radio specials in the moment.

News releases: Communications teams for various bodies that have newsroom contacts send news releases to newsrooms. Comms teams also contribute to a landing page on a publicly available webpage where the same releases all get posted. The social media presence of these bodies—university research units and think tanks, government departments, BC Avalanche, many others—also falls under this category. A recent example of a news release shared in multiple places is one from the University of Northern British Columbia, letting media know of funding for new weather stations to monitor extreme weather in the province; this news release was posted on UNBC's website and was also sent directly to our newsroom inbox.¹²

Scheduled media briefings: These are pre-organized events where experts, researchers, officials, and decision makers share information in a live event, allowing cameras and journalists to engage in a question period after the event. An example of this are the live press briefings regarding where the BC government shares updates to COVID-19 regulations.¹³

Access to events: Invitations to journalists to participate in or view training exercises or simulations. Examples of such events include Heavy Urban Search and Rescue (HUSAR) Task Force training, seismic simulation laboratories, and avalanche testing. One such event in 2020 (reported by CTV News) where media were invited to watch involved local first responders and the Canadian Armed Forces conducting training exercises for heavy urban rescue.¹⁴

Planned releases under embargo:

Advance research is sometimes given to the newsroom ahead of a publication or announcement so that the newsroom can prepare a story in advance. This approach often leads to higher-quality journalism and wider platform release and interest. The Insurance Bureau of Canada, for example, sent an embargoed copy of their post, "Severe Weather in 2021 Caused \$2.1 Billion in Insured Damage,"¹⁵ a week ahead of time so that journalists could set up interviews and plan for stories.

In-depth project: This is an investigation into a particular topic as part of a series or documentary or enterprise journalism. The CBC Vancouver Faultline podcast¹⁶ would be considered an in-depth project, on a topic not necessarily connected to a news hook of the day. Newspaper features can also be in-depth projects, such as the 2016 Vancouver Sun piece that reported how Vancouver's poorest residents are living in buildings at risk in an earthquake.¹⁷

Small events that remind, refresh audience of overall risk and strategy:

A small, non-damaging local earthquake or a large earthquake somewhere else in the world can be used by media to update the audience on our current seismic hazards and preparations. For example, The Weather Network reported the small earthquake felt on Vancouver Island on December 17, 2021, and within the story are reminders of the greater risks to the region.¹⁸

Stories from the community:

Journalists who share stories of the trials, triumphs, personal battles, and grassroots initiatives that involve risk and resilience will also share the facts of the bigger picture. Such an example are the personal stories of resilience and farmers banding together after floods in Sumas Prairie in the fall of 2021, as reported by Global News.¹⁹



GAPS

The media landscape and the way the public is consuming news is constantly changing, so journalists and media platforms must stay agile. Journalists have a responsibility to stay informed about emergency procedures as well as the latest risks to our communities, and to navigate the best way to get information to the public. The media also needs an open line of communication to all those involved in risk reduction and resilience, especially as messaging and information changes. However, as much as the way people are consuming news is changing, the core mission of providing facts to the public is even more important in the age of misinformation.

There is no overarching protocol for the media on how to respond to disaster, at any stage. The media has journalistic guidelines—at both federal and agency levels—but there is no specific protocol to be followed by all agencies. However, individual newsrooms have extensive emergency response protocols, which rely heavily on a list of existing of contacts. These include readily available and predetermined experts and officials who can be contacted during breaking news. Developing these relationships ahead of time is key. Often these protocols are created following an event. The 2021 Haida Gwaii earthquake, for example, initiated a detailed contacts document and procedure for the CBC Vancouver newsroom.

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OPPORTUNITY

For all phases of risk reduction and resilience, the media has the ability to:

- Quickly deliver critical information to large audiences over multiple platforms.
- Provide critical information to the public about resource services during a crisis (e.g., information about mandatory evacuations during wildfires and where to follow for updates).
- Increase public awareness about disruptions to daily life (e.g., alert the public of changes to infrastructure following the November 2021 floods).
- Reassure and calm the general population; encourage calm under times of great stress (e.g., during the ongoing COVID-19 pandemic).

 Take down paywalls during a disaster (e.g., during the first year of the pandemic, CBC offered its streaming services for free).

RECOMMENDATIONS

Additionally, there is opportunity to address existing challenges by applying the following recommendations:

1. Highlighting communities that are resilient. When disaster strikes, accountability to communities and individuals who have suffered is often the main priority, which means focusing on what hasn't or still needs to be done when it comes to resilience. Positive news stories are harder to find outside the realm of personal resilience. Reframing the narrative during and after high-risk events can help with this. For example, during major flood events where some communities are hit very hard, finding stories of communities that recently undertook retrofits, upgrades or entire projects (like dikes) to protect against this kind of event would help to show the tangible side to preparation. This is exactly the kind of story that could inspire change in other communities.

Recommendation: Work with an expert who can help find these stories. It may be hard to know whether an area would have experienced a more significant impact from an event like an earthquake, flood or heat wave without an expert with "forensic



expertise." Pairing such experts with newsrooms would really help to be able to tell stories of success and resilience.

2. Planning for telecommunication resilience and redundancy.

The majority of media organizations rely on large technological infrastructure (telecommunications) to remain in place. Most news organizations have contingency plans to outsource outside of the province but this should be regularly reviewed and updated. For example, during a major seismic event in Vancouver, broadcasting will revert to Toronto, with collaboration with ham radio operators. Most of the time, such plans only get reviewed following a disaster.

In an emergency, major news organizations know where they are in the priority sequence of getting infrastructure back online. All news organizations, especially those that have come to provide regular updates and that a portion of the public might rely on during a disaster, need to have a contingency plan and must coordinate with emergency officials.

Recommendation: Set up crossmedia collaboration. Perhaps during urgent times, social media accounts, landing pages, radio spots and other platforms could be temporarily taken over by other organizations. Currently, collaboration (pooling resources) does sometimes happen between competing agencies during times of need. For example, CBC and Global share video during some breaking events.

3. Staying focused on public safety. Press briefings with a Q&A period with reporters during an unfolding crisis are critical in helping to distill information to the public. Sometimes reporters may appear aggressive and adversarial, while experts and politicians can seem hesitant to share the full picture (perhaps for fear of being misquoted) and unwilling to stray from key messages. A note that this scenario is the minority; the majority show a very positive working relationship between the two sides.

Recommendation: Train briefing staff from other agencies.

Knowing that both sides are trying to get information, perhaps there is a chance to expand on basic media training with an understanding of what makes a briefing effective for newsrooms. Formal media training does exist, but there is an opportunity at the beginning of each "season" for all parties to meet and be reminded of the risks for the season ahead and what each party wants to get out of future briefings.

When presenters have preproduced "simple" slides and graphics of the information they are trying to convey, either during media briefings or press releases, the story immediately has higher engagement and is easier to share across platforms. Especially when journalists are working to a deadline. Visuals have to be simple, so that organizations do not have to reproduce them in-house. These should be easy for the media to share and point people to. Reproducing slides from the COVID-19 briefings, for example, has been very time consuming. Simple is best for mass public consumption.

Researchers can assist media by providing stills and video of actual people doing the work they are wanting to share. Again, offering additional visual or audio elements makes a story so much easier and more engaging to produce across platforms.

4. Having more journalists with expertise. While the topic of risk and resilience stretch across a broad range of content units (politics, community, business), reporters have historically not been assigned to this topic as a beat. Having insider contacts and relationships in the way that Capitol Hill reporters do, for example, would help drive the story with the same level of importance as other beats.

Recommendation: More beat reports and/or regular experts.

The pandemic is a great example of a situation where several high-profile epidemiologists were a regular part of programming. This built trust between the



experts and the audience. As well, these experts have become an invaluable resource behind the scenes for verification, thoughts, and guidance on the science and policy. The same system could work well for resilience experts and scientists.

Newsrooms could hold public town halls to help connect agencies and information and answer questions or engage with the public. Newsroom website landing pages could help direct the public to the direct sources of information they are looking for (i.e., a place on a media platform where the Resilience Pathways report can live).

THE CHALLENGE

Getting information to the most vulnerable members of the community is the most challenging aspect of media's role in disaster risk reduction. Often the most vulnerable are also those most greatly affected by disaster and have the least access to a platform where their voices can be heard. During the 2021 heat dome, for example, most of the heat-related deaths were older people living alone, and people living in low-income housing. This is also the audience that is most difficult to reach and impact.

Having a multi-disciplinary approach with the shared goal of reaching the most vulnerable would sharpen the message for all those consuming news. At this point, telling our audience to "check in on neighbours" has not been enough and we need collaboration at all levels to find solutions; a multidisciplinary town hall could be a good first step.

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RESOURCES

1. How to work with media to communicate effectively during an emergency:

"The Media's Role in a Crisis, Disaster, or Emergency." Centres for Disease Control and Prevention. Accessed May 4, 2022. <u>https://emergency.cdc.gov/cerc/cerccorner/article_031517.asp</u>.

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3.2 THE ROLE OF PROFESSIONAL ASSOCIATIONS IN DISASTER RISK REDUCTION

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BY:

Harshan Radhakrishnan, P.Eng., Professional Associations Adaptation Working Group

Bev Windjack, MBCSLA, Professional Associations Adaptation Working Group

CONTRIBUTORS:

Deborah Carlson, LLP Donna Rodman, MBCSLA Nelson Lee, P.Eng. Paul Nuttall, RPF Peter Mitchell, P.Eng. Robin Cox, PhD Tom Llewellin, AIBC, MBCSLA

EDITORS:

Sahar Safaie, Sage On Earth Consulting

Shana Johnstone, Uncover Editorial + Design



ROLE OF PROFESSIONAL ASSOCIATIONS

DESCRIPTION

Professional regulatory bodies and associations (referred to jointly as professional associations) govern the activities of their registrants and members with requirements for professional status and professional development, codes of conduct and ethics, standards of practice, and other guidelines, oversight, and disciplinary processes. Governance that sets and maintains standards of practice and training, including rigorous accountability for one's decisions and work, is what separates professionals from non-professionals. In an increasingly specialized world, with ever-more limited resources for government agencies, decision makers in the public, private, and not-for-profit sector increasingly look to professionals, such as foresters, biologists, agrologists, engineers, geoscientists, architects, lawyers, landscape architects, and planners to provide critical information and support for decision making about a wide range of issues. The influence of professional associations is far-reaching and well placed to play a

complementary role to government as a distinct part of civil society.

It is the combination of disciplines, their independent and collective responsibility to community and public trust, and their frequent role in translating government regulation and policy into practice that make the impact of professional associations both effective and potential—so important. Their professional (and often legislated) governance and collective expertise in a wide range of sectors provides the communities in which they live and work with expert knowledge and accountability.

Professional associations govern professional interactions with the social, natural, and built environment, making them well positioned as leaders and key advisors in disaster and climate risk management. They are nonpartisan, facilitate innovation, communication, and connection, and have a professional responsibility to ensure their members have access to and are working with current knowledge around the full continuum of risk, resilience, and recovery. Associations stimulate action from within their membership, contribute to public education and awareness, and can play a vital role in providing communities with expertise founded on established standards and accountability, ensuring community expectations of good practice and social purpose are met.

Professional associations embrace diverse types of trusted experts, creating the potential for rich dialogue around hypotheses, new and implemented ideas, and ongoing research. Collectively, professionals play critical roles in ex-ante and ex-post measures. By supporting integration of risk-informed planning and design to avoid creation of new risk or reduce existing risk, as well as supporting emergency preparedness and response, professionals play a key role in reducing potential impacts of various hazards to local infrastructure, watersheds, housing, and economies. They are the ones doing the "building" in "building back better," implementing nature-based solutions, and decarbonizing buildings and industrial processes (Figure 1).

The influence of professional associations is farreaching and well placed to play a complementary role to government as a distinct part of civil society. . . [They] govern professional interactions with the social, natural, and built environment, making them well positioned as leaders and key advisors in disaster and climate risk management.

In BC, a number of regulatory bodies and professional associations have the responsibility for self-regulating their respective professions and protecting the public interest within the scope of their professions. In February 2021, the regulatory bodies for agrologists, applied biologists, applied science technologists and technicians, engineers and geoscientists, and forest professionals transitioned to operating under the new *Professional Governance Act (PGA)* (SBC 2018, c 47), a consolidated framework that sets consistent governance structures and standards for self-regulated professions¹ including a clear directive for the regulatory bodies it governs to "serve and protect the public interest with respect to the exercise of the profession, professional governance, and the conduct of registrants in the registrants' regulated practice; and to exercise its power and discharge its



Figure 1: Professionals play a key role in reducing potential impacts of various hazards to local infrastructure, watersheds, housing, and economies; they design and approve built projects (Photo: LADR Landscape Architects).



responsibilities in the public interest."2 The PGA also establishes a statutory Office of the Superintendent of Professional Governance (OSPG) in the Ministry of the Attorney General, responsible for administering the PGA and for ensuring that best practices for professional governance are implemented. While the PGA does not specifically address responsibility for action in the areas of disaster and climate risk, with their legislated responsibility to protect the public interest and maintain professional standards in their areas of practice, professional associations have the responsibility to promote and enhance the ability of their registrants to respond and adapt to changes in practice environments, advances in technology, and other emerging issues.

ALIGNMENT WITH THE SENDAI FRAMEWORK

In BC, most professional associations include upholding public health, safety, and welfare in their Act or mandate; this aligns with the Sendai Framework which advocates for "the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries."³

Professional associations are mentioned in the Sendai Framework under "non-state stakeholders," with a critical role in managing disaster risk aligned with the "whole of society" approach, which the framework promotes. Professional associations accept responsibility for their expert role and agency in promoting sustainable development. They strengthen action at a local level through partnerships among industry and institutions, the private sector, and civil society, including mobilizing volunteers aligned with the Sendai Framework's four priorities for action.

UNDERSTANDING AND REDUCING RISK

RISK REDUCTION PRACTICE AND CAPABILITIES

For many decades, the professional associations have played a role in risk management and have responded to past events—directly as associations, and indirectly through association members and registrants. They continue to play an active role in climate and disaster risk management through a wide range of programs and activities. Professional associations do not have a mandate to collect information around post-disaster damage and loss. However, some associations provide guidance and training so registrants can carry out assessments in a post-disaster scenario. More commonly, professional responses to post-disaster damage and loss are documented and shared through a wide range of media.

PROFESSIONAL PRACTICE GUIDELINES

The guidelines developed by professional associations are discipline oriented. Examples are:

- At the time of writing, Engineers and Geoscientists BC (EGBC) is working on revising Professional Practice Guidelines on Landslide Assessments and Dam Safety Reviews. For the list of current professional practice guidelines and practice advisories from EGBC, visit www.egbc.ca/guidelines.
- EGBC in collaboration with BC Ministry of Transportation and Infrastructure created Developing Climate Change-Resilient Designs for Highway Infrastructure in British Columbia.⁴
- Association of BC Forest Professionals, College of Applied Biology, and EGBC coauthored Legislated Riparian Assessments in BC.⁵
- EGBC, in collaboration with UBC Civil Engineering Department, and commissioned by the Ministry of Education, developed Seismic Retrofit Guidelines⁶ for the seismic assessment and retrofit of existing school buildings.

PRACTICE RESOURCES

Practice resources are developed by professional associations in collaboration with external stakeholders and partners including (and not limited to) all orders of government, non-governmental



organizations and standards development organizations. Examples are:

- EGBC worked with the National Research Council on the National Guide on Urban-Wildland Interface Fires, and the Coastal flood risk assessment guidelines for building and infrastructure design: supporting flood resilience on Canada's coasts.⁷⁸
- BC's Professional Associations Adaptation Working Group was consulted for *Low Carbon Resilience: Best Practices for Professionals*,⁹ published by the Adaptation to Climate Change Team at Simon Fraser University.

CONTINUING EDUCATION AND TRAINING

Another very important function of professional associations that can be effectively leveraged to support risk management in society is their provision of continuing education and training. Additionally, many associations have developed or are developing climate-specific policies and a range of micro-credential requirements for their membership (Figure 2).

Assessments, for example, often require professionals to have microqualifications or advanced learning for additional competency. Flood hazard assessment reports must be prepared by a "Qualified Professional" who, for this purpose, is defined as a professional engineer or geoscientist



Figure 2: Professionals must pursue continuing education to stay current with knowledge and practice (Photo: LADR Landscape Architects).

with experience or training in geotechnical study and geohazard assessment, or in geotechnical engineering, or a person in a class prescribed by the minister under subsection 7 of the PGA. To meet the provisions of the Riparian Areas Regulation, riparian area assessments must be completed by a "Qualified Environmental Professional" who, for this purpose, is defined as an individual registered under the PGA.

Association of BC Forest Professionals (ABCFP) created initiatives and partnerships around wildfires in BC. In 2019, ABCFP and BC Wildfire Service collaborated to develop and deliver training for forest professionals and others. In 2020, ABCFP hosted webinars on "Wildland Forest Fire and Fuel Management Stakeholder Engagement," and "Integrating Fire Behavior Principles in Prescribing Fuel Treatments," and the association also expanded wildfire-related practice areas to better reflect emerging areas of professional practice. ABCFP is currently engaged with UBC and BC Adaptation Learning Network initiatives to develop wildfire risk mitigation and related courseware and predictive tools for forest professionals.

COLLABORATION AND VOLUNTEERISM

Knowledge exchange within and between associations is increasing and new collaborations are continually being formed, such as risk-related committees, advisory groups, and task forces, to focus on the delivery of knowledge to members within professional associations. These activities can collectively contribute to the public's ongoing trust in professional associations and in professional associations' ability to deliver.



For example, the BC Professional Associations Adaptation Working Group (PAAWG), initiated by West Coast Environmental Law (WCEL) and formally established in 2015 by the provincial Climate Action Secretariat, has thirteen members (professional associations or organizations). When PAAWG became part of the BC **Regional Adaptation Collaborative** work undertaken by the Fraser Basin Council (FBC), FBC became the chair. One of PAAWG's positive outcomes is the Joint Statement on Professional Leadership in a Changing Climate,¹⁰ adopted in 2016 by ABCFP, Association of Professional Biology, College of Applied Biology, Planning Institute of BC, and the BC Society of Landscape Architects.

In another example of collaboration, EGBC and BC Housing together have established a list of professional engineers with availability to respond to earthquakes and other natural disasters.

STRATEGIC FRAMEWORKS AND KNOWLEDGE MANAGEMENT

As professional liability for professional associations and their registrants increases, so too does the demand for accessible evidence-based knowledge around risk management. In response, professional associations are acting to address and reduce both their risk to exposure and the risk to society by increasing risk management and climate knowledge delivery to their membership, often through platforms open to the public. The speed at which they act is, in part, dependent on their capacity as many professional associations rely on member volunteers to do this work. Examples are:

- BC Adaptation Learning Network, established in 2019 through the support of several BC universities and professional associations, created a *Climate Adaptation Competency Framework*¹¹ to ensure those working in climate adaptation have expertise and abilities to perform climate adaptation job functions.
- BC Institute of Agrologists hosts a publicly accessible webpage that provides up-to-date links to educational resources around natural resource management.
- Both the BC Society of Landscape Architects (BCSLA) and EGBC have open climate portals on their websites; the BCSLA site is curated and includes nearly 1,000 resources. EGBC has released a *Climate Change Action Plan*¹² that provides a structured and proactive approach to support its registrants with managing climate impacts and reducing emissions in professional practice.

While some associations' knowledge platforms are open, communication to the public is largely the responsibility of the public sector and, to a lesser extent, private sector practitioners.

Professional associations also use their internal strategic frameworks to advance climate and risk management practice. Examples are:

- Writing "preparing for climate change" position papers that outline the association's position on disaster risk reduction, sustainability, and their plan and expectations for moving forward through the collective work of their members.
- Encouraging members to educate themselves about UNDRIP, the Truth and Reconciliation Commission, Indigenous Knowledge and culturally sacred spaces, and to commit and contribute to reconciliation.
- Establishing professional performance standards or guidelines that include risk-based approaches or updating existing standards to include risk-based approaches. Although these guidelines and advisories may have limited applicability in the world of unpredictable and ever-changing risks, they are typically developed in collaboration with multiple stakeholders and, therefore, the guidance developed is relevant and broadly applicable to multiple professional groups and situations.
- Architectural Institute of BC, in coordination with BC Housing, EGBC, and the Justice Institute of British Columbia, created a framework for their respective organizations to participate in post-disaster building assessments.



HAZARD AND RISK DATA AND INFORMATION

Disaster and climate risk information is primarily a component of continuing education that professional associations provide through knowledge sharing and resource delivery; individual associations' approaches vary somewhat. EGBC provides one example—it has an EGBC Disaster Recovery Hub (internal to operations) and integrates disaster and climate risk information to develop professional practice guidelines and training for its registrants.

Professionals with agency can use the knowledge and resources, in whole or in part, as a basis for revising and creating new policy around economics, planning, development, disaster risk mitigation, and disaster response. This, in turn, impacts all aspects of development, including land acquisition, financing, schematic design, approvals, construction, and occupancy, and ultimately influences our connection with nature, relationship with community, food and clean water security, and health; in short—our sustainability (Figure 3).

Members of professional associations use data produced by all levels of government, NGOs, and academic institutions as well as data created through their own work; they benefit greatly from open-source educational material posted to academic and research websites. It is often opensource material and member- or



Figure 3: The knowledge professionals learn allows them to create new policy that affects all aspects of land development (Photo: LADR Landscape Architects).

colleague-produced work that is posted by professional associations on the web and social media, newsletters, and magazines.

Professional associations mostly use open-access information on climate and disasters. The sources include but are not limited to:

- <u>Action on Climate Team</u>
- Prairie Climate Centre
- Adaptation Learning Network
- <u>Natural Resources Canada Climate</u> <u>Change Adaption Platform</u>
- <u>Climate Data Canada</u>
- <u>Fraser Basin Council Retooling for</u> <u>Climate Change</u>
- International Panel on Climate
 <u>Change</u>
- <u>Preparing Our Home Sharing</u> <u>Circles</u>
- <u>Aboriginal Housing Management</u>
 <u>Association</u>

GAPS

To fully understand climate and disaster risk and what professionals can do in managing the risk, a body of knowledge is required. This knowledge needs to be transdisciplinary, interprofessional, cross-cutting, and accessible; it needs to include Indigenous Knowledge and nature-based solutions. In this instance, accessibility includes use of a common language because community wellbeing, design, and scientific vernaculars may not be interchangeable, and if the exchange of knowledge is not clear, much may be lost in translation. The knowledge must address scale and all facets of disaster risk, including but not limited to: health, culture, economics, livelihood, food security, clean water and air, infrastructure, structure, and environment. A common repository of knowledge to hold information about hazards, risks, and responses would be useful, as would a compilation



of model bylaws and policies to address these risks. Access to data, information, and methods that are paid for with the public funds should be available to all professionals for use and to build on.

There is a huge demand from professionals for resources and guidance to support nature-based approaches to disaster risk reduction (DRR), especially resources to obtain the detailed and often extensive baseline information that is necessary for nature-based methodologies. Professionals are constrained in the approaches they can recommend by their minimal capacity to obtain data relevant for specific sites in the context of project-based work. Gathering baseline and monitoring data on a regional and sub-regional level relevant for ecosystems is critical.

A body of knowledge is required . . . [that is] transdisciplinary, interprofessional, cross-cutting, and accessible . . . Access to data, information, and methods that are paid for with the public funds should be available to all professionals for use and to build on. Climate change adaptation and DRR have evolved separately as areas of research, policy, and practice, and there are differences in terminology, values, and interests between the two. There are very few practice resources that integrate these concepts to accelerate progress on enhancing resilience.

There is a recognized disconnect between professional associations (and, by extension, their members) and Indigenous Peoples, and between these two groups together and the rest of society. Additionally, Indigenous representation within professional associations is low. Professional associations can attempt to address the disconnect with society through outreach, but there

APPLICATION OF THE SEISMIC RETROFIT GUIDELINES TO EXISTING LOW-RISE BUILDING STOCK IN BC

In 2019, the Building and Safety Standards Branch (BSSB) of the Office of Housing and Construction Standards in the Ministry of Municipal Affairs and Housing discussed with EGBC the initiative they were undertaking to develop a building code for existing buildings that would address seismic performance. BSSB was interested in considering if the *Seismic Retrofit Guidelines (SRG)* developed for the seismic assessment and retrofit for existing school buildings could be expanded for application to various types of existing low-rise building stock (three storeys or less) in BC.

The Seismic Retrofit Guidelines Expansion Project – Low Rise Buildings was dovetailed with the development of SRG2020 for existing school buildings by using the same technical methodology:

- Performance-based damage prediction: performance-based earthquake damage prediction that embraces a wide range in earthquake damage (minor damage to total damage)
- High-performance tools: user-friendly access to this analytical database by practitioners through use of a rapid parametric selection process.
- Guidelines: 12 comprehensive manuals fully detail the technical procedures and the technical background for the *Seismic Retrofit Guidelines*. Technical questions on the guidelines are answered by the EGBC Technical Review Board (TRB).

In addition, The National Research Council and Natural Resources Canada were involved in the development of *SRG2020* – *Low Rise Buildings and the Seismic Performance Analyzer* in order to provide an independent assessment of a mature performance-based methodology. The intent of *SRG2020* – *Low Rise Buildings* is to identify common minimum evaluation and mitigation measures for the seismic performance of existing buildings.



is no clear process for such action, and it would be incomplete without interprofessional and Indigenous Peoples' collaboration. The lack of collaboration and understanding of how associations and all Indigenous people can benefit from addressing DRR cooperatively is a significant worry as, regardless of their expertise, no one group has the knowledge or capacity to effectively address the complexities of disaster risk management on their own, and building relationships takes time. DRR is a wicked problem.

There is a recognized disconnect between professional associations (and, by extension, their members) and Indigenous Peoples. . . . Additionally, Indigenous representation within professional associations is low.

Funding is insufficient for all aspects of DRR: trying new techniques and options at all scales; enabling access to climate and DRR info; doing educational outreach; undertaking discipline/interdisciplinary/ Indigenous-based DRR research; preparing action-specific guidelines, and more.

Businesses' role in DRR is largely overlooked despite being impacted



by, and contributing to, the effects of DRR. Firms providing professional services are starting to be regulated under the PGA. There are three pillars to the regulation of firms: ethics, continuing professional development, and quality management. While the process of regulation enables meeting requirements of the PGA and the bylaws, more work needs to be done to understand the full extent of the role that firms could have in relation to DRR.

OPPORTUNITY

RECOMMENDATIONS

In addition to Table 1 below, it is important to mention here a list of challenges and tasks that PAAWGⁱ members identified, in 2016, to assist interprofessional collaboration. Tackling the list might be a timely first step:

- Create a shared vocabulary for communicating risk broadly, cross-disciplinary communication, and developing a business case for adaptation action; create a process to support development of a shared vocabulary.
- Communicate climate action as a professional obligation and to empower professionals.
- Integrate climate and DRR skills into professional practice areas.

- Create shared and experiential learning opportunities and case studies to support building on successes and learning from failures.
- Increase the effectiveness of existing tools: disseminate existing tools and learning resources more widely and evaluate uptake of existing tools; develop memorandums of understanding between professional associations to share knowledge and provide access to the data and tools behind individual associations' website login (or locate knowledge on an open-source platform).
- Provide every professional with ongoing continuing professional development (CPD) and beyondintroductory climate adaptation/ DRR knowledge.
- Check on use of guidelines (enforcement); if guidelines are not in place, develop them.
- Identify basic climate change impacts and DRR courses required for association registration or, if the professional is already registered, for CPD (like an ethics course).
- Create and use effective surveys to assess member awareness and involvement.
- Recruit mentors; potentially share mentors between associations.

¹ PAAWG exists for the purpose of interdisciplinary collaboration among, primarily, professional associations focused on natural resources.

Table 1: Recommendations

Recommendation ¹³		Description of Impact	Priority Level	Capabilities Needed
1.	Develop a collaborative community of practice amongst professional associations, and between professional associations and Indigenous Peoples.	Creates a venue for interdisciplinary collaboration, knowledge sharing, and a repository for shared resources and case studies (exemplars).	Critical	Non-volunteer to facilitate discussion, training, etc.; knowledgeable participants; Indigenous participation may need separate funding.
2.	Develop guidelines for the relevant professionals on nature-based solutions for climate change adaptation, disaster risk management, and resilience.	Empowers action at various scales, costs, and levels of effort; opportunity for immediate action and outreach.	Critical	Funding and technical expertise for research and development.
3.	Make the connection between climate adaptation and disaster risk reduction with GHG emissions reduction more explicit in guidelines and strategic frameworks of professional associations.	Enables strategic planning around "build-back-better" and maximizes co-benefits that reduce disaster risks and emissions.	Critical	Funding for outreach; leadership.
4.	Create policies or guidelines to ensure disaster and climate risk management is incorporated into rezoning and development-related applications.	Helps protect the public and brings DRR expertise to rezoning and development approval processes.	Critical	A coordinated public-private sector effort; change to development approval policies (possibly legislation).
5.	Provide open-source access to all disaster and climate risk management projects, research, and strategic planning that are paid for from public funds.	Reduces cost and speeds up risk data and DRR knowledge sharing by building on work already completed.	Recommended	A managed repository and jurisdictional willingness (this could be at the provincial level, extend across several provinces, or be national).

THE CHALLENGE

In addition to the above-mentioned gaps and recommendations, there are three complex challenges that stand out:

 What legal liability does a professional take on, and for what period, when they become involved in DRR? Public sector requests for professional liability insurance coverage are often out of

RESILIENCE PATHWAYS step with the level of risk inherent in a project.

- 2. In a DRR project, how is the professional's responsibility to have "current" knowledge measured, and who does the evaluation?
- 3. Professionals work for a variety of clients, including climate change skeptics and those who acknowledge climate change but are unwilling to engage in risk

reduction efforts, usually due to cost. Without appropriate policies, regulations, and standards, knowledgeable professionals face the ethical dilemma and professional dilemma of interacting with a client that refuses to incorporate disaster and climate risk management measures into the project.

RESOURCES

1. Website geared to professionals in BC, who work at the front line of climate adaptation, to integrate adaptation competencies into their professional practice through education, training, and networking:

Adaptation Learning Network. "Inspiring Climate Action." Accessed March 3, 2022. <u>https://adaptationlearningnetwork.com/</u>

2. Geared to Engineers and Geoscientists in BC, these professional practice guidelines establish the expectations and obligations of professional practice in relation to specific professional activities:

Engineers and Geoscientists BC. "Professional Practice Guidelines." Accessed March 3, 2022. <u>https://www.egbc.ca/app/Practice-Resources/Individual-</u> <u>Practice/Guidelines-Advisories</u>

3. Guidance for resource professionals developed collaboratively by the College of Applied Biology and the Association of BC Forest Professionals, focused on stewardship of species at risk in BC:

College of Applied Biology. *Managing Species at Risk in BC*. 2009. Accessed March 3, 2022. <u>https://www.cab-bc.org/file-download/guidance-resource-</u> professionals-managing-species-risk-bc

4. Independent report on the Professional Reliance Review to inform efforts to strengthen professional reliance in the natural resources sector:

Haddock, Mark. Professional Reliance Review. 2018. Accessed March 3, 2022. https://professionalgovernancebc.ca/app/uploads/sites/498/2019/05/ Professional Reliance Review Final Report.pdf

5. BC guide designed to assist local government elected officials and staff, including planners, engineers, chief administrative officers, financial officers and others, to plan and act in ways that will make their communities more resilient to the impacts of climate change:

West Coast Environmental Law. "Preparing for Climate Change – An Implementation Guide for Local Governments in BC." 2012. Accessed March 3, 2022. <u>https://www.toolkit.bc.ca/Resource/Preparing-Climate-Change-Implementation-Guide-Local-Governments-British-Columbia</u>



6. Several titles about urban design and sustainability:

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Russ, Tom. Sustainability and Design Ethics. CRC Press, 2010.

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⁶ Engineers and Geoscientists BC, "Seismic Retrofit Guidance," accessed March 3, 2022, <u>https://www.egbc.ca/Practice-Resources/Programs-Resources/Seismic-Retrofit-Guidance</u>

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⁸ Natural Research Council Canada, Coastal flood risk assessment guidelines for building and infrastructure design: supporting flood resilience on Canada's coasts, 2020, accessed March 3, 2022, <u>https://doi.org/10.4224/40002045</u>

⁹ Adaptation to Climate Change Team, *Low Carbon Resilience: Best Practices for Professionals*, 2018, accessed March 3, 2022, <u>https://act-adapt.org/wp-content/uploads/2018/12/lcr_best_practices_final.pdf</u>

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Adaptation Learning Network, *Current State of Adaptation Focused Course Offerings*, 2019, accessed March 3, 2022, <u>https://adaptationlearningnetwork.com/sites/weadapt.org/files/aln-current_state_of_adaptation-focused_course_offerings-may_2019.pdf</u>

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3.3 NATIONAL DISASTER MITIGATION PROGRAM OUTCOMES IN BC

June 2022

DRRPathways.ca





This article is part of the Resilience Pathways Report. The report has the following objectives: a) to share knowledge about existing practices and recent advances in understanding and managing disaster and climate risk in BC, including some information on relevant federal programs, and b) to provide insights on gaps and recommendations that will help build pathways to resilience in BC.

This article belongs to *Chapter 3 Climate and Disaster Risk Management: Enabling Action.* To read all articles in the report, see DRRPathways.ca.

The Resilience Pathways Report is a project of Natural Resources Canada.

3.3 NATIONAL DISASTER MITIGATION PROGRAM OUTCOMES IN BC

BY:

Grace Chiang, Public Safety Canada

Laura Friedrich, Public Safety Canada

CONTRIBUTORS:

Sue Olsen, Public Safety Canada

Kim Trafford, Public Safety Canada

EDITORS:

Sahar Safaie, Sage On Earth Consulting

Shana Johnstone, Uncover Editorial + Design



ABOUT THE NATIONAL DISASTER MITIGATION PROGRAM (NDMP)

The National Disaster Mitigation Program (NDMP) is the foundation for informed mitigation investments that could reduce, or even negate, the effects of flood events. The NDMP fills a critical gap in Canada's ability to effectively mitigate, prepare for, respond to, and recover from floodrelated events by building a body of knowledge on flood risks in Canada and investing in key flood mitigation activities. Knowledge that is up to date and accessible will not only assist governments, communities and individuals to understand flood risks and employ effective mitigation strategies to reduce the impacts of flooding but will also further discussions on developing a residential flood insurance market in Canada.

The program was established as part of the Government of Canada's commitment to building safer and more resilient communities. Budget 2014 earmarked \$200 million dollars (from 2015 to 2020) to support this new program. In light of the ongoing need for risk mitigation investments in Canada and a number of provinces and territories advocating for an extension of the NDMP, the Economic and Fiscal Snapshot 2020 earmarked funding for NDMP renewal for two additional years (2020 to 2022). There are four funding streams under the NDMP:

- Risk Assessments This stream provides funding for the completion of risk assessments to inform flood risks. Risk assessments are the foundational step in disaster risk mitigation; they identify flood hazards, potential impacts, and community and infrastructure vulnerabilities as well as the overall flood risk profile for the area.
- 2. Flood Mapping This stream provides funding for the development and/or modernization of flood maps. A flood map identifies the boundaries of a potential flood event based on type and likelihood, and it can be used to help identify the specific impacts of a flood event on structures, people and other assets.
- **3. Mitigation Planning** This stream provides funding for the development and/or modernization of mitigation plans to address flood risks. A comprehensive mitigation plan allows applicants to develop realistic and sustainable mitigation solutions by clearly outlining the plan's objectives, key activities,

expected outputs, timelines, and roles and responsibilities.

4. Investments in Non-structural and Small-Scale Structural Mitigation Projects – This stream provides funding for other non-structural and small-scale structural risk mitigation projects. Eligible projects would include actions such as the replacement of storm culverts, or would improve flood resilience by proactively preventing or mitigating damages and losses.

From 2015 to 2022, the NDMP funded 460 projects across Canada, including 132 in BC, and contributed to an increase of communities that undertook mitigation investments to reduce their vulnerability to disasters. The program helped small, rural communities and municipalities (median population size of recipient communities is 18,000) in mitigating the social and economic impacts of floods; it funded communities with higher representations of vulnerable populations, such as seniors and Indigenous people, and its sequential stream approach provided the prerequisites to develop a residential flood insurance market in Canada.

Flooding is the most common natural hazard affecting Canadian communities, and among the most costly.¹ Between 2008 and 2018, the Canada Disaster Database recorded 170 major disasters resulting in tens of billions of dollars in damages; of these, 108 were flood-related events, including flooding from major storms. Since 1970, the

Government of Canada has paid out an estimated \$8.5 billion dollars in post-disaster assistance through the federal Disaster Financial Assistance Arrangements (DFAA) to assist provinces and territories with response and recovery costs. Of these costs, 97% occurred in the past 25 years, and more than one-third occurred in the past six years alone, which indicates that disasters are increasing in both frequency and cost. This is due to the growth of population and assets. Canada's population has grown by 80% since 1970 and many of the assets are built on floodplains. The increase can also be attributed to climate change to some extent. Flooding now accounts for nearly 75% of DFAA events and two-thirds of all DFAA payments.

ALIGNMENT WITH THE SENDAI FRAMEWORK

The NDMP was informed by, and seeks to align with, the *Sendai Framework for Disaster Risk Reduction* 2015–2030, which advocates for a substantial reduction of disaster risk and losses in lives, livelihoods and health as well as in economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries. The NDMP is divided into four funding streams that seek to both address and operationalize the Sendai Framework's four action priorities.

Stream 1 (Risk Assessments) and Stream 2 (Flood Mapping) align with Sendai Framework Priority 1, Understanding disaster risk, by

developing an understanding of disaster risk in the various dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics, and the environment. Stream 3 (Mitigation Planning) is informed by Priority 2, Strengthening disaster risk governance to manage disaster risk, and Priority 4, Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation, and reconstruction. Stream 4 (Investments in Non-structural and Small Scale Structural Mitigation Projects) directly relates to Priority 3, Investing in disaster risk reduction for resilience, by providing public investment in disaster risk prevention and reduction through structural and non-structural measures.

The NDMP incorporates the guiding principles of the Sendai Framework, which recognizes the shared responsibility between governments, sectors and stakeholders, through its cost-sharing mechanism with provinces and territories, in addition to recognizing the primary responsibility of the federal government in preventing and reducing disaster risk. The program empowers local authorities and communities by funding the development of resources, providing incentives, and helping to inform decision making. The NDMP further encourages stakeholder and public engagement from across society, providing eligible funds for workshops and consultations as well as national public awareness and engagement activities to advance the discussion on overland flood insurance.



NDMP'S EFFECT ON PRACTICE

The following discussion is informed by a desktop document review, interviews with NDMP recipients, and input from the Province of BC, focusing on qualitative data. The desktop document review considered corporate, policy and program documents, and public reports. Four semi-structured interviews were conducted with representatives or recipients of six NDMP projects: Okanagan Basin Water Board, Cowichan Valley Regional District, Fraser Basin Council, and Capital Regional District (note that some entities had more than one project). The cross-section of representatives included directors and project managers, providing important perspectives on outcomes and outputs of the NDMP at local and regional levels. In addition, Public Safety Canada sought input from Emergency Management BC, which works closely with the department to administer the NDMP across the province. This report seeks to fill an identified limitation in the standard national evaluation of the NDMP. which does not involve communities directly. Public Safety Canada typically works in collaboration with counterparts in provincial or territorial governments rather than the communities benefiting from NDMP project funding.

Overall, there was consensus among recipients that the NDMP projects met the objectives of being able



NDMP projects met the objectives of being able to effectively mitigate, prepare for, respond to, and recover from flood-related events by building a body of knowledge on flood risks in Canada, and by investing in foundational flood mitigation activities.

INFORMATION PRODUCTS

A number of the recipients stated that they were satisfied with the information products (e.g., maps, reports, assessments) that were developed with NDMP funding. These information products have led to a better understanding of

local and regional flood risk and have highlighted major gaps in flood management. Maps, in particular, have been incorporated into local government planning and public websites, contributing to an increase in available information at the local level, technical analysis, and informing policy decisions for a long-term flood strategy. The Capital Regional District noted the importance of translating the technical reports into more "public-friendly" material, including summary documents with key findings. These products have played an important role in informing inter-municipal networks and provincial agencies. The Cowichan Valley Regional District indicated that the outputs of the program are now informing the Province of BC's approval process for land-use products and the maintenance of infrastructure.

All of the project funding secured by the Fraser Basin Council relates to a multi-vear initiative for the Lower Mainland Flood Strategy. The Fraser Basin Council noted that the hydraulic model was used by the City of Chilliwack to model dike scenarios and develop flood bylaws to reduce flood risks. Similarly, Cowichan Valley Regional District's tools have been translated into planning and development procedures, including public communications, bylaws, and permits. Okanagan Basin Water Board notes that the central Okanagan is now able to conduct non-structural flood mitigation planning based on the results of the mapping. Now that the project outputs and tools are available for long-term use, they have begun





Figure 1: Construction of a new pump station (Photo: NDMP).

to foster improved land management and building practices.

Final products were shared widely within municipalities and among government officials and staff, Chiefs and councillors, and emergency managers. The Fraser Basin Council established joint committees between managers, practitioners, and representatives from local governments as well as project specific advisory committees. The modelling and reports were made available to the public, and the Fraser Basin Council interviewee highlighted the importance of developing an executive summary, digital presentations, FAQ material, and other background documents with plain language and simplified terminology to ensure the information was accessible. All participating

organizations were informed that the outputs and maps were available for their use.

STAKEHOLDER ENGAGEMENT

All six interviewees indicated that they sought to encourage and incorporate a high level of stakeholder engagement and collaboration in their NDMP projects. While the NDMP does not mandate the creation of stakeholder networks, it does encourage the use of new and existing networks to accommodate the project needs. For example, the Fraser Basin Council noted challenges in capacity and technical expertise that made the ability to participate in this particular project challenging, so it set up data-sharing agreements to manage and track the use of GIS maps and modelling.

All of the recipients interviewed recognized the work accomplished to date to engage First Nations, though they also acknowledged the ongoing need for continuous engagement. Indigenous input through workshops, stakeholder committees, and working group meetings has informed priorities and the direction of the projects. For example, the Fraser Basin Council helped establish an emergency planning secretariat based on a community member's suggestion, which was then led by an Indigenous organization to support and promote Indigenous engagement for the Lower Mainland Flood Strategy. The Okanagan Basin Water Board noted that local Indigenous communities contributed to the knowledge base of historical flooding in the region.

The Capital Regional District indicated that involving the public, elected officials, and municipal staff in its NDMP projects raised the public profile of flood preparedness. Local elected officials and municipal staff learned that they have the responsibility to prepare for, and build the capacity for, flood events and emergencies. The project highlighted impacts of potential flood events and prompted policy decisions.

REGIONAL SCALE, FUNDING, AND FOCUS

A key advantage of the NDMP is that it provides an opportunity for communities to receive funding for regional projects and tools. The Fraser Basin Council and Capital



Regional District highlighted the importance of regional cooperation in the development of these types of projects, as it can be helpful to smaller communities that may not have the resources—including funds, staff, and project management expertise-to complete substantial mitigation work independently. NDMP funding enables a regional scope to help develop context-driven tools within local areas and facilitate greater relationship building between municipalities and communities. This helps to create knowledge and foster long-term strategic planning, which is important as emergency management staff are often preoccupied with other incidents or events.

The Fraser Basin Council and Capital **Regional District** highlighted the importance of regional cooperation in the development of [NDMP-funded] projects, as it can be helpful to smaller communities that may not have the resources . . . to complete substantial mitigation work independently.

The majority of the projects that were managed by the interviewees for this report fell into the Stream 1 and 2 categories, which may affect

the responses received. For example, while NDMP funding informed planning efforts as a result of the assessment and mapping stages, it is difficult to determine the value of reduced disaster-related financial liabilities for municipal, provincial or federal governments (the objective of the NDMP).² However, the recipients overwhelmingly stated that their projects contributed towards reducing financial liabilities, as these projects triggered policy work and decision making at the municipal level which is effecting changes to future developments and spin-off projects.

NDMP recipients emphasized that the focus of the NDMP on flood-related disaster and mitigation planning and the integrated approach to flood risk management (i.e., the varied funding streams and breadth of eligible projects) was positive. However, they also called for an all-hazards approach to the program to recognize disasters beyond floods. The recipients acknowledged alternative funding sources,³ such as the UBCM **Community Emergency Preparedness** Fund or the Disaster Mitigation and Adaptation Fund from Infrastructure Canada. Even so, the NDMP was noted as possessing numerous advantages, such as being better suited to the proposed projects and possessing a larger pool of available funding. In addition, it was noted that as a result of provincial caps, current funding earmarked for risk mitigation at the provincial level is not sufficient. Nearly all recipients interviewed asserted that they would have been unable to complete their respective projects without funds through the

NDMP, given the lack of a comparable alternative. Interviewees further stated that they hoped to receive future NDMP funding to continue the work funded to date.

INDIGENOUS PARTICIPATION

Program recipients present at each interview highlighted the importance of Indigenous participation and input into the plans. The Fraser Basin Council indicated that their flood planning efforts were greatly informed by Indigenous and non-Indigenous local governments. One of the biggest gaps noted in the mapping products produced was the lack of information pertaining to First Nations sites of interest; these includes land, treaties, buildings, assets, traditional fishing sites, erosion areas, and cultural and sacred sites. As a result, the potential sensitivity of mapping a number of these areas, the lack of publicly available data, and the need to obtain consent from First Nations created a complex and challenging situation for project managers.

The Fraser Basin Council risk assessment included categories related to social vulnerabilities based on census data but acknowledged not seeking out other vulnerable populations in addition to Indigenous communities. The Capital Regional District indicated that discussions are ongoing to address the needs of transient populations, Elders, and seniors.



The potential sensitivity of mapping First Nations sites of interest, the lack of publicly available data, and the need to obtain consent from First Nations created a complex and challenging situation for project managers.

OPPORTUNITY

Interviews with NDMP recipients identified many similar opportunities and challenges. Some of these were included in the 2019 *Evaluation of the National Disaster Mitigation Program*,⁴ but many were findings that are specific to local and regional perspectives (Table 1).

PROGRAM CHALLENGES AND RECOMMENDATIONS

Overall, the program recipients interviewed had positive feedback to share regarding NDMP funding and the outcomes of their projects. Many emphasized the collaborative nature of the work and sharing of joint successes. Despite the sometimes ambitious nature of these projects, overall project management has proceeded smoothly, though it was noted that this may be due to the organizations interviewed having greater capacity than some smaller communities. Recipients acknowledged, though, that as the impacts of climate change continue to be felt, there will be an increased demand for disaster and climate risk mitigation funding.

Many recipients disclosed that the NDMP timelines were challenging to meet, especially given the complexity of the projects, requirement for stakeholder input, and numerous COVID-19 complications causing delays. Recipients further indicated that the limited number of consulting firms available to undertake risk mitigation work contributed to sometimes lengthy delays, as there can be more projects than technical consultants available. Consultant firms often work on multiple NDMP projects with the same deadline for deliverables, which causes timeline issues due to lack of capacity. Other issues identified include a delay in receiving GeoBC LiDAR data, which resulted in projects using existing LiDAR, rather than waiting for the 2019 data to become available. Challenging site conditions, such as high river levels, also caused surveying delays; hydraulic modelling was then delayed due to river surveys having not been completed. Finally, permitting challenges impeded progress and result in structural project delays.

A number of general project administration challenges were identified by recipients for future consideration. One interviewee requested that the program look to minimize or lessen the burden of proof for applicants. For example, is

it necessary to provide evidence that climate change will impact the west coast, or can it now be considered common knowledge? Another area of concern was identified by Emergency Management BC, which indicated that Request for Proposals templates often resulted in higher actual costs than were estimated in the proposals, creating requests for downward scope amendment at a later date. Other recipients echoed that their proposals had underestimated the complexity and cost of the projects and noted that there was also a lack of clarity and definition for each eligible expense category in the budget. There was a desire for further standardization and guidance in terminology and methodology, to ensure regional, national and international alignment; this includes improving the sharing of information, plans, and strategies across jurisdictions.

To fully realize the disaster reduction goals of the Sendai Framework, the Government of Canada should consider broadening NDMP eligibility to reflect an all-hazards approach.

As part of this project, NDMP recipients spoke candidly of the benefits and challenges of obtaining federal funding, proposing numerous programmatic tweaks that would



improve program administration. It was acknowledged, however, that a key limitation of the NDMP is that, to date, it only funds mitigation for flood-related risks. And while the Disaster Mitigation and Adaptation Fund (DMAF) funds structural and natural infrastructure projects to increase the resilience of communities that are impacted by hazards triggered by climate change, to more fully realize the disaster reduction goals of the Sendai Framework, the Government of Canada should consider broadening NDMP eligibility to reflect an all-hazards approach. Following the NDMP's 2019 *Evaluation* recommendations, future mitigation programming will be considering interplays between hazards to increase resilience in Canadian communities and reduce the overall disaster risk to individuals and their homes.

Table 1: Recommendations

Recommendation		Description of Impact		
1.	 Simplify project administration: Lessen the burden of proof for applicants (i.e., on providing evidence that climate change will impact the West Coast). Adjust templates to ensure they better reflect the complexity and cost of projects. Standardize guidance and terminology. 	Reduces the amount of time and number of resources or capacity recipients need to dedicate to the application process.		
2.	Adapt timelines to ensure they can be met by recipients.	Increases the maximum number of eligible recipients applying to NDMP.		
3.	Broaden NDMP eligibility to reflect an all-hazards approach.	Enables recipients to apply for mitigation funding to address other hazards, such as wildfires.		
4.	Increase disaster and climate risk mitigation funding.	Reduces the impacts of climate change being felt by communities.		

ENDNOTES

¹ Public Safety Canada, "Evaluation of the National Disaster Mitigation Program (2019)," <u>https://www.publicsafety.gc.ca/cnt/rsrcs/pblctns/vltn-ntnl-dsstr-mtgtn-prgrm-2019/index-en.aspx</u>

² As part of the Canadian Safety and Security Program 2018 Call for Proposals, an *Adaptation Project Return on Investment Toolkit* is in development to help city officials evaluate the dollar amount of disaster risk reduction by assessing natural hazard impacts to economic, social, environmental, and cultural assets. <u>https://aecom.com/wp-content/uploads/2021/07/SUSTAINABILITY-PROJECTS.pdf</u>

³ Government of British Columbia, "Emergency management financial supports," <u>https://www2.gov.</u> <u>bc.ca/gov/content/safety/emergency-management/local-emergency-programs/financial</u>

⁴ Public Safety Canada, Evaluation.

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3.4 OPEN DISASTER RISK REDUCTION DATA PLATFORM

June 2022

RESILIENCE PATHWAYS DRRPathways.ca

CO-CREATING NEW KNOWLEDGE FOR UNDERSTANDING RISK AND RESILIENCE IN BC This article is part of the Resilience Pathways Report. The report has the following objectives: a) to share knowledge about existing practices and recent advances in understanding and managing disaster and climate risk in BC, including some information on relevant federal programs, and b) to provide insights on gaps and recommendations that will help build pathways to resilience in BC.

This article belongs to *Chapter 3 Climate and Disaster Risk Management: Enabling Action.* To read all articles in the report, see DRRPathways.ca.

The Resilience Pathways Report is a project of Natural Resources Canada.

3.4 OPEN DISASTER RISK REDUCTION DATA PLATFORM

BY:

Joost van Ulden, Natural Resources Canada

William Chow, Natural Resources Canada

Drew Rotheram-Clarke, Natural Resources Canada

Damon Ulmi, Natural Resources Canada

Anthony Fok, Natural Resources Canada

Tiegan E. Hobbs, Natural Resources Canada and UBC

CONTRIBUTORS:

Phil LeSueur, Natural Resources Canada

EDITORS:

Sahar Safaie, Sage On Earth Consulting

Shana Johnstone, Uncover Editorial + Design



ABOUT THE OPENDRR PLATFORM

The Open Disaster Risk Reduction Platform (OpenDRR Platform) aims to provide tools to share hazard and risk data such that users can investigate, assess, and mitigate earthquake disasters. It is specifically aimed at policy makers, risk analysts, private and public institutions, and citizens, to facilitate decision making prior to a crisis. The platform is under development and is intended to be launched in the fall of 2022.

Developed by Natural Resources Canada (NRCan) to support with delivery of a national assessment of earthquake risks, the OpenDRR Platform is middleware between hazard or risk modelling platforms like OpenQuake and end users who need to understand and evaluate risk to make investment and policy decisions. The end-user interface will operate as a web application using standard web browsers in desktop, tablet, or hand-held device environments.

Development and execution of hazard and risk assessment models is a separate process, outside of the OpenDRR system. OpenDRR receives output from these models as input, using one or more interfaces and interchange formats based on existing standards or on specifications developed by the implementation team if no standards meet the requirements.

The high-level goals for OpenDRR are:

- Support open and collaborative development, using science outputs
- Provide centralized access to the science outputs
- Provide tools and applications to engage users, transfer information, and support decision making with respect to mitigating risk
- Improve the efficiency of disseminating risk assessments results

RISK MANAGEMENT

OpenDRR provides access to datasets that help improve understanding of the earthquake risks in Canada through a variety of industry accepted standards and best practices for geospatial data dissemination. The multichannel approach, which includes application programming interfaces (APIs), web applications, and dashboards, serves to reduce barriers to the reuse of project assets. By reducing the barriers for all stakeholders to access, explore, and visualize earthquake risk information, the platform ensures that timely access to authoritative information

about earthquake risk can be utilized to build disaster resilience.

Emergency response planners will have at their disposal a suite of data products, as well as supporting web applications, that can be readily used in emergency planning. Two key elements of Open DRR are purpose-built to serve the community: 1) a dashboard that is highly customizable and allows individuals and organizations to create public or private spaces where they can query and intuitively visualize all available data; and 2) a purposebuilt application, called RiskProfiler, that seeks to communicate the key messages relating to earthquake risks without any technical capacity on the part of the user.

[OpenDRR's] multichannel approach . . . [reduces] the barriers for all stakeholders to access, explore, and visualize earthquake risk information . . . to build disaster resilience.

These elements will allow an emergency manager to obtain information about potential impacts from earthquake scenarios, such as anticipated demands on the healthcare system, disruption to housing, or financial impacts. This information can be used to develop emergency response plans and training exercises. Emergency managers, for example, will be able to use the platform to build resilience into response plans by working with healthcare planners to expand hospital surge capacity. As well, OpenDRR will provide decision makers and the general public with comprehensive dynamic map visualization (showing earthquake scenarios) for all regions in Canada. This will give information, for example, on which construction types are most at risk and may therefore be in need of seismic retrofitting so as to prevent building collapse in the event of an earthquake.

The platform will support more efficient delivery of NRCan risk assessments over time while providing a place for ongoing contribution to NRCan's risk models. and it will address the current paucity of mechanisms by which to access seismic risk information. While existing applications like GeoBC's Common Operating Picture¹ provide situational awareness after an event occurs, OpenDRR will provide comprehensive, public, nationwide information about seismic risk that can be used for preparedness and mitigation.

PLATFORM DEVELOPMENT

Early stages of OpenDRR data platform development were part of the DRR Pathways project of NRCan, contributing to two objectives of the project: "Enhancing understanding of disaster risk" and "Strengthening risk governance through knowledge exchange and community engagement."

The initial requirement focused on earthquake risk, but with a desire to include other natural hazard types (e.g., landslides, wildfires, flooding, tsunami). The decision was made to focus on earthquake risk and bring in additional hazards when the platform was more mature. Earthquake risk data and information in OpenDRR does not include secondary perils like aftershocks, landslide, liquefaction, or tsunami. Data is provided for all populated regions of Canada.

The scale and scope of the data involved in the project necessitated an approach that not only streamlined the production of science-based outputs, but also provided for a high degree of collaboration across many disciplines (e.g., policy, technology, and science) and stakeholders (e.g., provincial and municipal).

Decision-support requirements were well understood at the outset. A comprehensive set of requirements for a multitude of stakeholders was developed.² The diversity of the stakeholders and their specific needs necessitated a multichannel approach since a single application (ex: only API) was deemed to be insufficient to serve all use cases effectively.

With development led by the Government of Canada, the platform had to comply with requirements for publishing science outputs, including standardized metadata, open data,



support for both official languages, accessibility, and compliance with scientific integrity and publication policies. The scientific integrity and publishing requirements were particularly problematic as they have traditionally pushed the science and development behind closed doors. To comply with policy while supporting the objectives of the project, a balanced approach that prioritizes openness and transparency is needed.

The generation of science outputs is becoming increasingly reliant on software to automate processing, quality control, and publishing. Considerable attention was paid to alignment with best practices for Open Science.³ As such, OpenDRR adopted FAIR Principles⁴ (findability, accessibility, interoperability, and reuse of digital assets), which emphasize machine-actionability of data, and R5 Principles⁵ (re-runnable (R1), repeatable (R2), reproducible (R3), reusable (R4), replicable (R5)), which describe ideal characteristics of software code that is released as a scientific output.

ALIGNMENT WITH THE SENDAI FRAMEWORK

OpenDRR supports Canada to achieve the first priority for action: understanding risk. Risk indicators provided on the platform also align with targets established by Sendai to support end users to develop resilience strategies that are aligned with this global framework. It allows practitioners to understand the current seismic risk facing Canadians and to explore ways in which that risk could be lessened, and by how much.

PLATFORM DESIGN

SOURCE DATA

Source data for this project includes the National Human Settlement Laver (physical exposure and social fabric), the National Seismic Risk Model for Canada (CanadaSRM, probabilistic), Canada's National Earthquake Scenario Catalogue (deterministic), and boundary geometries adapted from 2020 Statistics Canada, 2016 Census - Boundary files. The National Human Settlement layer includes a social vulnerability component that addresses the challenges posed to disadvantaged groups and help end users understand how they can create more equitable strategies to benefit the most vulnerable members of society.

TECHNOLOGY STACK

The OpenDRR technology stack (Figure 1) is made up of four main components: 1) Data Processing Pipeline, 2) GitHub, 3) Applications, and 4) Federal Geospatial Platform.

DATA PROCESSING PIPELINE

The OpenDRR data processing pipeline (Figure 2) is responsible for extracting, transforming, and loading data. It consists of several open-source technologies, namely PostgreSQL with PostGIS extension, and Python.

OPENDRR GITHUB

GitHub⁶ was chosen as the platform (Figure 3) to support the development of the science outputs and related software, documentation, and tools. While well known in the software development community, it is relatively lesser utilized in the science community. However, the core functions of GitHub (e.g., versioning, repositories) were recognized to be beneficial by key contributors.

Where possible, runnable code is available to ensure transparency in the science. For example, an interested party could clone a repository and replicate a particular output, such as a dataset or even the entirety of the OpenDRR infrastructure. GitHub makes heavy use of containerization and infrastructure as code technologies for rapid deployment on personal computing devices or the cloud.

Built-in features of GitHub, such as continuous integration and deployment, community building, websites, peer review, and secure workspaces, are tools for achieving an open and collaborative approach to science, one that seeks to build consensus and drive engagement throughout its lifecycle.

Fortunately, GitHub provides many of the statistics that feed key performance indicators, such as visitor count, number and type of downloads, and number of



followers, to name a few. These will help contributors and stakeholders measure impact, sentiment, and reuse of project assets over time.

GitHub also provides robust auditing, allowing project leads to follow up on contributions as required—for example, to determine what changes were made and by whom. This functionality helps to support integrity in the science carried out on the platform and allows users from outside of the core project team to comment or contribute safely.

APPLICATIONS

Due to the diversity of use cases and user profiles for the information products (e.g., maps, visualizations), it was clear that a single solution would not be sufficient. It was determined







Figure 2: Data processing pipeline.



Figure 3: OpenDRR GitHub.



3.4 Open Disaster Risk Reduction Data Platform

that a purpose-built web application (RiskProfiler) and a dashboard (Kibana) would be required to meet the needs of all users.

RiskProfiler Web Application

RiskProfiler (Figure 4) aims to provide planners and emergency managers with information on earthquake risks. This includes deterministic and probabilistic earthquake risk assessment results at a neighbourhood scale, across Canada. The scenarios are organized into a library that users can filter based on a variety of properties (e.g., location, magnitude). The library will grow over time to include more than one hundred deterministic scenarios covering the highest risk regions across Canada.

RiskProfiler aims to provide planners and emergency managers with information on earthquake risks. This includes deterministic and probabilistic earthquake risk assessment results at a neighbourhood scale, across Canada. ... Scenario properties can be adjusted to indicate how structural mitigation (retrofit) can affect loss.



Figure 4: RiskProfiler.

The scenarios and associated risk information are intended to support emergency planning. Users are provided with a variety of visualizations that express the nature of the risk and the impacts that it may have on a community. These impacts are quantified, and in many cases, scenario properties can be adjusted to indicate how structural mitigation (retrofit) can affect loss. For example, the location and number of damaged buildings can be viewed for current conditions, or a toggle can be used to view the same metric if all buildings were brought up to modern design levels.

Kibana Dashboard Application

The Kibana Dashboard (Figure 5) is intended to support a more specific or sophisticated use case than that of RiskProfiler.

The dashboard allows users to customize workspaces where they can collaborate with others on data visualizations and reports. The entirety of available data in OpenDRR is available to dashboard users. The data is identical to what is available via OpenDRR's APIs. Users can add or link additional datasets to combine the DRR Pathway's project data with their own. For example, users could integrate risk assessment datasets provided through the OpenDRR Platform with their own linear infrastructure data to visualize the intersection between seismic risk to buildings and the existing road network.

Users can create reports, data visualizations, and maps for an area of interest. Visualizations can be exported and embedded in presentations and websites. Kibana can also be used as a platform to develop complex queries that can





Figure 5: Kibana dashboard.

be sent directly to the Elasticsearch API. This is the first of such platforms to be made available to the public containing multi-scale risk data. It will be most useful to users who have one-off use cases, for example, those tasked with developing financial or insurance policy for a specific area.

FEDERAL GEOSPATIAL PLATFORM

The Federal Geospatial Platform (FGP) is a Government of Canada catalogue of geospatial data. The FGP provides enterprise-grade geospatial infrastructure and support services to facilitate the dissemination of data. OpenDRR datasets are hosted on the FGP and made available publicly via Esri REST services for organizations that utilize Esri-based tools and applications.

OPPORTUNITY

RECOMMENDATIONS

ADDITIONAL NATURAL HAZARD TYPES

Time will be needed to further build relationships with other federal partners who hold expertise in each of the other hazards. With this in mind, the decision was made to focus on earthquake risk and bring in additional hazards (e.g., landslides, wildfires, flooding, tsunami) when the platform is more mature.

There are several ways in which additional hazards can be added. They can be integrated fully or partially depending on the nature of the data and the capacity of the responsible party. For example, at the most basic level, a repository could be set up for each hazard type and the datasets, stored as release assets, could be easily propagated to the dissemination infrastructure by way of existing processes. A more advanced approach would be to generate the datasets from within the platform as it currently done for earthquakes; this would require a fair amount of scripting (e.g., Python, Shell) to achieve, but would not be impossible.

ENGAGEMENT

To engage the public more effectively and efficiently respond to queries about the science, the project will leverage the Discussions module in GitHub. The Discussions module can support FAQs, general discussions, feedback collection, or any other type of engagement. Outside of GitHub, the primary researcher would typically have to respond to queries on an ad hoc basis—a time-consuming but necessary task. The Discussions module could reduce the level of effort to support science hosted in repositories.

Other opportunities to engage with the user community will be explored as time and resources permit.

CHALLENGES

WORKING IN THE OPEN

Working in the open is standard practice in the software community, but this is not the case in the scientific community. Despite many sciencebased institutions promulgating FAIR and Open Science, they struggle to fully adapt to the very principles upon which these are based. Instead



of working in the open from the outset, science continues to be carried out behind closed doors until such time that a final product is formally published. In part, this is a natural outcome of the way that the scientific community is structured—it is undesirable from a scientist's perspective to release to the public results which have not been reviewed. This is doubly true in the field of natural hazard and risk research, where outcomes may have direct tangible effects on the assets or safety of community members.

The science-based organization under which the OpenDRR platform is being developed decided to take a more liberal approach, open by default but closed where required. Internal policies regarding Open Science were not yet fully developed, therefore the approach was to do much of the science modelling and development in private repositories until peer review could be completed. It is expected that such work will be carried out in the open once Government of Canada policies and practices around Open Science are mature.

While not ideal, the OpenDRR did demonstrate that peer-review of science using GitHub was tractable. Transparency in the science that informs government policy is an important part of any democracy, and so the platform will continue to aspire to a future where policy-driven decisions are supported by data that is aligned with the principles of FAIR and Open Science.

CONTINUOUS INTEGRATION

It was readily apparent early in the development process that automation would be beneficial. In software development, continuous integration is a technology that integrates subsystems into larger systems on some predetermined event (e.g., tests have completed successfully for an update such as a bug fix). In the case of OpenDRR, continuous integration is used for software integration and data integration.

When new datasets are added and/ or models are updated, automated tasks are run to deploy new services, downloadable assets, and metadata. This saves a significant amount of effort and reduces the amount of time it takes to make these assets available to the community.

In the case of OpenDRR software code, continuous integration scripts are used to prepare and publish containerized solutions, generate database scripts, generate configuration files, and run tests. Deploying systems into the cloud via continuous integration is in active development and is expected to further reduce the level of effort required to deploy the software stack.

SOFTWARE DEVELOPMENT LIFECYCLE

The intersection of science delivery and software development has traditionally been carried out independent of each other; that is, the science is completed and then the system is developed. With a very ambitious delivery schedule, it was decided to do both in parallel.

The Pathways OpenDRR development utilized the scrum process with twoweek iterations. Tasks were assigned to each iteration and reported on every two weeks. The complexity of the products being developed necessitated a tight coupling of the raw science outputs with custom software and continuous integration processes.

This tight coupling presented several challenges. It was immediately apparent that a high degree of flexibility would need to be designed into the software to accommodate constantly changing data schemas. As well, the development of the science outputs moved at a much slower pace as it required collaboration with other scientists and peer reviews. The twoweek iteration cycle resulted in too much overhead on the development of the science outputs, and therefore engagement with the science staff suffered.

GITHUB

The use of GitHub as a platform for the development of the science outputs was well received and uptake was high. The core concepts of GitHub were well understood, and the distributed nature of the platform proved to be a benefit during the COVID-19 pandemic, which saw most project participants working remotely, often disconnected from the enterprise network. Fine-grain control over access to repositories and associated assets was a critical factor in the success of the platform



to support Open Science.

The 100-megabyte file size restriction imposed by the GitHub platform was an issue for some repositories. Thankfully, GitHub provides an alternative storage called "Git Large File Storage" (Git LFS) which was enabled on many repositories. Bandwidth quotas for Git LFS were exceeded. GitHub provides 1 GB of free storage and 1GB per month of free bandwidth. Additional costs were incurred to increase the quotas.

To mitigate the potential of increasing costs for managing large files, a strategy of including datasets and files in the release assets of a repository was adopted. GitHub allows for release assets (e.g., files, datasets) up to 2 GB to be stored and disseminated at no cost.

RESOURCES OR SIMILAR PROJECTS

As part of the requirements gathering exercise for the OpenDRR Platform a review of National and International risk portals, technologies and tools were reviewed and documented.⁷ Descriptions and links are provided and can be found in Section 5.2 of *A Federated OpenDRR Platform to Support Disaster Resilience Planning in Canada: High Level Requirements – Risk Management Platforms.*

ENDNOTES

¹ Government of British Columbia "GeoBC's Common Operating Picture" last accessed March 18, 2022, <u>https://bcgov03.maps.arcgis.com/apps/MapSeries/index.html?appid=11821451d60a49168d</u> <u>1f7602d379abf5</u> (requires password).

² Government of Canada, A Federated OpenDRR Platform to Support Disaster Resilience Planning in Canada: High Level Requirements – Risk Management Platforms, last modified December 19, 2019, https://opendrr.github.io/documentation/docs/opendrr-platform.html

³ Government of Canada, "Open Science," last accessed March 18, 2022, <u>https://science.gc.ca/eic/site/063.nsf/eng/h_98054.html</u>

⁴ Go Fair, "FAIR Principles," last accessed March 18, 2022, <u>https://www.go-fair.org/fair-principles/</u>

⁵ Digitalization and Open Science, "R5 Principles," last accessed March 18, 2022, <u>https://like-itn-digitalization.readthedocs.io/en/latest/4_R5/</u>

⁶ See GitHub at <u>https://github.com/OpenDRR</u>

⁷ Government of Canada, A Federated OpenDRR Platform to Support Disaster Resilience Planning in Canada: High Level Requirements – Risk Management Platforms, last modified December 19, 2019, https://opendrr.github.io/documentation/docs/opendrr-platform.html#5-2-risk-managementplatforms

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