

A LIFE CYCLE-BASED MODEL TO RISK AND CRISIS COMMUNICATION DURING WILDFIRE EVENTS IN BRITISH COLUMBIA

Final Report

June 30, 2021

Principal Investigator: Michael D. Mehta

Co-Investigators: Wendy Gardner, Jon Heshka, and Wendy McKenzie

Graduate Student Research Assistant: Merieme Boutaib

Undergraduate Student Research Assistant: Jasper Edge

This is a review of risk and crisis communication practices in British Columbia, Canada, followed by organizations involved in wildfire emergency management. With a focus on the interior of the province, this report discusses challenges and opportunities while suggesting a cycle-based model for practicing risk and crisis communication that may be more effective at mitigating risk, building trust, and improving how communication is done with internal and external stakeholders.

The principal investigator, Michael Mehta, can be reached at mmehta@tru.ca

Acknowledgements

We would like to thank the following organizations consulted for this study: BC Wildfire Service, Emergency Management BC, First Nations' Emergency Services Society, Simpcw First Nations, City of Kamloops, Thompson-Nicola Regional District, PreparedBC, and Emergency Info BC.

Funding is provided by BC Wildfire Service, Thompson Rivers University, and Canada Wildfire.

June 30, 2021 Thompson Rivers University Kamloops, B.C.

A life cycle-based model to risk and crisis communication during wildfire events in British Columbia

Table of Contents

Executive Summary ... Page 4

Chapter 1

1.0 Overview / Setting the context ... Page 6

1.1 A review of risk and crisis communication ... Page 7

1.2 Existing risk and crisis communication models ... Page 9

1.3 The Incident Command System and application in British Columbia ... Page 18

Chapter 2

2.1 Examples of communication approaches and application of holistic models ... Page 25

2.2 The role of risk perception and responses to wildfires ... Page 29

2.3 The relationship between public understanding and willingness to act upon wildfire risk reduction measures ... Page 32

2.4 Climate change-mediated wildfire risk and communicating with the public ... Page 34

2.5 Social media and crisis communication ... Page 37

2.6 Risk and crisis communication during an evacuation ... Page 38

2.7 The role of trust ... Page 41

2.8 Lessons from flood risk communication research ... Page 43

2.9 Lessons from tsunami evacuation research ... Page 46

Chapter 3

3.1 Consultations with stakeholders in British Columbia ... Page 49

3.2 Anticipated outcomes from participants in this study ... Page 49

3.3 Differences between risk and crisis communication ... Page 50

3.4 Use of the Incident Command System by study participants ... Page 51
3.5 Gaps in communication – Internal and external stakeholders ... Page 61
3.6 Managing jurisdiction ... Page 72
3.7 Use of forecasting as a tool ... Page 72
3.8 Communicating with First Nations ... Page 73
3.9 Communication challenges during COVID-19 ... Page 76
Chapter 4
4.1 A new life cycle-based approach for risk and crisis communication ... Page 78
4.2 Interpretation and application of the model ... Page 78
Chapter 5
Recommendations ... Page 82
References ... Page 86

Executive Summary

The nature of wildfire events in British Columbia has changed in recent years. With climate-change increasing the frequency, scale and duration of fires in the Province, there exists a need to revisit existing approaches to risk and crisis communication.

This report provides a synthesis of communication models frequently cited in the literature. Through consultation with organizations involved in wildfire risk management in the interior of the province, the report explores current approaches, gaps, use of the Incident Command System, internal and external communication challenges, and other related issues.

We conclude that an opportunity exits to improve how risk and crisis communication are currently conducted and propose a life cycle-based model. This model recognizes that differences exist at pre-event, intra-event, and post-event stages of a wildfire. Moreover, these stages shift from risk communication to crisis communication to a hybrid crisis-risk communication approach across these stages. Each stage also includes key features or elements that need to be a primary focus. Our proposed model emphasizes the centrality of local/Indigenous knowledge and the primacy of recognizing how wildfire events can affect perceptions of safety and impact the mental health and well-being of individuals and communities. In short, better risk and crisis communication practices lead to less loss of property and human lives, more trust, and higher levels of resiliency.

Recommendations include distinguishing between risk and crisis communication, reviewing trust and how it is built or lost, supporting amateur radio, satellite, cellular and broadband in remote and First Nations communities, studying ways to reduce staff turnover and loss of experience, and systematically dissecting parallel natural hazards for training and personnel development purposes.

Chapter 1

1.0 Overview / Setting the context

Models for risk and crisis communication have evolved over recent decades with a shift from command-and-control, top-down, linear approaches to holistic, cyclic models that strive for greater transparency. These newer models are people-centered, include a wider range of stakeholders, and they are designed to (re)build trust. The main deficiency with these models is that they fail to consider the life cycle of a disaster, or how to effectively use different approaches at various points in this life cycle. They also inadequately distinguish between risk and crisis communication.

Risk and crisis communication should be different at pre-disaster, intra-disaster, and postdisaster stages. Moreover, it is important to determine thresholds, indicators, and transition points for shifting from one approach to the next. Standard risk and crisis communication models – even the more evolved and holistic ones - tend to apply a one-size-fits-all approach which may be ineffective during natural disasters. Regional differences and context matter.

Existing models also fail to distinguish between internal and external communication, and poorly explain how best to incorporate multiple stakeholders from various levels of government including First Nations, first responders, healthcare providers, media, and others.

This knowledge synthesis will focus on reviewing existing models, and move towards developing a multi-modal, life cycle approach. Consultation with key stakeholders informs this research, and an initial emphasis will be placed on wildfire risk mitigation in the context of the interior region of British Columbia.

The need for this research is heightened given a report by Abbott and Chapman (2018) where the following conclusions on disaster management in British Columbia require examination within the context of this study. First, it is essential for communities to have access to timely and accurate information during a wildfire event. Second, efforts to include local and Indigenous knowledge in the response must be real and meaningful. Third, the response must recognize existing local governance structures where First Nations are treated as partners rather than as receivers of risk management interventions. Fourth, that comprehensive and regularly updated databases be available with contact information for all First Nations communities in B.C. Lastly, that ongoing education programs be established to reduce risk. Abbott and Chapman (2018) included dozens of additional recommendations in their report. We have selected this particular set since it fits most closely our goal of exploring the development of a new risk and crisis communication model.

1.1 A review of risk and crisis communication

In recent decades, the nature of risk has changed significantly. Since 1970, the number of disasters worldwide has more than quadrupled (Economist, 2017). Natural disasters including floods, wildfires, tsunamis, extreme weather events, and avalanches are of particular concern in British Columbia, and there is a growing recognition that communication before, during, and after such events is a powerful influencer of individual and institutional risk decision-making and behavior. Furthermore, wildfires are becoming extremely complex (Tedim et al., 2020), and concerns regarding impacts on air quality were heightened in 2017 and 2018. These issues are magnified given the propensity of climate change to increase the threats posed by wildfire, and how this may impair the resiliency of communities (Eisenberg et al., 2019).

Risk information must be expressed clearly with uncertainties explained, and this can be done at the pre-event stage through education and stakeholder engagement to help reduce misunderstandings during an event. The fluid and quickly evolving nature of natural disasters makes risk and crisis communication a complex, sometimes ad hoc approach, where agencies responsible for managing the situation easily become targets of discontent and criticism from a wide range of actors. This has been called by Nilsson and Enander (2020) when discussing wildfires a "damned if you do, damned if you don't" situation where media focus quickly shifts from questions regarding the root cause of the disaster, to how the situation was allowed to escalate, and who is to blame. During a disaster, communication is often considered by critics as insufficient in terms of timeliness and comprehensiveness, and concerns exist regarding the consistency of information provided (Sutton et al., 2020). This can generate controversy, increase costs, lead to additional negative environmental and human health outcomes, and make the risk management process needlessly complicated. It may also generate legal liability.

Risk communication is the purposeful flow of information between institutions and individuals (Covello et al., 1986), whereas crisis communication is more usually found in the field of public relations where an emphasis is on reputation management (Coombs and Holladay, 2010). Risk communication is the dissemination of information prior to an event, whereas crisis communication is the sharing of information during an event. Both risk and crisis communication have evolved given the introduction of social media (Acar and Muraki, 2011; Ultz, Schultz, and Glocka, 2011), and it is clear that social media is proving to be a double-edged sword for a lot of organizations who have new avenues to quickly disseminate information including detailed maps, graphs, and videos while at the same time being required to manage expectations, alternative interpretations, and even misinformation. Social media can also

accelerate the speed, accuracy, and veracity of information requests and this can sometimes generate uneven flows of information to various stakeholders leading to confusion and anxiety.

1.2 Existing risk and crisis communication models

Risk communication focuses on raising awareness, education, motivating individuals to act, reaching agreement, and obtaining, maintaining or rebuilding trust (Bier, 2001). It usually begins before a wildfire has started and it should be thought of as a long-term process of engagement and preparation. Risk communication is primarily oriented towards external stakeholders including the general public. By contrast, crisis communication occurs once a hazard has materialized. It involves internal and external stakeholders, and an emphasis is placed on inter-agency coordination, mobilization of the public to evacuate in some cases, and on highly specific locations and timelines as a wildfire event evolves.

A typology of models of risk and crisis communication commonly found in the literature includes the following as explained by Leiss (1996), and they incorporate lessons that were learned from mistakes made in the past (Fischhoff, 1995). These three model categories provide a good typology that allows for additional models and variations to be conceptualized.

<u>Information flow model</u>: This model is rooted in legal frameworks and is based on a "duty to warn." Communication pathways are one-way from expert/industry/government agency to the public. The mass media, and now social media, are typically the mode of transmission. The information flow model is the dominant approach used today for crisis communication.

<u>Message transmission model</u>: This approach is based on an engineering theory of communications using a source, channel, and receiver approach. The focus is on quality of the message including the impact of distortion. Additionally, many early risk communication training programs focused on how to build capacity for communicators based on teaching them appropriate phrasing as well as managing non-verbal cues including eye contact, posture, and general appearance. This model has less utility today and only remnants of it can be found in modern practices including press conferences.

<u>Communication process models:</u> These models incorporate features of the two models above and are based on the interplay between technical risk and perceived risk. There is a misguided assumption that we can meaningfully distinguish between "real" risk and perceived risk when it is clear that all risks are socially processed and subject to cognitive and perceptual biases. It is assumed that government acts as a bridge between these two domains.

In Canada, most federal government agencies use a variant of <u>Health Canada's Strategic</u> <u>Risk Communication Framework</u> (Health Canada, 2006) where risk communication is defined as: "any exchange of information concerning the existence, nature, form, severity, or acceptability of health and environmental risks." This cyclic model is a process-based approach for interacting with stakeholders which involves identifying issues, assessing risks and benefits, option analyses, selection of a strategy, implementation of the strategy, and monitoring and evaluating outcomes.



Health Canada's Decision-Making Framework

https://www.canada.ca/en/health-canada/corporate/about-health-canada/reportspublications/strategic-risk-communications-framework-health-canada-public-health-agencycanada.html

The framework is considered a strategic approach, evidence-based, stakeholder-oriented,

transparent, and focused on continuous improvement.

Other variants include the <u>Risk Information Seeking and Processing (RISP) model</u> which focuses on how individuals seek information before and during a disaster based on perceived characteristics of the hazard, affective responses, and motivation (Griffin, Dunwoody, and Neuwirth, 1999; Aliperti and Cruz, 2019).



Risk Information and Seeking Process Model

https://www.researchgate.net/figure/The-Risk-Information-Seeking-and-Processing-Model-Illustrated fig1 233169868

Internal and between organization risk and crisis communication may involve application of something called the <u>Holistic S-HELP DSS Framework</u> for overcoming challenges due to lack of coordination, information sharing, interoperability, and managing the effects of information overload (Neville et al., 2015).



Holistic S-HELP DSS Framework

https://www.researchgate.net/figure/Holistic-S-HELP-DSS-Framework_fig1_332178997

The <u>Protective Action Decision Model (PADM)</u> is based on how people respond to disasters, and it includes how information is processed based on environmental and social cues (Lindell and Perry, 2012). It is considered a holistic model.



Protective Action Decision Model

https://www.researchgate.net/figure/The-Protective-Action-Decision-Model-PADM-Reproduced-from-Lindell-and-Perry-2012 fig8 321854002

Another model reviewed is called a <u>"people-centered" approach</u> where there is a shift from a top-down, command-and-control style to more inclusion to increase participation (Siddall and Bennett, 1987; Scolobig et al., 2015). The main objective of this approach is to redistribute how risk management is carried out during disasters by building institutional capacity through inter-agency collaboration. Although not specifically a risk or crisis communication model, such an approach is assumed to be useful for establishing new and better quality communication pathways and formal frameworks of accountability. It is designed for smaller audiences and communities where local knowledge is deemed germane. The model itself involves a bidirectional set of pathways between three entities; namely, local authorities, scientific advisors, and the public. Risk communication models have come from health-related fields as well. For example, Berry et al. (2013) in discussing communicable diseases posits the following as a tool for lowering mortality and morbidity rates.



Seeger et al. (2018) developed the following complex model to explain emergency risk communication. This conceptual model is one of a handful found in the literature to recognize the importance of managing and communicating risk issues taking into consideration a lifecyclebased approach. It also makes a distinction between risk and crisis communication in an integrated way.



Zhang, Li, and Chen (2020) presented the following model of effective risk communication during COVID-19 to deal with the outbreak of the virus in Wuhan, China. Their model illustrates how collaboration of experts, government, and the public can reduce risk, uncertainty, and lead to more openness and accessibility.



The International Risk Governance Council developed the following interdisciplinary approach with a strong emphasis on assessing different kinds and levels of uncertainty. The model also highlights the importance of recognizing how the technical, social, and psychological come into risk communication. A more complex model was published in 2012 but the 2005 example as discussed by Jansen et al. (2017) is included here since it contains more detail including an expansion on sub-components.



1.3 The Incident Command System and application in British Columbia

The Incident Command System approach is central to the British Columbia Emergency Management System, and it is an organizational structure used to manage emergency situations (Government of B.C., 2002). Although not strictly a risk or crisis communication model, it represents a modular approach that requires robust internal and inter-agency communication and coordination. To understand the flow and organizational responsibilities during an incident, the following analysis represents a simplified depiction of how information and decision-making is communicated between different stakeholders. Small and large wildfires are illustrated.



- 1. Incident Commander (Crew Leader)
 - a. On the ground decision making and communicating with Zone/ Regional Wildfire Cordination officer (Z/RWCO) and Fire Center (FC) Dispatch.

2. ZWCO/ RWCO

 Liaises with local stakeholders, fulfills IC's resource requests. Provides fire behaviour predictions/ forecasts.

- 3. The Fire Center Information Officer will communicate hazard information and often share relevant information from the Local Government/ FN who issued the restrictions.
- 4. Local Government (LG)/ First Nation (FN)
 - Based on recommendations from Z/RWCO, the LG / FN will determine what (if any) Evacuation Alerts or Orders to implement. If needed, refer to large wildfire incident flow chart.
- 5. Local Government Information Officer
 - a. Responsible for communicating with the public.

Large Wildfire: This model is a piece of a larger model. In the full model, firefighters fall below the Operations sections.



- 1. Firefighters
 - a. On the ground decision making and communicating up the chain of command within the Incident Management Team (IMT): Crew Leader to Division
 Supervisor to Operations Section Chief to Incident Comander (IC).
- 2. Incident Management Team

- a. IC- head of the IMT- ranging in size based on size and complexity of the incident (it expands and contracts throughout the incident).
- b. Relevant Command Staff:
 - i. Liaison Officer (LO)- communicates with internal stakeholders- FN, industry, EOC, LG, other response organizations.
 - ii. Information Officer (IO)- communicates with external stakeholderspublic, media.
- 3. BCWS Provincial Wildfire Coordination Center (PWCC) and Regional Fire Centers (FC)
 - a. BC has six FCs, each with a full-time staff following the ICS structure. Led by the FC Manager or designate, they have all the roles found within an IMT (most IMT staff on roster are from the FC level). They have IOs who communicate with the public, the media, internal, and external stakeholders with risk communication (before and after an incident) and crisis communication during an incident. During an evacuation Alert/ Order, they will often share relevant information from the LG / FN who issued the restrictions.
 - b. The PWCC (based in Kamloops) is the next level above FC and follows a similar ICS operational structure.
- 4. Local Government (LG) / First Nation (FN)
 - Based on recommendations from the IMT, the LG / FN will determine what (if any) Evacuation Alerts or Orders to implement.
 - b. The Local Governments responsibilities are described in the BC Government's (1996) *Emergency Program Act*. Appendix C contains the portion related to declaring a Local State of Emergency and Orders.

- c. Emergency Operations Center (EOC)- typically uses Incident Command Structure like the IMT. Well established EOCs will include an IO which is an important role for crisis communication during the incident. Ideally, this same person will be conducting risk communication prior and after an incident as well, even when the EOC is not activated.
- d. The LG is also responsible for establishing the Emergency Support Services (ESS) with funding support from EMBC available. There are mobile ESS units available for deployment upon request.
- e. The LG is responsible for developing, maintaining, and implementing a Local Emergency Plan.
- 5. The Minister of Public Safety
 - a. As outlined in the Emergency Program Act, the Minister is responsible for signing off on all State of Emergencies and subsequent evacuation orders and alerts. In practice, this is a formality which often does not occur until during or after the evacuation has occurred.
- 6. Emergency Management BC (EMBC)
 - a. Formerly known as Provincial Emergency Plan (PEP)
 - b. Overarching emergency management organization responsible to plan for and coordinate the response to provincial emergencies.
 - c. Information flows from response organizations (BCWS) to EMBC through Coordination Prep Meetings with stakeholders that increase from weekly to daily as hazard escalates.
- 7. EmergencyInfoBC

A program within EMBC responsible for disseminating risk and crisis

information to the public. They receive their information through internal

channels of EMBC and relationships stakeholders. One primary means of rapid

information sharing is Twitter.

BCWS Large Fire ICS Flow Chart:

(BCWS, 2019)

S-230: Introduction to Supervision

British Columbia Wildfire Service

Large Project Fire/Incident (Type 1/2)

The Incident Commander has people performing in all command staff functions and most general staff functions. These incidents are of a significant size and complexity so adding staff in each section is necessary. However, only the positions that need to be filled to manage the specific incident are required. The Type 1 and 2 fires in British Columbia will have an IMT take over expanded attack resources that have been deployed. A team will perform all the ICS functions until the incident can be downsized and local fire personnel are able to comfortably sustain suppression activities.



Chapter 2

2.1 Examples of communication approaches and application of holistic models

In a study on risk and crisis communication, Steelman and McCaffrey (2013) examined how communication before and during three wildfires in California, Wyoming, and Montana could improve by becoming more holistic and flexible with respect to fire management strategies. To understand these characteristics, key informants including federal fire managers and local officials were interviewed. Members of the public within affected communities also participated in the study. Interviewees were asked about pre-fire activities, fire communication strategies during an event, and their overall evaluation of how well the fire was managed.

Steelman and McCaffrey (2013) identified several factors that should be considered when developing new models of risk and crisis communication, and for reviewing how well wildfires were managed. These include the following:

- (1) The use of interactive processes involving dialogue with a wide range of stakeholders to identify risk perspectives and how they might be addressed.
- (2) Delivery of messages and content that fits a community's circumstances and social context.
- (3) Providing honest, timely, accurate, and reliable information.
- (4) Using credible authority figures with local legitimacy within established communication channels.

(5) Communicating before and during incidents to leverage pre-established relationships. The study suggests that each of these factors can be evaluated independently but also together to yield a deeper understanding of the effectiveness of communication approaches. It is also suggested that these factors can be used to assess the resiliency of a community. In 2008, the Gap Fire in the Los Padres National Forest of California burned close to 9500 acres. Adjacent to a dense urban interface, the fire threatened 3000 homes and put more than \$2 billion of real estate at-risk. A full fire suppression approach using perimeter control was ultimately effective, and no homes were lost. During this fire, communication was primarily unidirectional and included the use of traditional media like radio, television, kiosks, and newspaper messaging. Notwithstanding the successful resolution of the fire, Steelman and McCaffrey (2013) reported that residents were frustrated by a lack of specific or timely information. Part of this was due to an associated power outage and the overtaxing of a call center.

Pre-fire communication efforts were community driven and the U.S. Forest Service had a limited presence in the area. Information was primarily delivered by Incident Management Team members from outside the community who were not recognized as credible. To make matters worse, the Gap Fire occurred in a large, heavily populated wildland-urban interface region which created significant communication challenges with the diverse populations both before and during the event.

By contrast, the Cascade Fire (2008) in the Custer National Forest of Montana, and the Gunbarrel Fire (2008) in the Shoshone National Forest in Wyoming, occurred in smaller, rural communities where it was assumed that communicating fire hazard was more straightforward and where building relationships with stakeholders could occur.

The Cascade Fire utilized a modified suppression tactic with perimeter control on one side of the fire and monitoring on the other side. The communication strategy included interactive activities as well as more traditional, unidirectional communications. Radio stations broadcasted live community meetings, and a local webpage was set up with wildfire maps which

proved to be more popular than resources made available through the U.S. Forest Service wildfire website.

The Incident Management Team involved in the Cascade Fire used a unified command model with the local fire chief functioning as Incident Commander despite the incident being outside of municipal jurisdiction. They also engaged volunteers to staff an information call center. These actions had the dual effect of providing the community with meaningful engagement while utilizing the fire chief's personal relationships within the community. Prior to the incident, the county and U.S. Forest Service staff had worked on evacuation drills.

For Steelman and McCaffrey (2013), the Gunbarrel Fire's communication strategy was determined to be the most effective. This was attributed to pre-incident actions such as fuel management work to reduce hazards and educational programs to teach children and adults a range of fire response techniques. Homeowners were also taught about the risks they faced. The U.S. Forest Service worked cooperatively with local government and stakeholders, and actively volunteered in the community to build agency trust and credibility.

During the fire, interactive and unidirectional communication approaches were used. The U.S. Forest Service and the Incident Management Team communicated directly with the highest risk stakeholders, and daily updates were emailed to all who subscribed to this service. The Incident Management Team was able to leverage the credibility of the U.S. Forest Service and personal relationships within the community to create high levels of trust. Even though the wildfire strategy used involved a monitor, confine, and contain strategy which was deemed controversial, and the fire burned 68,000 acres of forest, the public were satisfied because they understood why this strategy was used and felt consulted.

It is important to note that risk communication prior to an incident was key to community resilience during and after an incident. Steelman and McCaffrey (2013) observed that homeowners in the wildland-urban interface region of the Gap Fire who had higher subjective wildfire knowledge tended to undertake more risk reduction measures. Crisis communication was most effective when a credible agency representative used interactive processes that considered local knowledge and customs, provided timely, accurate, and useful information in a reliable, transparent, and honest manner. When new fire management approaches are used, additional communication with affected stakeholders ahead of an event is necessary to clarify the social context in which to frame, present, and discuss the risks during an incident. Without pre-existing relationships to assess values and past performance record, stakeholders in a community make immediate, intuitive decisions about whether an unfamiliar approach makes sense. Although continual interactive communication requires resource commitments, these investments are key to ensuring community expectations are aligned with future management trends.

A key conclusion from this study is that communication must involve building trust in the communicator, raising awareness, educating, reaching agreement, and motivating action. These actions prior to an event allow risk and crisis communication to effectively provide accurate information that stakeholders desire in a timely and trustworthy manner, and may result in less loss from wildfires.

2.2 The role of risk perception and responses to wildfires

It is important to understand how individuals perceive risk and the factors that influence how they respond to exposure to wildfire hazards. This research is still evolving and the use of it in building better risk and crisis communication models is needed.

A study by Martin, Bender and Raish (2007) surveyed three wildland-urban interface communities in the western United States to explore these dynamics. The study examined the relationship between homeowners' subjective knowledge, motivations, decision stages, and the number of risk-mitigating actions that they would undertake to protect their properties in highrisk zones. The protection motivation theory (PMT) and the trans-theoretical model (TTM) were proposed as tools for better understanding these processes.

It is argued that a risk-exposed individual goes through six decision-making stages which includes pre-contemplation, contemplation, preparation, action, maintenance, and termination. PMT and TTM are integrated and used to place individuals into three categories based on their involvement with wildfire mitigation; namely, pre-contemplative, contemplative, and action stages.

Martin, Bender and Raish (2007) show that an individual's perception of risk, and the type of knowledge they have of the hazard, is mediated by personal experience. According to PMT, individuals can be motivated to engage in positive behaviors to avoid health, social, and interpersonal risks if sound risk communication is provided. Personal evaluations of threats including severity, vulnerability, and benefit analyses, and coping factors like self-efficacy, response efficacy, and cost, are weighed by individuals to determine how much effort will be made to protect themselves from hazards. It is clear that effective risk communication can

support better individual decision-making by increasing awareness of a hazard in a manner that elicits these protective actions.

It was also found that individual recollections of past experiences with a hazard type strongly influence responses to future events. Previous experience with similar kinds of hazards may elevate or moderate risk perceptions depending on how an individual was impacted, and how psychometric factors like causality, uncertainty, and voluntariness of exposure are interpreted by individuals. For this reason, communities with frequent exposure to wildfire hazards tend to more accurately assess the nature of the hazard, and demonstrate a willingness to increase investments in mitigation measures. For example, Martin, Bender and Raish (2007) noted that objections to adopting fire smart measures often include concerns about cost, the proximity of dense surrounding forests, and loss of aesthetic value of properties. The effect of nearby neighbors or management agency actions (or inactions) can influence homeowners to adopt a similar level of action. Fire insurance requirements had little effect in encouraging or discouraging residents from undertaking mitigation actions.

From a practical perspective, it is clear that fire managers and others need to communicate risk in a way that increases the knowledge-base of individuals in a community. This can propel individuals up the trans-theoretical model (TTM) ladder leading from precontemplation, contemplation, followed by action. To do this effectively, managers should distinguish between different groups and types of individuals in a community to ascertain what motivates them.

Martin, Bender and Raish (2007) combined low/high subjective knowledge precontemplative individuals and low knowledge contemplatives together since they appeared to be motivated by perceived vulnerability. In general, elevated perceptions of vulnerability led to

greater engagement in risk reduction behavior in such individuals. By comparison, the high knowledge contemplative group were more motivated by the severity of the risk. Low knowledge homeowners in the action stage were engaged in risk-reduction behavior to some degree. They were more likely to feel vulnerable to the consequences of an interface fire, and believed that such consequences were severe enough to implement further protective actions. This group of individuals reported the least number of impediments to undertaking riskmitigating behaviors.

Fire managers are encouraged to utilize tangible examples from past fires in the region to educate the public. Before homeowners are ready to move into the action stage, they need to feel they have the knowledge, ability, and resources to mitigate risk and that their actions will be effective.

Martin, Bender and Raish (2007) also recommended that fire managers use targeted oneon-one information strategies designed to address the issues of a particular property or physical characteristics of a region. Demonstration plots that highlight ideal defensible spaces, property assessments with recommendations of specific risk-reduction measures, and free or low-cost resources to remove fuel loads were shown to be effective. All of this requires trust with local stakeholders and community leaders and the leveraging of existing relationships. It is important to note that general information communicated through pamphlets, media, and public presentations were found to have low motivational effects. Although it seems likely that there is some value in using these approaches, more research is needed to understand the relative contributions of other educational and communication techniques.

It is clear from this work that fire managers and other involved in communication need to recognize the heterogeneity of the public. Segmentation of the public, and an understanding of what motivates individuals, will prove beneficial at the pre-wildfire stage in order to reduce risk.

2.3 The relationship between public understanding and willingness to act upon wildfire risk reduction measures

Public understanding and support of fuel management practices like prescribed burns are more important than ever given debates on its effectiveness, ecological impacts, and issues around human exposures to particulate emissions. Toman, Shindler, and Brunson (2006) used principles from adult learning to study public reactions to commonly used communication techniques from fire agencies. A survey was sent by mail to members of the public in fire-prone communities in Arizona, Colorado, Oregon, and Utah. This research demonstrated a connection between public understanding of, and support for, fire and fuel management activities.

Using the Theory of Reasoned Action (TRA) and the Elaboration Likelihood Model (ELM), Toman, Shindler, and Brunson (2006) explored various kinds of persuasive communication approaches found in the field of social psychology. TRA is premised on a belief that behavioural change can be promoted through communication strategies that target individual attitudes and subjective norms. The ELM approach focuses on communication around salient beliefs, while considering the relevance of the message's content, and the credibility of the information provider.

The study suggests that adults learn information about hazards associated with wildfires in a variety of ways. Most use a problem-based rather than a subject-based approach. It is important to recognize the role of prior experiences and knowledge, especially for solving natural resource

problems such as fuel hazard management. However, past experience can create assumptions and biases that may block new information from being processed and acted upon. In general, adults tend to prefer autonomy and control over their learning experiences and this requires the creation of a trusting and safe environment that fosters effective bi-directional information exchange. Agencies need to incorporate these principles to be seen as credible and relevant by people targeted for risk-based communications programming.

More specifically, Toman, Shindler, and Brunson (2006) found that interactive methods were more effective than top-down approaches. The two most effective approaches were the use of interpretive centers and guided field trips. While interactive methods were most useful to receivers of information, unidirectional communications were particularly useful for building general public awareness about an issue or problem and were deemed cost-effective. Unfortunately, it was hard to determine if mass media mediated information was received and understood by participants in this study.

Interactive methods were better at encouraging a shift in attitudes and behaviours. The problem-centered approach explored in this study used salient, real-world examples that focused on things like local conditions and potential outcomes. Communication strategies that targeted these specific circumstances were most effective when they also provided a rationale to explain practices and potential outcomes on the effective of mitigating wildfire risk. Interactive programs worked with individual knowledge and experience to positively shape attitudes and understanding of management actions and priorities. Again, trust between people and agencies responsible for wildfire risk reduction was vital to the success of these management strategies.

Toman, Shindler, and Brunson (2006) noted that public meetings were the lowest ranked of all communication methods by participants in their study, and they were found to be only

nominally interactive. Respondents felt that they were "talked at" and given no chance to participate in discussions and agency trust eroded. It was suggested that meetings should occur early in any plan development, and should include representatives from all stakeholder groups who are shown that their contributions matter.

Before initiating communication plans, agencies need to determine specific goals and desired outcomes. While unidirectional, standardized communication is more cost-effective, messaging will often be missed, and local priorities and geographic conditions will be lost. Standardized communication assumes a homogeneous audience. Since heterogeneity is the norm, a standardized approach misses the mark for many, if not most, stakeholders. Interactive models are more time consuming but, if based on the principles of adult learning, they should provide more meaningful and lasting change in attitudes and behaviours. Practices, such as prescribed burning, are more likely to be accepted if homeowners understand the reasoning for it and are given an opportunity to personally engage in a discussion about its merits, risks, and potential outcomes. Fire managers should also be willing to openly engage in discussions on alternatives, and have an open mind to these options.

2.4 Climate change-mediated wildfire risk and communicating with the public

As wildfires increase in frequency and scale due to factors associated with climate change including temperature, earlier snowmelts, and drought, it is becoming clear that a need exists to develop better models of risk and crisis communication sensitive to these factors.

Wilson, McCaffrey, and Toman (2017) discussed the challenges associated with the expansion of wildland-urban interfaces, the use of prescribed burning as a fuel management tool, and climate change. They noted that the area of wildland-urban interfaces in the western part of

the United States increased by 52% from 1970 to 2000, and the importance of a joint response between homeowners, fire agencies, and resource management companies to reduce risk.

In their analysis, the authors review the motivations and inhibitors of homeowners to engage in fire smart actions. Although there is high public support (80%) for the use of prescribed fire as a management tool amongst participants in this study, many internal and external factors prevent this approach from being regularly used. It was recommended that four strategies be used to communicate risk and to increase acceptance of prescribed burning:

- (1) Promote increased efficacy through interactive learning. Interactive learning is the most effective model of communication to encourage preparedness before and during an incident. An interactive approach should be based on local context in a manner consistent with adult learning. This builds the highest degree of understanding and acceptance of fuel management practices. During an incident, evacuees rely on interactive information sources including public meetings and conversations with fire representatives. The effectiveness of public meetings appears to be mixed as noted previously. More research is required on this topic in order to make definitive conclusions. Informal interactions between community members have a major influence on understanding the potential consequences of fire and mitigation activities.
- (2) Build trust and capacity through social interaction. The development of relationships between communities and resource managers increases preparedness and trust. Interactive communication brings individuals together and builds social networks, which foster shared goals and a mutual sense of responsibility to prepare for future events. Engagement of a critical mass of the community is needed to encourage collective wildfire risk mitigation efforts. There is a need for participatory decision-making.

Stakeholders need a chance to identify shared values, goals, and motivations which are all critical drivers of trust. Individuals trust and give more weight to information from neighbours than public sources so, building community networks are important to disseminate information quickly to all residents.

- (3) Account for behavioral constraints and barriers to action. The Theory of Planned Behavior identifies that an increase in participation occurs when there is a positive attitude towards a particular behaviour, social pressure to adopt the behaviour, and perceived behavioural control such as a sense of high self-efficacy. Time, cost, lack of equipment or physical ability, and low self-efficacy are the main barriers for individuals preforming mitigation actions. Means to overcome these challenges must be included in pre-incident planning.
- (4) Facilitate thoughtful consideration of risk-benefit trade-offs. Every action or inaction comes with inherent trade-offs. These shift over time and communication needs to tangibly demonstrate potential risks and benefits different options available to homeowners. Communication needs to focus on long-term planning rather than on shortterm impacts, despite these being more concrete.
- (5) Overall, Wilson, McCaffrey, and Toman (2017) found that, while climate change is increasing wildfire and other natural disaster's frequency, intensity, and severity, homeowners do not need to link the two to increase fire smart actions and reduce risks. Wildland-urban interface communities need the opportunity to interactively engage with each other, fire agencies, and resource managers to build trust and relationships.
2.5 Social media and crisis communication

The rise of the Internet, and of social media in particular, has multiple impacts on how risk and crisis communication is conducted in the 21st century. In a meta-analysis of more than 100 scholarly papers on the use of social media in relation to natural and technological disasters published between 2007 and 2019, Saroj and Pal (2020) provided recommendations to disaster management organizations on best practices. Their aim was to explore how different stakeholders used social media during an event, and to discuss how best to disseminate information, increase preparedness, and encourage risk mitigation actions.

Currently, social media is primarily used by disaster management organizations to disseminate information to the public. In rapidly evolving emergencies, traditional broadcast media including television, radio, and newspapers struggle to provide updated and locally specific information. Communication specialists can utilize different social media platforms based on their target audiences and messaging options. For instance, Twitter is superior for realtime notification, Facebook increases community engagement, and blogs deliver more in-depth background details. All of these media can be used to share other kinds of information including video, real-time mapping, etc. Due to social media's capacity and interactive qualities, there are major opportunities for early crisis detection and communication. Additionally, data gathered by management organizations from public postings allows social media to function as a bidirectional communications platform, and to improve emergency response.

Saroj and Pal (2020) list five important lessons. First, risk assessment needs to be conducted and communicated prior to an incident. Second, adequate resources and effective social media team development is necessary, and it must be backed by government agency actions. As with all risk communication, interactive social media has high costs but is more

effective and may result in greater public tolerance to mistakes and missteps. It is interesting to note that public acceptance of mistakes through social media appear to be given greater leeway than in traditional media. Third, if the government fails to provide meaningful information, the public will attempt to fill the gap and this increases the risk that false or poorly contextualized information will spread. In other words, a "risk communication vacuum" will invariably be filled with information that is difficult to dislodge later. Fourth, risk control measures are more important than risk analysis to the public. Lastly, official social media accounts of disaster organizations and governments need to actively interact with the public and traditional media before, during, and following an event.

Despite the challenges associated with the circulation of false or misleading news, social media should be the primary tool for crisis and risk communication due to its instantaneous and wide reach, and its ability to remain functional during most kinds of disasters. Credibility concerns can be reduced by using official social media accounts to provide timely, accurate information and to respond appropriately to feedback from the general public.

Social media is a constantly evolving medium which brings new opportunities and tools to engage with users who look to both receive and share incident location, time information and to offer emotional, medical, or material supports. It seems likely that the development of new apps will increase the tools that managers have to identify incidents and to share crisis information with specific demographics.

2.6 Risk and crisis communication during an evacuation

In May of 2011, the Whitefish Lake First Nation in Alberta was evacuated due to a wildfire in the region. This community was significantly affected by the Utikuma Lake complex

fire located south of Slave Lake that burned approximately 100,000 Hectares. Residents were evacuated for up to three weeks.

Christianson, McGee, and Whitefish Lake First Nation #459 (2019) studied 45 band members' perspectives and experiences on this evacuation using a semi-structured interview approach. Previous research showed that wildfire evacuations have negative impacts on evacuees, and that stress can be significant. A lack of control, questions about personal safety and the protection of property, and proximity to the hazard all conspire to elevate perceptions of risk. When combined with little advance notice, the stress of evacuation can be overwhelming to some, and long-term individual and community-level impacts are possible.

In an earlier study by Epp, Haque, and Peers (1998) on three First Nations communities in Manitoba in 1995, evacuations were made more difficult due to communication issues and the absence of well-designed evacuation plans. Since approximately one third of wildfire evacuations in Canada involved Indigenous communities, and 60% of First Nations are found in wildland–urban interface regions, the need for better risk and crisis communication is clear.

In particular, the Whitefish Lake First Nation and other First Nations in Canada are under federal jurisdiction while emergency response and wildfire management are provincial in scope. Emergency management in the Whitefish Lake First Nation existed within an agreement that delegated responsibility to the community, and Chief and Council led emergency responses including declaring an emergency and ordering evacuation. In the case of a high-risk scenario, many other agencies are involved to assist in the evacuation including the federal government, provincial government, police, non-governmental organizations, and communities/municipalities that host evacuees.

Christianson, McGee, and Whitefish Lake First Nation #459 (2019) concluded that several factors can be used to explain how individuals responded to the wildfire and the evacuation order. The researchers noted that the time to prepare for an evacuation varies with some participants having a few hours to get ready, while others had 15 minutes or less. Others, however, did not receive a call or order to evacuate and found out that there was a wildfire when the Royal Canadian Mounted Police went door-to-door and advised people to leave immediately. Transportation was a major issue for the community. While some community members had personal vehicles, others lacked mobility. The elderly was especially a challenge given language difficulties.

Due to a well-known shortage of adequate housing in First Nations communities, a fear of losing shelter magnified the anxiety experienced by evacuees. Moreover, media attention focused primarily on the non-indigenous community of Slave Lake making it difficult to get specific information about what was happening in Whitefish Lake. With many chronic health issues, there was a need to process and manage additional layers of risk due to the well-known interaction of wildfire smoke and the prevalence of asthma and bronchitis in the community.

To improve the outcomes of future evacuations, Christianson, McGee, and Whitefish Lake First Nation #459 (2019) recommended that government agencies should provide additional financial and other kinds of resources to First Nations communities for emergency management. This could involve hiring a full-time emergency manager who would also focus on development and implementation of emergency plans that were customized to a community. A clear need to deal with transportation issues was also noted, as was the need for a translator to deal with language differences.

2.7 The role of trust

Multiple studies on risk and crisis communication, and parallel fields, have shown the importance of public trust in agencies responsible for disaster management. Trust increases the likelihood that messaging will be understood and believed by the public, and helps increase the social acceptance of management options that may reduce risk pre-emptively.

Raisch and McCaffrey (2019) suggested that trust consists of three interconnected components: competence (ability), benevolence (goodwill), and honesty (integrity). With specific reference to trust in wildfire agencies, this study pointed out how several factors can influence trust including how an agency communicates, inter-agency and public-agency relations, public exposure to agencies during wildfire events, experience with prescribed burns, and agency values or preferences that are expressed or assumed to play a role in guiding management actions. The first three were found to be builders of positive trust whereas all five were factors that could negatively affect the building and maintenance of trust.

Prescribed burning generally led to distrust or a neutral response with 18% of respondents believing that such management practices caused wildfires compared to the actual incidence rate of 2%. This shows how some individuals remember and magnify negative experiences but forget successful actions. This effect is commonly described in a range of psychological and sociological literature as the "saliency effect." Another negative factor that created social conflict coincided with the arrival of non-local responders during a wildfire and a perceived lack of regular communication from the agency. Generally speaking, rural communities had lower overall levels of trust. Rural communities often have less reliance on public services including support from fire response agencies. A lack of shared values and differences in forest

management preferences also tended to damage trust. Lastly, a perception of poor interagency cooperation both prior to and during an incident eroded trust.

Building trust requires specific conditions and activities. For instance, the public appreciated an opportunity to provide input to management plans which gave them a voice and an opportunity to express concerns. The frequency and openness of communication was associated with expressions of trust. Of note was the finding that respondents in all five communities studied by Rasch and McCaffrey (2019) linked trust with positive personal experiences interacting with agencies during an incident. This was framed in the context of visibly wellcoordinated efforts that fostered a perception of competence. Participants ranked inter-agency cooperation higher than agency-public relationships in terms of gaining trust. The more suburban a community, the higher the general trust in wildfire agencies. Trust was most often described based on an assessment of ability and competence of the agency. Agencies that were socially and geographically embedded in a community, and shared values, had higher levels of trust with the community. The ability to demonstrate local knowledge and to recognize public concerns about social and ecological conditions was critically important.

Several recommendations were made to fire agencies resulting from this research. The inclusion of local stakeholders in decision-making processes helps build, maintain, and restore trust within communities. Daily interactions in a community, not just during a fire, demonstrates competence and recognition of local values. When communicating crisis information, such as evacuation orders and fire updates, managers need to be sensitive to individual and community history. Building an understanding of inter-agency coordination through cross-training also strengthens community trust. With respect to prescribed burning, managers need to be transparent with the how, when, why, and consequences of the burn plan so that community

members can more willingly accept risks. This messaging should include the historic track record, goals, and experience of individuals conducting the fuel management project.

Raish and McCaffrey (2019) found that trust is singularly positive or negative. Based on the five factors stated above, individuals will make up their minds about the credibility of the agency and therefore support or reject fuel management and fire response actions. Trust is difficult to build and easy to lose, and it is clear that it takes a lot of intentional work for an agency to regain trust following a negative incident.

2.8 Lessons from flood risk communication research

Although wildfire events are unique when compared to other kinds of natural and technological hazards, there are lessons that can be learned from an examination of hazards like flooding. Both hazard types are increasing in frequency and intensity, are climate-change mediated, and unfold over a longer period of time compared to earthquakes, and technological disasters like chemical factory explosions or train derailments.

A study by Rollason et al. (2018) considers risk communication with respect to flooding events in the United Kingdom by exploring key points of failure in risk communication associated with commonly used models. Alternatives are recommended based on the kind of information needed by the public in order to limit the impacts of flooding. A multi-method participatory experiment was developed to explore existing perspectives of flood communication, and several models were tested on participants.

Traditional approaches to risk communication for flooding often involve a hybrid of a risk message model (RRM) and a risk information model (RIM) with an emphasis on transmitting information about a hazard to activate protective responses. There is an emphasis on

infrastructure and supporting property-based resilience. RIM is the translation of hazard information into action, and it is influenced by previous experience of a threat, geographical factors, socioeconomic and cultural factors, reliance on public protective infrastructure, requires higher levels of trust in the management authority, and involves balancing the protection of personal security with uncertainty.

This kind of risk communication is expert led, and it is likely to generate a limited impact on driving risk awareness or promoting resilient behaviours. RIM results in low levels of personal preparedness and information penetration which is linked to distrust in communication and management organizations. It fails to engage stakeholders in dialogue, and is sometimes interpreted as elitist, top-down, and unduly narrow in terms of the topics and issues allowed into the conversation. It is clear that this approach of centralizing and professionalizing public consultation has generated a disconnect between agencies tasked with communicating and managing risk and members of the public. Rollason et al. (2018) noted that this could also explain several of the commonly expressed reasons why the public fails to follow fully the messaging associated with advisories. More specifically, these reasons included the following:

- (1) A perception that risk managers inflate the protective value of infrastructure-based interventions without fully acknowledging limitations.
- (2) A lack of trust in the agencies communicating on the hazard.
- (3) Relative severity of the risk not communicated which results in the absence of a point of reference to compare with previous events.
- (4) The paradox of the "prison of experience," where infrequent, less severe incidents become the yardstick for developing expectations for future events.

A more robust and effective risk communication model must be more engaging, interactive, and

able to activate appropriate and timely responses. It must also be sensitive to the need to incorporate local knowledge and experience.

Rollason et al. (2018) were able to produce a series of models to be tested, and used flood risk mapping based on GIS software to run two-dimensional flood models. Participants showed more interest in active communication, particularly with real-time maps of river levels. By expressing their frustration regarding the absence of forecasting of river levels, study participants showed a strong preference to have more information presented in models to aid in decisionmaking. Developing flood or other kinds of hazard literacy can be done through active and passive communication. Active modes are more effective because they allow individuals to make informed decisions themselves rather than relying entirely on experts. Since expert knowledge is often incomplete and subject to uncertainty, a balance must be struck between using such knowledge and other competing sources. Users assess their risk tolerance and determine the timing and severity of the hazard. They can initiate appropriate risk mitigation measures to reduce exposure to the hazard. It is clear that a need exists to understand the risk so that individuals can feel in control of their decisions and respond appropriately.

Risk communication should provide more detailed, holistic hazard-based information. This can improve local "flood literacy" by building an understanding of flood dynamics and vulnerabilities. Affected members of the public are then able to examine their personal levels of risk exposure and to define suitable actions to limit these effects by increasing capacity to respond.

It was demonstrated that protection motivation theory (PMT) as well as a participatory approach were the most effective risk communication models. PMT outlines the contrasting variables which contribute to triggering behavioural responses from risk information. An

individual's actions are based on the severity and likelihood of hazard exposure relative to the potential effectiveness of embracing specific protective actions. PMT shows the complex, contested, and highly personal nature of the relationship between risk communication and behavior mobilization. The participatory approach is democratic in that it treats everyone as equals with respect to determining a course of action. By including many voices, including outliers, better decisions can often be made to reflect the values, needs, and expectations of a community. PMT was shown to be a useful tool to raise awareness and to communicate complex hazard information.

The study also found that timely warnings are the only way to reduce the impact on mental health from a natural disaster. Clear, comprehensive communication prior and during an incident is critical to reduce impacts, and to improve community well-being. Resilience and participation in risk communication are based on trust, co-production of solutions, and the development and ongoing support of relationships.

2.9 Lessons from tsunami evacuation research

Tsunamis, wildfires, and floods all represent hazards that have the potential to generate catastrophic consequences. These hazard types threaten infrastructure, expose communities to risk, and "stress test" emergency response systems and associated risk and crisis communication practices. Makinoshima, Imamura and Oishi (2020) examined 22 tsunami-related events occurring between 1960 and 2018, and developed a framework to show how behavioural and physical processes are related to preparedness. They relied primarily on academic articles and reports that had an emphasis on notifications and evacuation processes.

The evacuation process itself consists of a response phase and an evacuation movement phase. Three notification types include early, mid, and late stages. Early stage notifications tend to occur once seismic activity is detected. Threat assessments and modelling are done to provide early alerts. Mid stage notifications rely heavily on social cues including modelling of behaviour and tapping into personal networks to communicate risk-based information. Late-stage notifications are generated when physical signs of a tsunami are recognized including nearshore waves and unusual sounds.

From this research, it is clear that risk and crisis communication depend heavily on the kind of information available, interpretation of social and physical cues, as well as how this is translated by traditional broadcast media and social media through various channels. As with other hazard types, local context and different kinds of backgrounds of affected individuals determine responses. Tsunamis, wildfires, and floods all require responses attuned to both the magnitude of the threat and also the speed at which it develops. Unlike wildfires and floods, the underlying processes of threat generation are mostly hidden, and prediction of future seismic activity is challenging.

In another study on earthquakes and tsunamis, Gaillard et al. (2008) reflected on how responses by different ethnic groups varied based on the existence of a disaster sub-culture and more general cultural, economic and political factors. McAdoo et al. (2006) examined differences in mortality data and discussed the importance of using Indigenous knowledge and past experience to reduce losses associated with future tsunamis events. For example, a 1983 earthquake and tsunami in Japan led to 72.4% of people studied in Okushiri to learn lessons from the past that prepared them for future hazards. Another study by Ushiyama and Atsuo (2010) explored the intention to evacuate following a 2010 Chilean tsunami by posing several questions

related to forecasting and modelling based on the predicted height of waves. This study showed that tsunami forecasts had the potential to create non-adaptive responses where some individuals misinterpreted this information and could return to their homes prematurely. Harnantyari et al. (2020) showed that 95% of respondents begin evacuation preparations immediately when informed of a threat, while a small minority wait for the late notification stage.

Chapter 3

3.1 Consultations with stakeholders in British Columbia

Between June 16, 2020 and January 26, 2021, seven virtual consultations using a videoconferencing platform were conducted with a wide range of organizations involved in wildfire risk communication. The primary focus of this study was on the interior of the Province of British Columbia, and a combination of purposive and "snowball" sampling was used to identify organizations to participate. Participating organizations were:

BC Wildfire Service Emergency Management BC First Nations' Emergency Services Society Simpcw First Nations City of Kamloops Thompson-Nicola Regional District PreparedBC and Emergency Info BC

3.2 Anticipated outcomes from participants in this study

Since a significant proportion of the funding for this project came from a grant to Thompson Rivers University from the BC Wildfire Service, participants from that organization were asked how this research could be of value. It was clear that the BC Wildfire Service is interested in understanding more fully how and what to communicate during a crisis. Providing the public and other stakeholders with timely and accurate information is paramount to them, and lessons learned from provincial wildfire events in 2017 and 2018 in particular reinforced the need to use other approaches for communication including social media. The BC Wildfire Service emphasized how their communication practices have evolved in recent years, and they clearly showed an interest in shifting away from a "conservative" or traditional approach to risk and crisis communication to a more holistic and responsive system. A noteworthy change occurred with the introduction of information officers located in at-risk communities who could play multiple roles including liaising with local governments, the media, and others. Given that the public has an interest in accessing detailed and timely information, it is clear that the BC Wildfire Service can inspire greater degrees of trust through transparency. A fine balance exists between providing information and generating a fear response in communities, and the BC Wildfire Service is keenly interested in exploring new models of risk and crisis communication that allow them to modernize their approach, decrease risk, ensure more cooperation and coordination, and to shift from simply providing information to building a more sophisticated risk-based approach.

3.3 Differences between risk and crisis communication

The terms risk communication and crisis communication are often used interchangeably. There are differences conceptually and in practice between these approaches that require explanation and nuancing.

The BC Wildfire Service views risk communication as a process that occurs prior to a wildfire event. Effective risk communication should help prevent wildfires through proactive communication on risk factors, and to increase the level of understanding that the public and other actors have with respect to mitigating risks. This can increase community resilience, and it is based on principles found in programs like FireSmart and the use of prescribed burning to reduce fuel loads.

By contrast, crisis communication occurs during an event, and it involves communicating risk information including the suitability of options that can act as safeguards to intervene between the hazard and human life, property, and infrastructure.

The BC Wildfire Service emphasized the importance of focusing on risk communication as a tool to reduce the need to shift into a crisis communication mode. They are interested in developing new models and predictive approaches that can assist in educating stakeholders on how to interpret fire danger ratings and to understand how fast a fire moves based on rate of spread, fire intensity, fuel load, biophysical factors, etc. Models like this are complex, multifactorial, and mathematical in nature. These tools can be a valuable adjunct to effective crisis and risk communication given that the interactions explored allow for predictions to be based on both historical and emergent data. Clearly, a challenge exists with respect to explaining complex information to stakeholders so that appropriate responses are activated.

3.4 Use of the incident command system by study participants

As previously discussed, the Incident Command System is the foundation for the BC Emergency Management System (BCEMS). The Incident Command System (ICS) emerged from the ashes of the 1970 California wildfires that, in 13 days, killed 16 people, destroyed 772 structures, burned over 500,000 hectares, and cost \$233 million USD. In its review of the fires, the U.S. Forest Service learned that at the incident or field level, there was confusion derived from different terminology, organizational structure, and operating procedures between the various response agencies, and at the agency level, the mechanisms to coordinate and manage competing resource demands and to establish consistent resource priorities was inadequate.

British Columbia was the first Canadian jurisdiction to adopt ICS in the mid-1990s, followed by the Canadian Interagency Forest Fire Centre (CIFFC). In 2002, the CIFFC 'Canadianized' the U.S.-based ICS materials to improve on-site incident efficiency, improve interoperability for mutual aid, and enhance firefighter safety. All provincial, territorial, and federal wildland firefighting agencies across Canada have subsequently adopted this ICS model (ICS/IMS Canada – Communiqué, 2015).

The Government of B.C. views the British Columbia Emergency Management System (BCEMS) as a standard system for emergency response. The BCEMS is currently mandated for use within the Government of B.C. and is recommended to local authorities. According to the British Columbia Emergency Management System Manual (Government of British Columbia 2016), the BCEMS utilizes the structure and fundamentals of the Incident Command System. The guiding principles, among others, of the BCEMS include collaboration and stakeholder engagement, and clear communication. Stakeholders are expected to collaborate in pursuing an integrated and unified approach to emergency management and to have open lines of communication with each other. Valid and accurate information is to be clearly communicated to stakeholders in a timely manner and this includes messaging before, during, and after an emergency.

The British Columbia Emergency Management System Manual (Government of British Columbia 2016, p. 77) defines communication and information management as "an organized, integrated, and coordinated mechanism to ensure the accurate, consistent, and timely delivery of information to site level responders, assisting and cooperating agencies, site support personnel, and the public/stakeholders."

Regarding emergency preparedness and public education before there is an emergency, BCEMS's goals are to empower the members of a community or organization to understand risks and hazards, prepare them for an emergency/disaster, participate meaningfully in emergency management initiatives, and develop the skills they need to mitigate their personal risk.

Examples of public/stakeholder awareness and education programs listed in the BCEMS Manual include information campaigns through television and radio, internet and social media, brochures and posters, information booths, specialized awareness campaigns like Emergency Preparedness Week or Tsunami Awareness Week, workshops and public forums, and community exercises/drills.

Regarding response operations, the goals of communication and information management are to:

- Standardize key information so that it can be accessed easily within and across organizations.
- Establish a process that promotes the regular sharing of information with other response organizations.
- Link the operational and support elements within and across various organizations.
- Provide a common operating picture and situational awareness for response personnel and organizations.
- Maximize the use of readily available resources, including the Internet and web-based tools.
- Ensure the secure management and timely release of sensitive information.

- Ensure the release of credible and accurate information to the public and other stakeholders.

The BCEMS acknowledges that during operations, accurate information must be disseminated in a consistent, coordinated, accessible, and timely manner. The BCEMS notes that establishing a joint information centre/system (JIC/JIS) may be of help in this regard as it is designed to coordinate incident information provided by multiple agencies and integrate the data into a cohesive whole. It also recognizes that traditional media and social media play a critical role in the response phase.

Representatives from the B.C. Wildfire Service, Emergency Management BC, Simpcw First Nation, First Nations' Emergency Services Society, the City of Kamloops and the Thompson-Nicola Regional District were asked about their use of the Incident Command System and their approach to crisis communication. Their responses are summarized and synthesized below.

The BC Wildfire Service (BCWS) was resolute about their use of the ICS. For example, a BC Wildfire Service workbook, *S-230 (BC) Introduction to Supervision – Trainee Workbook* (Province of British Columbia, Ministry of Forests, Lands and Natural Resource Operations and Rural Development 2019) unequivocally states that every wildfire in British Columbia is organized using the principles of ICS. This position was reinforced in the consultation. Regarding crisis communications, the BCWS representatives said that they use as many communications channels, from AM radio to Twitter, as possible. They use the BCWS website for internet-based communications and also use Facebook. They engage with local media first, then regional, national and international media. There were concerns raised about the

improvement in that relationship. Public forums were found to be challenging and not their preferred way to communicate with communities.

It was opined that the public does not always believe what the BCWS says and that sometimes misstatements concerning the status of a fire are released to the public by local Emergency Operations Centre communications officers. The value of both preventative risk and crisis communications and communications during response operations were appreciated and a willingness to improve in these areas was acknowledged. Similarly, the need for structured, consistent and clear communications among participating agencies was recognized.

Emergency Management BC, as the province's lead coordinating agency for all emergency management activities, including response, planning, training, testing and exercising, uses the British Columbia Emergency Management System (BCEMS) and ICS. Emergency Management BC (EMBC) collaborates with local governments, First Nations, federal departments, industry, non-government organizations and volunteers.

It was opined that a challenge of ICS is that it was designed for an on-site management structure but does not inherently account for remote regional support systems such as those offered by EMBC. The communication channels used by EMBC, as a coordinating agency rather than a response agency, and stakeholders rather than the public will be examined.

Many platforms, including Skype, MS Teams and Bluejeans, are used for videoconferencing. Skype is currently preferred for internal government communications and largescale coordination communications. It was acknowledged that many remote First Nations and Northern communities do not have internet or reliable internet or cellular service. This poses communications challenges with these communities.

The default back-up is amateur radio. Through the Provincial Emergency Radio Communications Service (PERCS), EMBC is linked with hundreds of volunteer amateur radio operators who are available to assist with communications in the event of an emergency. Licensed volunteer amateur radio operators are affiliated with their local government's emergency management programs. Some even supply their own equipment. PERCS volunteers train regularly and often take part in emergency exercises, so they are prepared for any crisis situation that arises.

In the event of an emergency, EMBC communicates with all affected stakeholders. EMBC maintains a list that is updated at biannual workshops hosted by EMBC. Jurisdictional issues of who is in charge is resolved through coordination calls. Advance planning at the biannual meetings is used to predetermine the level of responsibility of each agency before the incident. There is sometimes a challenge in knowing who to talk to in First Nations, whether it is the elected Chief, hereditary Chief or the Band Manager.

Simpcw First Nation representatives noted that the Incident Command System is used in the running of Emergency Operations Centres (EOC). The function of an EOC, according to Emergency Operations Centre Operational Guidelines, 2nd Edition (Justice Institute of British Columbia – Emergency Management Division, and Emergency Management BC) is to provide overall jurisdictional direction and control, coordination and resource support. ICS is also used to manage large events.

While ICS is trusted by Simpew First Nation, there are some challenges in its application. In particular, it was mentioned that the ICS concepts of span of control and chain of command do not strictly fit within Simpew First Nation. The Chief's role in the IOC is as the Public Information Officer. The Chief and Band Council are informed and kept in-the-loop during an

emergency. The Chief and Band Council have adopted ICS in the Simpcw First Nation's emergency plan.

Concerning crisis communications, Simpew First Nation uses a myriad of communication channels ranging from Facebook (e.g., for a fast-moving incident like a missing person) to e-mails and press releases for longer and larger incidents. In terms of emergency preparedness, they also hold a health and safety fair. The importance of building trust within the community and starting small and building bigger was acknowledged.

The City of Kamloops uses the Incident Command System. Many staff are trained in their roles and responsibilities in the City's Emergency Operations Centre. Due to the emphasis on pre-planning and operational readiness, the City has multiple levels of redundancy and capacity.

Regarding crisis communications, the City of Kamloops utilizes an array of channels. They range from social media including Facebook and Twitter, to TV and radio, and an interactive emergency map on the City's website are all communications channels used by the City of Kamloops. In terms of preventative work, staff from the City knock on every single door in high-risk zones to educate people face-to-face to FireSmart their properties.

The Thompson-Nicola Regional District (TNRD) Emergency Services program provides the direction and coordination required to respond and recover from major emergencies or disasters, like wildfires and floods, in the rural areas of the region. The program is in place to assist Incident Commanders when emergencies exceed their response capabilities, training or available resources.

In an emergency, the TNRD may activate an Emergency Operations Centre. Its EOC is based on the British Columbia Emergency Management System which utilizes the Incident

Command System. There are 20-25 TNRD staff trained to work in the EOC, including a few who can work as the Public Information Officer (PIO). These PIOs are trained to not communicate or paraphrase any information from any other agency. The TNRD does link or share other agencies' posts to increase reach without misleading people as to the origin of the information.

The communications channels used by the TNRD include a fulsome website with a lot of preparatory information as opposed to what to do after there is a fire, a web-based mapping system that shows fire boundaries and any alert or order areas, signage, preventative programs like FireSmart, Twitter, Facebook and Facebook live streaming.

It was admitted that many remote communities do not have internet or reliable internet or cellular service. Some rural communities do not have access to a local newspaper and do not get CBC or NL radio. This poses communications challenges with these communities. There is not a lot of engagement with residents through Twitter. Most social media is done through Facebook, including community group pages.

Communications between the TNRD and First Nations is sometimes challenging. Best efforts are made to coordinate decision-making and messaging together. Each level of government issues their own alerts and orders, which are sometimes different for lands which are nearby one another.

The mission of First Nations' Emergency Services Society (FNESS) is to assist First Nations in developing and sustaining safer and healthier communities through programs such as those that focus on forest fuel management and emergency management. The Forest Fuel Management (FFM) Department works with First Nations communities, and provincial and federal governments, and agencies, to assist First Nations with wildfire prevention activities.

FFM supports access to funding to communities through planning, education, and implementation of wildfire threat reduction activities. FNESS works closely with First Nation communities, Emergency Management BC (EMBC), Indigenous Services Canada and various other stakeholders to support the successful implementation of emergency management for First Nation communities in BC.

As the role of FNESS is to assist and support First Nations in their efforts to build safer communities, their output is evidenced in the operational readiness of First Nation communities. FNESS is not itself operational and so does not use the British Columbia Emergency Management System and Incident Command System in its work but helps First Nation communities with wildfire prevention activities and emergency management guidance and support.

PreparedBC is an arm of Emergency Management BC. Emergency management in British Columbia is guided by four pillars: mitigation, preparation, response and recovery. The goals of the B.C. Emergency Management System are to empower the members of a community or organization to understand risks and hazards, prepare them for an emergency/disaster, participate meaningfully in emergency management initiatives, and develop the skills they need to mitigate their personal risk. The BCEMS notes many ways of educating the public and stakeholders including information campaigns through television and radio, internet and social media, brochures and posters, information booths, specialized awareness campaigns like Emergency Preparedness Week or Tsunami Awareness Week, workshops and public forums, and community exercises/drills.

In this light, PreparedBC helps British Columbians prepare for hazards which not only include wildfires but floods, earthquakes, tsunamis and hazardous material spills. Its website is

user-friendly and easy to navigate. Viewers are invited to "Get prepared for wildfires" or told that "It's time to be Flood Ready!" These headings are not merely technical labels but calls for people to act and to do something in advance of the hazard manifesting. There is a concerted effort to not only educate people about the hazards of wildfire, for example, but what people should do to reduce their exposure to risk before there is even a wildfire burning.

The wildfire section is broken down into three sub-sections: Before a Wildfire, During a Wildfire, and After a Wildfire. The Before a Wildfire sub-section has six tips which include how people should prepare their home and make an emergency plan. Before a Flood also has three sub-sections on what to do before, during and after a flood and has four tips which include how people should protect their home and to make an emergency plan as well.

PreparedBC is attempting to prophylactically reduce the risk exposure to wildfire by changing people's behaviour before the hazard is present. Other agencies deal with fighting the fire or responding and reacting to other hazards like earthquakes or floods. PreparedBC, however, deals with hazards proactively by educating people on ways not to reduce the likelihood or severity of a hazard occurring but of that hazard becoming a disaster because of its affect or impact on people.

Its website is one way that PreparedBC seeks to educate and prepare people. It has also published a 20-page "Wildfire Preparedness Guide" and it has a strong social media presence with 30,100 followers on Twitter and is followed by 5,000 people on Facebook. It is interesting though that Emergency Info BC's Twitter account has more than five times as many followers (169,000) than PreparedBC and does not have a Facebook page.

3.5 Gaps in communication – Internal and external stakeholders

Effective risk and crisis communication require identifying and closing gaps that exist between emergency response organizations and stakeholders. Such communication is dynamic in nature, and it involves consultation, information sharing, building understanding, trust, and mobilizing appropriate risk mitigation responses. Poor communication may increase risk and leads to loss of life and property. It can also disrupt local economies and have long lasting effects on communities and individuals including on mental health.

According to Albris, Lauta, and Raju (2020), there are three kinds of knowledge gaps commonly seen in disaster risk reduction approaches: epistemological, institutional, and strategic. Epistemological gaps occur when different interests and worldviews intervene to influence how knowledge and information are interpreted. This can be most pronounced when examining differences between experts based on discipline, institution type, and experience. It is seen mostly when exploring gaps and challenges associated with internal, inter-agency communication, or between agencies and other branches of government. Epistemological gaps can also exist when external communication occurs between agencies and the public.

Institutional gaps are associated with differences in governance and are more embedded within internal communication. For instance, barriers to the integration of science and first-hand experience into policy invariably exist, and this can have implications for risk reduction including the effective deployment of new strategies and technologies needed by emergency response organizations.

Strategic gaps emerge when a lack of common vision on how to move forward exists. These gaps can be found in both internal and external communications. A strategic gap refers to a lack of common vision on how to progress. Albris, Lauta, and Raju (2020) noted that locus of

concern also plays a role in that the integration of knowledge transfer when dealing with local disasters tends to occur in a sectorial fashion instead of in cross or multi-sectional ways. To make matters more challenging, there is poor or non-existent communication between experts and the general public, and multiples studies spanning decades on risk perception and communication show a strong and persistent disconnection between expert and public assessments of risk.

Comprehensively identifying stakeholders is essential for the BC Wildfire Service to communicate effectively both internally and externally. Building and maintaining trust is a challenge given the wide range of stakeholder types that are engaged, and ultimately trust is associated with successful mobilization of individuals and organizations. Part of this engagement involves understanding the type and amount of information that different stakeholders require. As the public begins to develop an understanding of wildfire hazards based on direct and indirect experiences, the amount of information requested appears to be increasing, and the BC Wildfire Service is attempting to address this gap by developing a deeper understanding of how to best communicate this information.

The BC Wildfire Service is interested in understanding how the daily cycle of information during a wildfire event changes over time and space, and currently uses information officers in affected communities to liaise with a range of internal and external stakeholders. This approach is likely to generate more trust and engender proactive fire protective behaviours to mitigate risk, but it does come with some challenges. Timely and frequent updates can lead to an increased expectation for even more granularity and detail. With operational issues being paramount, this can create tension between the BC Wildfire Service and stakeholders who may want specific information that cannot be provided at the time. Furthermore, highly specific

information relating to individual properties is difficult to provide given the constantly changing nature of wildfire events and the availability or resources, communication between firefighters and emergency operations centres, etc.

For Emergency Management BC, a distinction is made between external and internal stakeholders for communication purposes. When communicating externally, there is an emphasis on facts and what is known to be true at the time. This is important since they are speaking on behalf of the Province and stakeholders rely on their work. By contrast, internal communication is more nuanced and recognizes the fluidity of emergencies. Such communications can be characterized as dialogical where freedom to discuss and debate possible scenarios and outcomes is encouraged. This reflects the culture of Emergency Management BC and their reliance on advice from specialist partners and experts for managing risks.

Communication gaps also exist and they tend to be concentrated around getting information to those who require it. Additionally, it is difficult for them to know if this information is understood. This requires the use of non-technical language for communications with external stakeholders. For communications with internal stakeholders and partners like the BC Wildfire Service, local governments, First Nations, and others, coordination calls are held to review and discuss operational details including evacuation orders. These calls are scheduled and organized by EMBC. This kind of communication was defined by Emergency Management BC as "tight" and deemed essential before information is provided to the general public. One major issue identified by Emergency Management BC is staff turnover within local governments and partners in smaller communities. High turnover rates make it more difficult to build and maintain relationships, result in lower levels of experience, and create some basic logistical challenges associated with having to find new contact names, telephone numbers, email addresses, etc.

As noted previously, the mission of the First Nations' Emergency Services Society is to assist First Nations to become safer and healthier communities by providing fire services, fuel management, and emergency management to members. They face many challenges with respect to risk and crisis communication, and gaps exist when dealing with both internal and external stakeholders although they do not formally distinguish between the two stakeholder types.

Both internal and external communication are constrained by access to technology, and there is still a reliance on facsimile equipment to send and receive information to 125 band offices. There is also a lower penetration rate of computers, internet connectivity, and cellular telephones in many of the more remote communities. It was noted that partners sometimes had to drive to "hot spots" outside of homes and offices in order to send and receive cellular calls and messages including email. There is also a serious challenge with respect to turnover of contacts in these communities making continuity of communication more difficult while slowing down response times. It was noted that a preference for paper-based approaches still exists in many of these communities, and face-to-face meetings are important given the culture and a need to cultivate and maintain trust.

With a territory covering approximately 5,000,000 ha, the Simpew First Nation is confronted regularly with hazards like wildfires and flooding that require a coordinated approach. They also have processes and practices in place for managing lost person incidents within their extensive and geographically diverse territory. EMBC is involved in search and rescue operations in First Nations lands. Their emergency operations centre communicates internally with Emergency Management BC, and this is designed to foster an open process for the purpose of coordinating multi-jurisdictional responses. External stakeholders include the BC Wildfire Service, Royal Canadian Mounted Police, local fire departments, and municipalities

including Clearwater and Barriere. Other First Nations' communities are sometimes involved, and the Simpcw First Nation appears to have a particularly strong relationship with Trans Mountain Corporation who assist in search and rescue operations and other tasks. For external stakeholders, communication falls mostly on an Information Officer working within the Emergency Operations Centre. There are direct connections between the Chief and Band Council with this individual and others who play supporting roles.

For the Simpcw First Nations, staffing turnover in key emergency management roles has been kept to a minimum, and they have experienced individuals in place. They also have an emergency communications plan which may be useful as a model by other communities along the Trans Mountain pipeline route in particular.

When communicating with external stakeholders, the Simpcw First Nations use previously collected email addresses from local businesses and other stakeholders, and they have a social media presence through Facebook. Contact databases are updated annually. Regular communication is conducted with their Chief and Council, and an effort to iteratively refine their emergency communications plan is evident, and they actively seek out feedback from Emergency Management BC and other partners. Being open to change allows this community to learn from incidents, and fire fighters and other emergency responders benefit from ongoing training.

When access to wireless or mobile networks is available, internal communication involves the use of the mobile app WhatsApp. This allows the Simpcw First Nations' team to text each other seamlessly and it supports the sharing of multimedia files including video. Another app is used to send messages through radios when in the field and outside of these

networks. For the Simpew First Nations, this improves response time and allows for a more dynamic approach for managing emergency response.

When a wildfire is detected, the City of Kamloops uses a tactical approach for communicating with potentially affected individuals. Once the scope of a wildfire is understood, "ground truthing" through in situ observation is used to verify facts, and a premium is placed on explaining what is known and unknown at that moment in time.

For communicating with external stakeholders including the general public, social media like Twitter and Facebook is used extensively. More traditional media including radio and television are also used. This allows the City of Kamloops to provide high quality updates in close to real-time. Using GIS software, the City's emergency response centre can quickly identify properties at-risk, and individuals are encouraged to register with emergency support services. If evacuation is imminent, door-to-door notifications are also used to make sure that everyone in an affected area is apprised of the situation.

The focus for both internal and external communications is on quality information. The City of Kamloops views this as their responsibility since they are the local authority in the municipality. They work closely with the BC Wildfire Service and have what they deem as a "high quality" emergency operations centre where stakeholders are assumed to understand their roles and responsibilities and to work in a coordinated fashion.

One notable gap in communication is the challenge associated with knowing if risk-based messaging reaches intended audiences. There was also a strong desire from the City of Kamloops to have access to a provincial mass notification system based on cellular technology where their emergency operations centre can push out text messages to individuals in geofenced regions. This approach is commonly used for marketing purposes to collect information and to

serve customized messages to consumers as they enter, leave or stay within a geographical area. The value of this technology for reaching large audiences where cellular technology penetration rates are high is indispensable in emergencies.

The Thompson-Nicola Regional District encompasses close to 45,000 square kilometres in the southern interior of the province. With a highly variable geography made up of deserts, valleys, mountains, and grasslands, this part of British Columbia is frequently exposed to hazards like wildfires and flooding events. In 2017, many parts of the District experienced significant flooding events with a state of emergency declared south of Merritt in May of that year. This was soon followed by the worst wildfire season in recent history.

Prior to 2017, the Thompson-Nicola Regional District relied primarily on traditional media to communicate with external stakeholders. This worked relatively well in urban communities who were served by local content providers. In rural communities, shortcomings became quickly evident, and social media and other forms of Internet-mediated communications were preferable.

The use of Facebook and other platforms requires careful reflection and significant investment in one-to-many and one-to-one communication through services like Facebook and Messenger where it was noted that Thompson-Nicola Regional District staff engaged in extensive personal messaging with residents during wildfire events. The rise of misinformation and disinformation in social media also presents unique challenges, and there is a need to carefully engage in dialogue to reduce anxiety while providing useful information. One challenge noted involved working with communities and other partners to move livestock from areas at-risk.

Reflecting on wildfires in 2017, the Thompson-Nicola Regional District participants highlighted the important of inter-agency cooperation and coordination. This is especially important during evacuations, and communication with local governments and the BC Wildfire Service was characterized in a positive manner.

In 2019, the Thompson-Nicola Regional District invested in an emergency alert notification system that allowed them to communicate with the general public through email and text messaging. The use of this technology increases the probability that the right people are reached during an emergency, and it works well when combined with other approaches including the use of social media.

With respect to gaps in communication, the largest obstacle identified is how to effectively reach individuals living in rural and sometimes remote locations. With a decline in newspaper readership, and the invariable delays associated with communicating information to the general public through this medium, digital communication is the best option. When communicating internally with other agencies, a daily call between stakeholders is common practice. This can sometimes generate delays in sharing information in a real-time fashion to reflect the speed at which wildfires can move. When evacuation is required, these delays can be problematic, and it was noted that evacuation orders have been issued in the past after local police had already began the process as part of their tactical assessment work. More often than not, evacuations would happen before the Regional Coordination Centre even knew of the situation and had an opportunity to notify Emergency Management BC and local government. This can be exacerbated given the bureaucratic channels that need to be followed including sign off on evacuation orders from the B.C. Minister of Public Safety and Emergency Preparedness. In mid-June of 2021, the District introduced a searchable online map that provides real-time data

on wildfire and flood events while including details on evacuation status

(https://www.arcgis.com/apps/dashboards/5815bca37239492c98e4324daf5f955d).

PreparedBC and Emergency Info BC fall under the Emergency Management BC umbrella. PreparedBC focuses primarily on education and works to build resiliency by helping individuals and communities prepare for emergencies. It is described on their website as a "onestop shop for disaster readiness information." By contrast, Emergency Info BC works with information during an emergency to ensure that accurate information is communicated as quickly and transparently as possible. This organization uses social media extensively to share official response and recovery information from trusted partners, and on Twitter they had approximately 169,000 followers as of June 6, 2021. It is important to note that neither organization uses paid advertising, and the use of print media is limited.

The primary target for communication for both PreparedBC and Emergency Info BC is the general public. These external stakeholders receive information that is amplified by these organizations. For instance, during a wildfire event Emergency Info BC will use their platforms to share details from the BC Wildfire Service and others. One of their main roles is to point individuals towards credible sources of information. To sharpen their skills, tabletop exercises are conducted periodically to verify that Emergency Info BC is capturing and communicating information from partners accurately and quickly. This can be a challenge given how there are now many competing sources of information available on the Internet. One issue that requires more exploration in future research is how a reliance on digital technology for emergency communication creates unique vulnerabilities flowing from disasters as well as cybersecurity threats that can disrupt electrical, cellular, and broadband infrastructure on a large scale.

3.6 Managing jurisdiction

Wildfire is complex and adding to this complexity is that fires may impact multiple land jurisdictions and involve various levels of government as well as other organizations. A study by Nowell et al. (2020) found that in the U.S. fires generally impacted three or more land jurisdictions representing multiple levels of government but larger, more complex fires could have up to 13 different land management jurisdictions. They noted that there were multiple tools within the Incident Command System to help allow for organizations to govern across jurisdictions but also pointed out the increasing complexity of these challenges and the capacity issues experienced with larger fires. Therefore, it is important to understand how organizations deal with jurisdictional issues and communication with other organizations.

For the BC Wildfire Service (BCWS) there can be unique challenges with jurisdictional issues in terms of communication with other organizations and specifically how the media may relay this information. It is important that the local information officer provide accurate information that supports the community or communities in need. Areas for improvement include addressing gaps with local government communications staff and continuing to improve communication internally with EMBC. A common challenge is that people often do not understand how the cycle of information in a fire situation works and have expectations, such as minute by minute updates, which are not realistic.

Emergency Management BC's (EMBC) approach to jurisdictional issues and communication across multiple organizations is to err on the side of caution and to make sure that all parties receive the information they need. First Nations are advised of events on their traditional territories even though they might not have formal jurisdiction on a map. Jurisdictional issues can be addressed through coordination calls, using resources such as the

Office of the Fire Commissioner (OFC) to liaise between multiple groups, and before an incident occurs EMBC uses advanced planning at their biannual meetings to predetermine the responsibility of different organizations. However, challenges exist. One issue is that when people are evacuated, they are generally moved to another jurisdiction and challenges arise over whose responsibility they now fall under and whether this is communicated effectively to them. These challenges dealing with communication and public expectations can lead to issues mid (or intra) event and after the event.

Preplanning and building relationships are important first steps in dealing with communications related to jurisdictional issues. The Simpcw First Nation finds that communication problems in relation to jurisdictional issues are best addressed through preplanning and actively engaging partners prior to an incident. For example, their fire department has a mutual aid agreement in place with the District of Barriere with all of the response information already in place and planning completed with the TNRD and BCWS. After an incident, they debrief to determine ways to address issues. Prepared BC also addresses jurisdictional issues by working in advance to build inter-jurisdictional relationships. Every jurisdiction has an important role to play in terms of communication during a crisis, and building relationships where everyone talks to each other in advance, is key to reducing issues when an incident occurs. The City of Kamloops takes a similar approach to ensuring that everyone is receiving the correct information by building active relationships with stakeholders.

Other challenges such as communication infrastructure and ownership of information impact jurisdictional issues and communications across organizations. For example, First Nations Emergency Services Society (FNESS) notes that a major limitation they face is that many of the communities that they work with do not have adequate connectivity. Many First

Nations communities do not have radios that will allow for easy communication and this transition needs to occur to make information accessible in case of an emergency. A challenge the City of Kamloops faces is that not everyone has access to information in an online format so this needs to be considered as well. The Thompson Nicola Regional District stressed the importance of clearly identifying ownership of information when communicating across jurisdictions. For their part, they train all information officers in the TNRD Emergency Operations Center (EOC) to make sure that information shared is clearly linked to the agency or organization that supplies it. This helps to increase the number of people that information can reach but keeps it clear on the source of that information.

3.7 Use of forecasting as a tool

Forecasting, the prediction of future events, is used in risk communication to warn people in advance of possible events such as floods or fires. Provincial organizations such as BCWS and the BC River Forecast Centre generate this information which is then shared to other organizations and the public. In Canada, the Canadian Forest Fire Danger Rating System is used to rate the risk of potential for forest fires by assessing factors such as ease of ignition and difficulty of control. One of the modules of the CFFDRS is the Fire Weather Index system (FWI) which allows for predictive modelling of relative fire potential using weather data which is generated daily over the course of the fire season. BCWS predictive services unit also develops monthly outlooks over the fire season. This information is used internally but is also shared with the public using various online sites. The BC River Forecast Centre is responsible for analyzing data related to flood risk and supplying this to emergency managers and the public.
EMBC is the lead agency in BC for all the disaster management and through Emergency Info BC their role is to supply the public with the information they need in a disaster situation. EMBC shares the relevant information they receive on fire, flood, and other events such as tsunamis from other government partners such as BCWS and the BC River Forecast Centre. Prepared BC is under the EMBC umbrella, and their role is to direct the messaging regrading an event to the public and to amplify the information that is coming from the main forecasting centre for that event. This is also true of other organizations such as FNESS, Simpcw FN, the City of Kamloops, and TNRD, all of which help to further communicate information from the forecasting organizations to their specific audience. For example, the City of Kamloops works to provide a high level of forecast to the public but makes this in a form accessible to the public with the necessary information and does not include the level of detail that they may receive from the forecasting agency. The TNRD recently invested in an emergency alert notification system that allows them to communicate to people's email, phone, directly. FNESS also passes information onto communities they are working with noting that flood forecasting is easier than wildfire as we have 5, 20 and 100 year flood prediction which helps with communities understanding potential risk.

3.8 Communicating with First Nations

A key lesson learned from our review on risk and crisis communication is that the approach taken needs to recognize differences between stakeholder types. When communicating with and between First Nations communities in the province, emergency management agencies need to align messaging to their audience and to be proactive, transparent, and demonstrate genuine consultation.

The BC Wildfire Service strives to communicate effectively to all stakeholders and they recognize the importance of trust. To build and support trust, and to increase support for wildfire management practices, the BC Wildfire Service often hires individuals living in First Nations communities within wildfire-affected regions. They also noted that recognition of other cultural and sub-cultural differences is essential to their success, and put effort into understanding differences by community type (e.g., ranchers).

Emergency Management BC follows a similar approach and emphasized the need to communicate with all First Nations communities affected by wildfires. They pointed out that this is consistent with a Government of British Columbia requirement to communicate with these stakeholders. One challenge identified is to ensure that they are working with the right people in the community, and it was noted that this can be difficult at first given the roles of individuals as elected Chiefs, hereditary Chiefs, and staff in band offices.

For the First Nations' Emergency Services Society, communication challenges are different in this respect. With a focus on fire services, fuel management, and emergency management, this organization works directly with their members who are First Nations communities themselves. This kind of relationship clearly has a different kind of dynamic than what one would expect to see between these communities and other kinds of emergency management agencies, and there are personal points of contact between communities and the Society. Since there is an emphasis on prevention in their work, the First Nations' Emergency Services Society can also support good practices and processes for emergency operations centres.

Within the Simpcw First Nations, there is a well-designed and executed approach to emergency management. Staff in the community responsible for this work are trained, have

substantial long-term experience in their roles, undertake continuing education, and enjoy a strong relationship with their Chief and Council to execute plans through their emergency operations centre. With the Chief functioning as their primary public relations person, and a plan that is well understood by internal stakeholders, the Simpcw First Nations is able to prioritize how they respond to emergencies. They are also exploring the development of an emergency social services team.

The Simpcw First Nations characterized their plan as a "living document," and they are proud of how comprehensive planning is within their community. With more than half of their 51 employees trained for emergency operations centre positions, they are able to deploy resources and be proactive. Engaging the community includes hosting health and safety fairs, ongoing training and fundraising for their fire department, FireSmart programming, and safety training on wood stoves. Staff of their emergency operations centre also receive training through the Justice Institute of BC, and they use a holistic emergency preparedness consultant. Other kinds of expertise are incorporated, especially during debriefings.

With respect to fire services, the City of Kamloops has a service agreement with the Tk'emlúps te Secwépemc First Nations to provide fire protection and rescue services to Reserve lands including the community of Sun Rivers. This agreement also incorporates FireSmart education and sharing of other fire-related information. To improve communications, the City of Kamloops uses their emergency operations centre to regularly inform the First Nations community with initial contact flowing through the Chief and band council.

The Thompson-Nicola Regional District noted that their approach to communication with First Nations was similar to how other stakeholders are consulted. Since these communities issue their own alerts and orders, the Regional District emphasized the importance of coordinating

messaging with them. Coordination can be challenging, and an example was provided of how one community issued an order well before the Thompson-Nicola Regional District for the same area which resulted in confusion.

For PreparedBC and Emergency Info BC, communication with First Nations communities is different given their role in disseminating, interpreting, and amplifying information provided by others. Many First Nations communities have a limited presence on the internet including the use of social media. As a result, the role of these agencies in wildfire risk and crisis communication involves curating information that is available to assist in broad distribution to relevant stakeholders. A lot of this work involves building relationship with stakeholders before an event, and table top exercises, meetings, and training sessions help connect stakeholders and build relationships.

3.9 Communication challenges during COVID-19

COVID-19 has created challenges for many organizations involved in emergency management. Fortunately, wildfire events in the province were substantially reduced during the 2020 season in particular compared to 2017 and 2018. For the organizations consulted in this study, many of the same themes and issues were raised. They will be discussed in an aggregate fashion given these commonalities.

Building and fostering new relationships was a challenge for many emergency management organizations. Relationship building is critical during all stages of a wildfire event, and it is clear that knowing who to contact and knowledge of their role is essential for a wellcoordinated response. This is particularly the case with inter-agency consultation involving government to government communication as is required between the province and First Nations

communities. There were also some challenges associated with including external stakeholders given technological limitations in some remote communities. For some organizations involved in this study, this suggests the need for reflection and precaution going forward as technological failures of telecommunications infrastructure are possible with certain kinds of hazards (e.g., earthquake). Effort is required to develop better backup plans including deployment of more satellite telephones.

Operationally, dealing with COVID-19 involved a learning curve where internal operations for organizations like Emergency Management BC and the BC Wildfire Service in particular had to shift significantly to virtual environments. Instead of having a command centre with many staff together at the same location, COVID-19 involved working from home for most staff. By all accounts this was a success although the systems were tested "lightly" due to reduced wildfire activity.

Chapter 4





4.2 Interpretation and application of the model

Using the Möbius loop as inspiration, and taking styling cues from the internationally recognized and non-trademarked symbol for recycling, this model reinforces the need for a holistic, life-cycle based approach to risk and crisis communication. The model has several layers and should be interpreted from the inside-out and in a clockwise fashion.

First, the centrality of local and Indigenous knowledge in the model recognizes that risk and crisis communication are processes that involves actual individuals and communities. Wildfires have the potential to generate negative impacts on built infrastructure including homes, community buildings, local businesses, places of worship, schools, etc. Remote and First Nations communities in particular have unique insights and relationships with respect to the land that need to be respected. True and meaningful consultation is required at all stages of a wildfire event in order to reduce risk, respond in a culturally and socially responsible way, and to best utilize all existing resources. It is also important to recognize that multiple layers of governance and oversight exist in such communities as per recommendations by Abbott and Chapman (2018).

Second, the model also places safety and mental health in its core to emphasize that risk and crisis communication must place a premium on these variables. Although safety is often confused with risk, they do refer to different things. Safety is generally defined as a state of being that is free from risk. Although it is well-recognized that zero risk is impossible both conceptually and in practice, a tolerance or appetite for differential levels of risk can influence interpretations of safety. Mental health is intricately connected to this, and wildfire events can put affected individuals under significant levels of stress that may have short and long terms impacts. Mental health can be impacted at all stages of an event (pre, intra, and post), and communities in regions with more frequent wildfire events must pay particular attention to these factors.

Third, the life cycle of a wildfire involves shifting across pre-event, intra-event, and post-event stages. Each of these stages require a particular communication focus, although it is important to note that both risk and crisis communication will likely have to occur throughout all events to some degree. That said, there are dominant modes of communication that will naturally be focused on at each stage.

At the pre-event stage, the emphasis will tend to be on risk communication. During this stage, there should be a concerted effort to practice sound and engaging

participatory decision-making. This can help prepare communities for wildfire events, and help make the response during a wildfire more predictable and consistent with best practices. Resources should be devoted towards educational initiatives, updating databases with contact information of key individuals at the community level, building and solidifying relationships, and conducting property-based risk reduction projects. Improvements to communications infrastructure should also be explored.

The intra-event stage involves a shift to a crisis communication mode. It is important to stress that this stage requires that local/Indigenous knowledge and safety/mental health still remain top-of-mind. There is a tendency during an event to shift to a command-and-control approach as represented by the Incident Command System. Although important from an operational perspective, crisis communication must be sensitive to context and community if it is to be effective. Otherwise, competing messaging including misinformation can spread more easily through social media and by word of mouth. At this stage, the focus should be on providing timely and accurate information, inter-agency coordination, and mobilization practices including evacuation that are likely to have the greatest likelihood of success.

The post-event stage can sometimes be difficult to gauge given that wildfires can occur again in a community within a given season. As a result, it may be necessary to practice a communications style that is a hybrid between crisis and risk communication throughout the season. By retaining some of the elements of crisis communication, flexibility to (re)mobilize a community exists and this can keep intact some of the operational channels for inter-agency coordination. This is also a time where risk communication can be emphasized. Again, it is essential to recognize how community

well-being, mental, health, and resiliency are involved. Communicating risk too soon after a serious wildfire event may trigger unanticipated responses and create higher levels of anxiety. A balancing act therefore exists here since it is also likely that communities fortunate enough to escape wide-scale damage can be motivated to support initiatives aimed at reducing future exposures. A return to full participatory decision-making, planning, and rebuilding infrastructure occurs during this stage although this may take years depending on the damage.

Chapter 5

Recommendations

Risk and crisis communication models are often considered academic exercises, and it is clear that few emergency management organizations are likely to use them as blueprints that need to be followed step-by-step during an actual emergency. Although such models are conceptual in nature, the life cycle-based model proposed here encourages a holistic understanding of how to navigate through wildfire events. As indicated, the model distinguishes between various stages of a wildfire (pre, intra, and post) while positioning local/Indigenous knowledge and mental health/safety in the core. This model is not prescriptive in nature but should be considered as a representation of an interconnected set of considerations and trigger points to reflect upon. Beyond the model are several recommendations based on a review of the literature and consultations with a range of emergency management organizations in British Columbia.

<u>Recommendation 1:</u> Since the scale and frequency of wildfire events has changed in recent years, and public concerns have intensified, emergency management organizations should reflect on current and past risk and crisis communication approaches. It is recommended that organizations make meaningful distinctions between risk and crisis communication, and have in place an approach that recognizes life cycle differences. Adoption of a particular model, or even the one proposed here, does not guarantee a sound approach although it may cultivate an enhanced appreciation of the nuances and complexities associated with communication. It is also essential to recognize the role of local and Indigenous knowledge at all stages of a wildfire event, and to focus on the safety and mental health of affected individuals and communities. This

requires cultivating a sense of compassion and respect, or what might be called an "ethics of care."

<u>Recommendation 2:</u> During a wildfire event, a premium is placed on accurate and timely information. It is important to stress that such qualities are necessary but not sufficient to motivate action or to reduce risk. Because trust is difficult to build and easy to lose, risk and crisis communication need to move beyond the simple transmission of facts. How a community responds to a wildfire can be highly variable, and individual responses are difficult to anticipate. The building and maintenance of trust between emergency management organizations and remote and First Nations communities must be a priority, and it should be recognized that trust is a two-way street. There is also value in building better bridges between emergency management organizations who work together to support optimal inter-agency coordination so that duplication of efforts is avoided. It is recommended that additional research by conducted on trust at these various levels.

<u>Recommendation 3:</u> With wildfire events that unfold over longer stretches of time, or where many such events affect a community during one season, a tendency towards complacency can emerge. This can numb responses on many levels and result in increased risk. There also exists a challenge to get the right messaging to those who need it most. These issues can exist when communicating with internal and external stakeholders, and it is clear from this research that communication and coordination is only as good as the weakest link. With many remote and First Nations communities having limited access to broadband and cellular technology, wildfires can be more difficult to manage. Some communities still rely heavily on facsimile machines, and

door knocking notifications are used extensively to notify individuals about evacuation alerts and orders. It is clear that many geographic challenges still exist in remote communications and that inadequate technology is exacerbating the situation. It is recommended that a program be developed to increase the supply of satellite telephones in such communities, and that more training be provided on the use of this technology and how it can be integrated with other more traditional approaches including radio. It may be useful to also examine the utility of community alert systems that parallel approaches used in some coastal communities for tsunami alerts. Developing mechanisms to support amateur radio may also make sense given the relatively low-cost involved and the existing network in place.

<u>Recommendation 4:</u> One challenge noted is that staff turnover at Emergency Operations Centres in remote and First Nations communities can impair communication. Staff turnover can occur for many reasons, and it was observed that in some communities the use of retired, volunteers occurs. It is recommended that better efforts be made to maintain updated databases of contact information. There may also be value in exploring how to reduce turnover, provide more crosstraining opportunities, and to find mechanisms to more formally transfer experience from longservice personnel to new employees. The human side of business continuity planning is important and often undervalued.

<u>Recommendation 5:</u> The use of social media as a tool for communicating with the public and other stakeholders is growing in popularity. Platforms like Twitter and Facebook have great potential to engage individuals and to communicate information quickly and inexpensively. That said, such technology can be a double-edged sword where the spread of misinformation or

disinformation represents a threat to emergency management organizations in terms of coordinating responses, maintaining trust, and mobilization efforts. Social media has more value in urban and in rural communities served well by broadband. It's utility declines in many remote and First Nations communities. It is recommended that emergency response organizations coordinate and lobby to support initiatives to deploy broadband provincially. This can also include working with the telecommunications sector and government to establish better cellular telephone connectivity in such communities. There may be value in pushing telecommunications companies to offer differential rate structures in these communities to encourage wider-scale adoptions of the technology, and this may involve a subsidy structure. Cellular telephones enable the use of SMS alerting as well.

<u>Recommendation 6:</u> It is recommended that a "lessons learned" approach be followed going forward to understand how to fine tune risk and crisis communication. One avenue involves examining and showcasing successful communities. In the interior of British Columbia, it is clear that the Simpcw First Nation is an exemplar in many respects. They have well-trained staff, understood roles and responsibilities between their Chief and Council and the Emergency Information Officer, and focus on building personal relationship to support one-on-one external communications. They also have historically low levels of staff turnover. Another avenue to explore involves learning from other kinds of natural hazards including floods, tsunamis, avalanches, and earthquakes in particular. This should not be limited to Canadian examples since many lessons can also be learned from international events. These events should be dissected regularly and used for training and personnel development within emergency management organizations.

References

Abbott, G. and M. Chapman (2018). <u>Addressing the New Normal: 21st Century Disaster Management in</u> <u>British Columbia</u>. British Columbia, Canada. <u>https://www2.gov.bc.ca/assets/gov/public-safety-and-</u> <u>emergency-services/emergency-preparedness-response-recovery/embc/bc-flood-and-wildfire-review-</u> <u>addressing-the-new-normal-21st-century-disaster-management-in-bc-web.pdf</u>

Acar, A. and Y. Muraki (2011). "Twitter for crisis communication: Lessons learned from Japan's tsunami disaster." International Journal of Web Based Communities, 7(3): 392-402.

Albris, K., Lauta, K.C. and E. Raju (2020). "Disaster Knowledge Gaps: Exploring the Interface Between Science and Policy for Disaster Risk Reduction in Europe." <u>International Journal of Disaster Risk Science</u>, 11: 1-12.

Aliperti, G. and A-M. Cruz (2019). "Investigating tourists' risk information processing." <u>Annals of Tourism</u> <u>Research</u>, 79: 1-18.

BC Wildfire Service (2019). S-230 Introduction to Supervision. Retrieved from https://www.for.gov.bc.ca/ftp/HPR/external/!publish/MSO%20Training%20Material/S-230%20Introduction%20to%20Supervison%20Trainee%20Manual.pdf

Bier, V.M. (2001). "On the state of the art: Risk communication to the public." <u>Reliability, Engineering</u>, and System Safety, 71(2): 139-150.

Berry, M.M. (2013) A literature review on effective risk communication for the prevention and control of communicable diseases in Europe.

https://www.researchgate.net/publication/259672983 A literature review on effective risk co mmunication for the prevention and control of communicable diseases in Europe

Christianson, A.C., McGee, T.K. and Whitefish Lake First Nation 459 (2019). "Wildfire evacuation experiences of band members of Whitefish Lake First Nation 459, Alberta, Canada." <u>Natural Hazards</u>, 98: 9-29.

Coombs, W.T. and S. Holladay (Eds.) (2010). <u>The Handbook of Crisis Communication</u>. Wiley-Blackwell, West Sussex.

Covello, V.T., D. von Winterfeldt and P. Slovic (1986). "Risk communication: A review of the literature." <u>Risk Abstracts</u>, 3(4): 171–182.

Economist (2017). "Weather-related disasters are increasing." See chart at https://www.economist.com/graphic-detail/2017/08/29/weather-related-disasters-are-increasing

Eisenberg, C. Anderson, C., Collingwood, A., Dunn, C.J., et al. (2019). "Out of the ashes: Ecological resilience to extreme wildfire, prescribed burns, and Indigenous burning in ecosystems." <u>Front. Ecol. Evol.</u>, 26 November 2019 | <u>https://doi.org/10.3389/fevo.2019.00436</u>

EmergencyInfoBC. (2021). Evacuation Alert vs. Evacuation Order. Retrieved from <u>https://www.emergencyinfobc.gov.bc.ca/home/wildfire-preparedness/evacuation-alert-vs-evacuation-order/</u>

Epp, D, Haque, C.E and B. Peers (1998). "Emergency preparedness and first nation communities in Manitoba. Emergency Preparedness Canada, Ottawa, ON. Retrieved from http://www.publications.gc.ca/collections/Collection/D82-52-1998E.pdf

Fischhoff, B. (1995). "Risk perception and communication unplugged: Twenty years of process." <u>Risk</u> <u>Analysis</u>, 15: 137-145.

Gaillard, J-C et al. (2008). "Ethnic groups' response to the 26 December 2004 earthquake and tsunami in Aceh, Indonesia." <u>Natural Hazards</u>, 47: 17-38.

Government of B.C. (2002). Introduction to the incident command system. See <u>https://www2.gov.bc.ca/assets/gov/environment/air-land-water/spills-and-environmental-emergencies/docs/intro-ics.pdf</u>

Government of B.C. (1995). Emergency Program Act. Local Authority Emergency Management Regulation. Retrieved from https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/12 380 95

Government of B.C. (1996). Emergency Program Act. Retrieved from https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/00 96111 01

Government of B.C. (n.d.). Emergency Support Services Authorities & Legislation. Retrieved from

https://www2.gov.bc.ca/gov/content/safety/emergency-preparedness-response-recovery/localemergency-programs/ess/local-and-other-authorities

Government of B.C. (2016). <u>British Columbia Emergency Management System</u>. <u>https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/bcems/bcems_guide_2016_final_fillable.pdf</u>

Griffin, R.J., Dunwoody, S. and K. Neuwirth (1999). "Proposed model of the relationship of risk information seeking and processing to the development of preventive behaviors." <u>Environmental Research</u>, 80(2): S230-S245.

Harnantyari, A.S. et al. (2020). "Tsunami awareness and evacuation behaviour during the 2018 Sulawesi Earthquake tsunami." <u>International Journal of Disaster Risk Reduction</u>, 45, <u>https://www.sciencedirect.com/science/article/abs/pii/S2212420919312154</u>

Health Canada (2006). "A framework for strategic risk communications within the context of Health Canada and the PHAC's integrated risk management." See <u>https://www.canada.ca/en/health-canada/corporate/about-health-canada/reports-publications/strategic-risk-communications-framework-health-canada-public-health-agency-canada.html</u>

ICS/IMS Canada (2015). <u>Communique – February</u>.

https://www.icscanada.ca/images/upload/docs/ICS%20IMS%20Canada%20Communique-%20February%202015.pdf

Jansen, T. et al. (2017) Breaking Down Uncertain Risks for Risk Communication: A Conceptual Review of the Environmental Health Literature. Risk, Hazards, and Crisis in Public Policy. https://onlinelibrary.wiley.com/doi/full/10.1002/rhc3.12128

Leiss, W (1996). "Three phases in the evolution of risk communication practice." <u>The Annals of the</u> <u>American Academy of Political and Social Science</u>, 554(1): 85-94.

Lindell, M.K. and R.W. Perry (2012). "The protective action decision model: Theoretical modifications and additional evidence." <u>Risk Analysis</u>, 32(4): 616-632.

Martin, I.M., Bender. H. and C. Raish (2007). "What Motivates Individuals to Protect Themselves from Risks: The Case of Wildland Fires." <u>Risk Analysis</u>, 27(40): 887-900.

Makinoshima, F., Imamura, F. and Y. Oishi (2020). "Tsunami evacuation processes based on human behaviour in past earthquakes and tsunamis: A literature review." <u>Progress in Disaster</u> <u>Science</u>, 7: 1-9.

McAdoo, B.G. Dengler, L. and G. Prasetya (2006). "Smong: How an Oral History Saved Thousands on Indonesia's Simeulue Island during the December 2004 and March 2005 Tsunamis." <u>Earthquake Spectra</u>. <u>https://journals.sagepub.com/doi/10.1193/1.2204966</u>

Neville, K., O'Riordan, S., Pope, A. et al. (2015). "Developing a decision support tool and training system for multi-agency decision making during an emergency." European Security Research, Workshop at the European Security Research Conference (Dublin), see

https://www.researchgate.net/publication/332178997 Developing a decision support tool and training s ystem_for_multi-agency_decision_making_during_an_emergency_

Nilsson, S. and A. Enander (2020). "Damned if you do, damned if you don't: Media frames of responsibility and accountability in handling a wildfire." <u>Journal of Contingencies and Crisis Management</u>, 28: 69-82.

Nowell, B., Steelman, T., Velez, A., Albrecht, K., Baines, S., McGovern, S., Minkowitz, H., Nauert, E., and R. Scott (2020). "Knowing What We're Up Against: A Profile of Jurisdictional Complexity of Wildfire. Is yesterday's fire organization equipped to deal with today's complex wildfires?" <u>https://www.iawfonline.org/article/2020-01-profile-jurisdictional-complexity-wildfire/</u>

Raish, R. and S. McCaffrey (2019). "Exploring Wildfire-Prone Community Trust in Wildfire Management Agencies." <u>Forest Science</u>, 65(5): 652-653.

Rollason, E. et al. (2018). "Rethinking flood risk communication." Natural Hazards, 92: 1665-

1686.

Saroj, A. and S. Pal (2020). "Use of social media in crisis management: A survey." <u>International</u> Journal of Disaster Risk Reduction, 48: 1-19.

Scolobig, A., Prior, T., Schroter, D., Jorin, J. and A. Patt (2015). "Towards people-centred approaches for effective disaster risk management: Balancing rhetoric with reality." <u>International Journal of Disaster</u> <u>Reduction</u>, 12: 202-212.

Seeger, M.W. (2018). "A Conceptual Model for Evaluating Emergency Risk Communication in Public Health." <u>Health Security</u>, 16(3): 193-203.

Siddall, E and C.R. Bennett (1987). "A people-centered concept of society-wide risk management," in <u>Environmental Health Risks: Assessment and Management</u>, R. Stephen McColl (Ed.), Waterloo, ON: University of Waterloo Press, p. 272.

Steelman, T.A. and S. McCaffrey (2013). "Best practices in risk and crisis communication: Implications for natural hazards management." <u>Natural Hazards</u>, 65: 683-705.

Sutton, S.A., Paton, D., Buergelt, P., Meilianda, E., and S. Sagala (2020). "What's in a name? 'Smong' and the sustaining of risk communication and DRR behavior as evocation fades." <u>International Journal of Disaster Risk Reduction</u>, 44: 1-10.

Tedim, F., Leone, V., and T. McGee (Eds.) (2020). <u>Extreme Wildfire Events and Disasters: Root Causes</u> and New Management Strategies. Elsevier. <u>https://www.elsevier.com/books/extreme-wildfire-events-and-disasters/tedim/978-0-12-815721-3</u>

Toman, E., Shindler, B. and M. Brunson (2006). "Fire and Fuel Management Communication Strategies: Citizen Evaluations of Agency Outreach Programs." Society and Natural Resources, 19(4).

Ultz, S., Schultz, F. and S. Glocka (2012). "Crisis communication online: How medium, crisis type and emotions affected public reactions in the Fukushima Daiichi nuclear disaster." <u>Public Relations Review</u>, 39: 40-46.

Ushiyama, M. and N. Atsuo (2010). "2010nen 2gatu 28nichi chile zishin tsunami no sai no hinan koudou ni kansuru chousa sokuhou." <u>Res. Rep. Tsunami Eng.</u>, 27: 73-81

Wilson, R.S., McCaffrey, S.M. and E. Toman (2017). "Wildfire Communication and Climate Risk Mitigation." Oxford Research Encyclopedia of Climate Science. <u>https://oxfordre.com/climatescience</u>

Zhang, L., Li, H. and K. Chen (2020). "Effective Risk Communication for Public Health Emergency: Reflection on the COVID-19 (2019-nCoV) Outbreak in Wuhan, China." <u>Healthcare</u>, 8(1): 64.