Understanding Links between Wildfires and Community Resiliency: Lessons Learned for Disaster Preparation and Mitigation

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Key Recommendations for Decision Makers

Disaster Preparedness
- Develop memorandums of understanding with relevant agencies to ensure that during and after the disaster, arising issues are addressed and that lines of communication and authority are in place.
- Develop public education and disaster awareness that is appropriate for the community (e.g., having a livestock evacuation plan).
- Create an updated community disaster plan which identifies a back-up community that could assist and transportation plans for evacuations (e.g., use of school busses).
- Maintain up-to-date maps to locate all individuals that may need evacuation.
- Establish policies to determine if large gatherings planned for the time period of an evacuation or evacuation alert should be cancelled.

During the Disaster
- Develop communication strategies so that the evacuees are updated about the condition of their homes and community during the wildfire.
- Create effective coordination of all relevant agencies.
- Ensure adequate safety and surveillance procedures are in place for vacated property.

After the Disaster
- Collect economic, social and health data in communities that experience wildfires for 5 years after the wildfire and then every 10 years for 3 more decades.
- Develop temporary programs for the school-aged population to help them deal with the ongoing issues associated with the wildfire.
- Provide long-term mental health/community change facilitation for all community members.
- Provide financial counseling for families.

Fostering Community Resiliency
- Providing opportunities for local residents to gather and reflect on the disaster experience thereby building their networks and developing opportunities for interaction.
- Organize celebrations to provide avenues for social support while also creating a sense of belonging and community.
- Provide support for local leaders and develop mechanisms to create the next generation of leaders within the community.

Executive Summary

Addressing disasters is important given the potential threat to human life, the environment, and the associated financial, physical and emotional cost involved in recovery post-disaster. Globally, natural disasters are increasing in numbers and intensity[1]. Canadians experience a range of natural disasters but wildfires have become a more frequent occurrence. Over 700,000 people and over 250 communities are affected by wildfires every year in Canada[2].

Disasters are a provincial and territorial responsibility in Canada including the provision of emergency response and recovery assistance to municipal governments. Rural and remote communities are most vulnerable to disasters such as wildfires primarily because of distances from specialized services, as well as the lack of internal resources and infrastructure needed to effectively deal with disasters. Fortunately, there is increasing emphasis on strengthening local capacity to deal with disasters before they occur, while they are occurring and in the recovery phase[3]. This study contributes to such knowledge by focusing on community response to natural disasters, specifically wildfires, and the relationship of that response to community resiliency in rural communities.

Approach

The purpose of this mixed methods study was to examine how resiliency is manifested in two rural communities (Barriere, BC and La Ronge, SK) that experienced wildfires. These locations were chosen because they each: a) have a population under 10,000; b) experienced a significant forest fire between 1996 – 2006 which forced residents to evacuate; and, c) provide comparisons with respect to geographical location and governance.

Barriere, BC, 66 kilometers north of Kamloops, was one of the communities directly affected by the 2003 McLure Fire. In total 26,420 hectares were burnt and the Ministry of

Forests total cost for fighting the fire was $31.1 million[4]. La Ronge, SK is adjacent to the Lac La Ronge Indian band (LLRIB) and the northern village of Air Ronge. The 1999 Mallard Fire caused the evacuation of parts of the town of La Ronge. The fire rapidly stretched over a distance of 8 kilometres causing the destruction of ten homes and some outbuildings[5].

For this study, our main research questions were:

- What types of local social dynamics and institutional structures contribute to resiliency in rural settlements that have experienced disasters?
- How is resiliency manifested under these circumstances at: a) an individual or household level and, b) a collective level?

Data Collection

The organization of a local advisory team at each community site and the use of local research assistants helped to ensure success of this research. We conducted qualitative interviews (30 in Barriere; 27 in La Ronge), compiled community profiles in each community[6-7] and conducted a household survey at each site, as well as at a comparative site that did not experience a disaster. Site visits occurred at each community site to train the research assistants, meet local stakeholders, attend local events (e.g., 2008 Fire Monument unveiling in Louis Creek, BC) and, in general, become familiar with the communities.

Results

Very few of the participants at either community site were familiar with disaster preparedness before they experienced the fires. Both community sites were evacuated; and upon their return, the residents, particularly those in Barriere (locally known as the Valley), had to invest considerable time and energy in rebuilding their homes and lives. External agencies were particularly helpful in this process. A number of Valley residents left due to the lack of employment caused by the loss of Tolko Industries Ltd. In La Ronge, some of the individuals who lost their homes did not rebuild and left the community. Health issues

were also noted as a result of the fire. In the Valley, people talked about the mental and physical health impacts and in La Ronge, some of the residents who lost their homes did not feel supported by the larger community. Although the McLure Fire was a stressful, challenging event, it did have its positive merits with indications of an economic and social rejuvenation in the Valley area. In La Ronge, the Mallard Fire was a wake-up call that even though they lived next to a major northern airport with water bombers on permanent standby, they too could experience a fire. The information generated about resiliency, noted the importance of neighbors helping one another, having similar values and experiencing the closeness and camaraderie after the fires. The participants also noted the significance of community leadership and being proactive.

The mixed method approach of this study provides a useful framework for deriving both qualitative and quantitative data on individuals and communities that have experienced wildfires. Using these approaches together allowed for a triangulated and more informed basis for policy recommendations.

In conclusion, the researchers identified numerous factors that impact community response to wildfires as a disaster experience. Some examples include the population size and available infrastructure within the community. For the two rural community sites included in this investigation, their lack of resources hindered their ability to address the wildfire while it was ongoing and after it was controlled. Both community sites updated emergency plans and La Ronge developed a shared Fire Centre for dealing with any future wildfires for the benefit of all community residents. The information generated provides support for the community resiliency model including the importance of helping one another, being proactive and having the ability as a community to make changes. Ultimately, creating a sense of community was important in the process of moving forward from the adverse effects of community resiliency.

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"Our local people are taking the wisdom that they received from the fire and are working with it to try and develop stuff that is going to make a difference" Valley Resident

Context

Addressing disasters is important given the potential threat to human life, the environment, and the associated financial, physical and emotional cost involved in recovery post-disaster. Globally, natural disasters are increasing in numbers and intensity[1]. Canadians experience a range of natural disasters but wildfires have become a more frequent occurrence in part due to climate change; the drying effects of record high temperatures combined with the existing fuel loads of forests resulting from limited fuel management; insect infestations; and residential expansion near forested areas. Over 700,000 people and over 250 communities are affected by wildfires every year in Canada[2].

Disasters are a provincial and territorial responsibility in Canada including the provision of emergency response and recovery assistance to municipal governments. There are initiatives such as the federal government's Joint Emergency Preparedness Program which can be accessed by local communities. However, the main source of responsibility continues to rest with municipal governments which must balance the challenge of directly responding to citizens' needs while also working with external agencies to deal with the disaster. Rural communities are most vulnerable to disasters such as wildfires because of their location and the type of vegetation that surrounds them. Smaller communities do not always have the internal resources and infrastructure needed to effectively deal with disasters, thereby further complicating their situation. Under these conditions, initiatives such as the National Strategy for Critical Infrastructure become necessary to improve communications while enhancing partnerships among the various levels of government[8].

Fortunately, there is increasing emphasis on strengthening local capacity to deal with disasters before they occur, while they are occurring and during the recovery phase[9]. This study contributes to such knowledge by focusing on community response to natural disasters, specifically wildfires, and the relationship of that response to community resiliency in rural communities. There is limited information about community-level responses that are effective in addressing disasters, despite evidence that communities are better able to cope with a disaster if they demonstrate proactive behavior and adopt activities such as attempting to stop a flood or evacuating families and belongings to prevent devastation[9-12]. Addressing disasters within the two participating communities provided the opportunity to examine the uniqueness of their environment and the relationship of inter-related variables with the type of disaster response.

Disasters have physical and emotional impacts on those who experience them[13-15], but in addition, these individuals may face changes within their social relationships. For example, the January 1998 ice storm that affected eastern Ontario, Quebec and the northeastern United States resulted in loss of electricity for up to two weeks[16-17]. From research conducted in towns and cities affected by the storm, it was concluded that disasters do not fragment a community nor increase solidarity, but are only temporary disruptions[18]. Similar research on communities that have experienced disaster confirms that there is an unclear understanding of: a) the relationship between the experience of a disaster and the impact it has on a community's functioning; and, b) the most effective community responses to disasters in rural settlements. In addition, with the changing nature of disasters, expansion and clarification of the definition to a more multi-disciplinary conceptualization including sociological and ecological perspectives needs consideration[19-20].

Community resiliency has been defined as the ability of a community to deal with adversity and develop a higher level of functioning as a result[21-22]. Resiliency is therefore conceptualized as a process[22] through which the community continually moves in relation to the dynamic conditions within which they exist. This process is dependent upon the presence of social cohesion and a sense of community[23]. Permeability strengthens the outcome as new ideas from external sources influence the different phases of the process as represented in Figure 1[24]. This conceptualization of community resiliency *was* applied in ***this study by***: (1) asking questions of individual community members about interactions as a collective unit, sense of community and community action; and, (2) analyzing the responses ***according to the resiliency process*** in order to generate information about resiliency within the participants' community.

Increasingly, the literature on disasters is using resiliency as a framework to understand community responses and to focus on capacity building in the face of disaster response, rather than vulnerability reduction[25]. Advocating for humanitarian, development and risk reduction work to increase resilience has been the suggestion of the 2004 World Disasters Report[1]. Activities include strengthening social capital and creating new institutional strategies and cross sectional coalitions to boost resiliency at the local level. People-centred planning and appropriate governance also contributes to this plan[12]. Other authors add that using a comprehensive systems perspective will assist in enhancing social and economic resiliency, while also meeting emergency response needs[26]. Finally, the presence of social resiliency, or strong local institutions, and a capacity to deal with challenges in general, can be directly attributed to a community's response to disaster, and thus ways in which social resiliency can be bolstered and encouraged[1]. Responses to disaster and resiliency have also been tied to the realm of policy development to produce "a more resilient and safe Can-

ada"[27]. Resiliency in communities can be further strengthened by thoughtful preparation and planning, otherwise known as mitigation. Some of these activities may include public education[28], land use policies, and improved warning systems or building codes. Resiliency issues are particularly noticeable within rural communities where there are limited resources, infrastructure and human capital that can be put in place to address such adversity.

In the last few years, there has been a significant proliferation of the literature related to resilience and disasters[29-30]. Some authors have even begun to use the phrase, "disaster resilience" and there are several scholarly journals that focus on this type of resilience. In part this increase in discussion is a direct response to the call from decision makers to move forward and develop more appropriate strategies to prepare for and address disasters given recent events such as the 9/11 Terrorist Attack in New York and Hurricane Katrina. Subsequent articles by our research team are planned to compare and contrast the models suggested in the recent literature with the resiliency model and findings from our study to further the theoretical understanding of community resiliency in light of disasters.

Approach

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Barriere, BC, 66 kilometers north of Kamloops, was one of the communities directly affected by the 2003 McLure Fire. This fire affected the Lower North Thompson Valley (hereafter referred to as the Valley) including the communities of Barriere, Chinook Cove,

Chu Chua, Darfield, Little Fort, Louis Creek, and McLure with a total population of 7,059). The fire caused the evacuation of 3,000 residents and resulted in the loss of 90 structures including Tolko Industries Ltd. lumber mill (as well as homes, barns, and other outbuildings in various geographic locations throughout the Valley but mostly in Louis Creek and Darfield). It left 180 local residents without employment. In total 26,420 hectares were burned and the Ministry of Forests total cost for fighting the fire was $31.1 million.[4] The fire was caused by a discarded cigarette. There were extreme weather conditions that summer (temperatures ranging from 30 to 40 degrees centigrade). Three other fires began on the same day (July 30, 2003) in the same geographic vicinity. At the time of the fire, the Valley was under the government administration of the Thompson-Nicola Regional District (TNRD). The TNRD was responsible for approximately 120,000 residents in 45,279 square kilometers and never before in its history had it dealt with the number of fires burning simultaneously as it did in the summer of 2003.

La Ronge, SK is located in northern Saskatchewan on the shore of Lac La Ronge. It is adjacent to the Lac La Ronge Indian band (LLRIB) and the northern village of Air Ronge. La Ronge is the largest community in northern Saskatchewan with over 2,700 people residing in the town, 2,000 people on the adjacent First Nations lands of the LLRIB, and approximately 1,000 people residing in the bordering village of Air Ronge. The Mallard Fire was started by a lightning strike on May 14, 1999 and caused the evacuation of parts of the town of La Ronge. The fire rapidly stretched over a distance of 8 kilometres and it took 248 firefighters and several water bombers to extinguish it. The damage included the destruction of ten homes and some outbuildings at an area east of La Ronge near a golf course and on the lake.[5]

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Data Collection

The organization of a local advisory team at each community site and the use of local research assistants helped ensure success of this research. We conducted qualitative interviews (30 in Barriere; 27 in La Ronge), compiled community profiles in each community[6-7] and conducted a household survey at each site as well as at a comparative site that did not experience a disaster. Site visits occurred at each community site to train the research assistants, meet local stakeholders, attend local events (e.g., 2008 Fire Monument unveiling in Louis Creek, BC) and in general become familiar with the communities.

Qualitative interviews were conducted with a variety of individuals in each community including local fire fighters, local government officials, individuals who had been evacuated, individuals who had lost their business or property and individuals involved in evacuation and rebuilding efforts. The community profiles were compiled with the assistance of the local advisory team. The profiles include information about the educational system, availability of retail and demographics and a list of other variables[6-7].

For the household survey, a sampling strategy was developed to choose randomly selected households within the study region. The sample frame of households was developed as follows:

1) GIS (Geographical Information Systems) software (MapInfo Professional) was used to identify a 25 km buffer region surrounding the population centres of the study. For each research site coordinates were derived from the National Atlas of Canada. For Barriere, this

region included the communities of Louis Creek and McLure, as well as the First Nations community of Chu Chua (see Figure 2). For La Ronge, this region included the communities of La Ronge, Air Ronge, Lac La Ronge, Kitsakie, as well as some outlying reserves such as Sucker River (see Figure 3).

2) All postal codes lying within the 25km buffer region were identified.

3) An electronic route planning software with combined electronic telephone directory (Street Atlas USA 2009+) was used to identify all residential names/addresses matching these postal codes (n=1,439).

4) All of these addresses were geocoded to identify residential location. The geocoding produced four levels of geocoding accuracy: exact street and address accuracy; street-level accuracy; FSA (Forward Sortation Area) accuracy, and regional accuracy. The last two provide unreliable locational information in terms of household contacts and so only those households with exact or street-level accuracy were retained in the sampling frame (n=1,013 for Barriere and n= 647 for La Ronge).

In Barriere, from the sample frame of 1,013 households with reasonable location accuracy, three sets of 250 randomly selected (without replacement) households were identified. Each set was mapped over a series of 1 km by 1 km grids using the GIS to check for adequate sample coverage throughout the study area. In La Ronge, two sets of 250 randomly selected (without replacement) households were identified, with a third set comprised of the remaining 147 addresses. Each set was mapped over a series of 1 km by 1 km grids using the GIS to check for adequate sample coverage throughout the populated portions of the study area. In both communities, each sample set functioned as the primary, secondary, and tertiary sampling lists for the researchers conducting the face-to-face interviews.

In each community, face-to-face interviews were carried out by a team of local research assistants. The survey development has been described in detail elsewhere[31-32] and included questions from the General Social Survey[33] as well as other established surveys. Each research assistant was assigned a share of the primary, secondary, and tertiary sample lists. Households on the primary list were approached; to ensure random selection of male and female respondents, an adult with the most recent birthday in each household was invited to participate in the survey. Members of the household were ineligible to participate if they did not reside in the community during the wildfire. If the household was ineligible or unoccupied, or if there was no response or contact after 3 visits to the household, an address from the secondary sample list (or tertiary list if required) was used as a substitute. Household contacts continued in this manner throughout the winter, spring, and summer of 2009. In total in the Valley, there were 429 contact attempts made, yielding 202 useable responses and a response rate of 47.1%. Assuming a population of 1,439 households in the area, the sample data provides a margin of error of +/- 6.4% at the 95% confidence level and +/- 5.4% at the 90% confidence level. In La Ronge 369 contact attempts were made, yielding 111 useable responses and a response rate of 30.1%. Assuming a population of 1635 households in the area, the sample data provides a margin of error of +/- 9.0% at the 95% confidence level and +/- 7.6% at the 90% confidence level.

Results

Demographics

In the qualitative interviews, there were 30 individuals interviewed in the Valley (15 women and 15 men). The average age was 60 years with the average level of education being 13 years. In La Ronge, 27 individuals were interviewed (14 women and 13 men). The average age was 51 with an average of 14 years of education among the group.

The household survey also collected demographic information about the respondents. In the Valley, of the 202 respondents, there were 122 females (61%) which is an over-representation by approximately 10% compared to the proportion of females according to Statistics Canada[34]. The majority of respondents had a high school diploma or less (58%), with 44% being between the ages of 45 – 64 years. Forty-six percent reported being retired. Annual household income for 42% of the respondents was reported to be between $20,000 and $39,999. In La Ronge, of the 111 respondents, there were 59 male respondents (53%) indicating an over-representation by 4% according to Statistics Canada[34]. The majority of the respondents had some form of post-secondary education (76%), with 54% between the ages of 45 and 64 years. Seventy percent were employed. Annual household income for 40% of the respondents was reported as $100,000 or higher.

The Meaning of Community: Barriere and La Ronge Perspectives

All of the participants were asked to discuss their definition of community and their experiences living within their respective communities. Findings from the qualitative interviews and the household surveys supported the perception that the community was a place where people work together for the betterment of all and that they had a sense of community while living there. The Valley was described as a friendly, welcoming, caring, and strong knit community, with a strong sense of identity and volunteerism. Helping one's neighbors was a natural activity; with 97% of the respondents reporting that neighbors help in emergencies and 81% reported feeling loyalty to the people in their community. The Valley was considered a rural area by 90% of the household respondents with Barriere identified in the qualitative interviews as being the hub for the other smaller communities surrounding it. Being rural meant that the individual was likely to be known by others in the community and had a strong social support network.

La Ronge was seen as both rural and urban in nature. For some of the individuals interviewed in the qualitative interviews, it was considered the "northern city" because of the government services, variety of stores and services and number of personnel in health, teaching and law enforcement. In the household survey, 71% felt strongly that La Ronge was rural. It is also a place with a long history of northern development including fishing and trapping and a place where building working relationships among the First Nations, Métis and Caucasian residents has been essential for its success. This was validated in the household survey where 96% of the respondents reported that neighbors helped in emergencies and 88% reported that they felt loyal to the people in their community.

During the Disaster

"Once your world changes, once you know that it's possible that your home and your community can be threatened, you lose something, and you never get it back."

<div align="right">La Ronge Resident</div>

From both the qualitative interviews and household survey, we learned that very few of the participants from the Valley or La Ronge were familiar with disaster preparedness before they experienced the fires in their communities. They did not have "grab and go" bags or prepared lists of evacuation items nor did they have a central spot in their home where essential items were kept for quick evacuations. School buses were not available as an alternative source of transportation for individuals such as senior citizens, the disabled, ill or individuals who did not have a driver's license or did not have insured and/or registered vehicles. In the Valley, some also discovered that they had insufficient gas in their vehicles, no cash on hand and were ill-prepared to evacuate in a hurry. In the Barriere household survey, of the 201 individuals who responded, 57% did not have a chance to prepare for the evacuation. Only 12% had more than 12 hours of warning time regarding the fire. The respondents were asked about their preparation to deal with the fire; 11% had previous training, 15% had previous knowledge and 12% had previous experience dealing with fires.

Sixty seven percent were overwhelmed by the suddenness of the fire and 76% were overwhelmed by the severity of the disaster.

In La Ronge, of the 111 individuals who responded, 82% did not have a chance to prepare for the evacuation. Only 12% had one to 12 hours of warning time regarding the fire. The respondents were asked about their preparation to deal with the fire. Eight percent had previous training, 12% had previous knowledge and 13% had previous experience dealing with fires. Similar to the Valley, the majority (62%) were overwhelmed by the suddenness of the fire and the severity of the disaster (63%).

In the Valley, findings from the qualitative interviews and household surveys revealed that not all participants received a formal evacuation order. Given the mountainous terrain, not all Search and Rescue personnel were aware of the location of homes in the more isolated areas. Luckily, friends and family members communicated the evacuation order to each other so that all residents safely left the area. Several interviewees noted that they did not know the locations of their family members when the evacuation occurred. Some women could not drive, requiring their husbands to do so. In several instances, this meant that these men could not help others in need. The increased number of outsiders involved in the fire and in the evacuations emerged as an issue in the qualitative interviews. Some suggested that local residents responded more positively to local individuals encouraging evacuation, rather than from "outsiders" to the Valley. Since outsiders were not familiar with the area, they unknowingly missed giving evacuation orders to some individuals in more isolated locations.

Not all individuals in the Valley evacuated. Some refused to leave in order to save their homes and businesses, reflecting their personal priorities that contrasted with the forest officials. These officials have three priorities: preventing human losses, preventing struc-

tural losses and finally preventing the loss of the forest itself. Although in some circumstances the RCMP were involved in enforcing evacuation orders, in other situations it became clear that the evacuation order was going to be refused and the individuals were left to manage on their own. This tension of staying and fighting the fire became an ongoing issue between the officials who were handling the fire and the residents who had differing opinions about what could and should be done. Among the household survey sample, the range of hours spent fighting the fire ranged from 0 to 5,812 but 135 respondents spent zero hours directly fighting the fire. Many individuals assisted in the fire efforts of their property or the property of other family and friends.

In La Ronge, the evacuation order involved a more limited geographic area which meant that entire neighborhoods had to be evacuated. There were no known refusals to evacuate and through the household survey we learned that there was minimal involvement in direct fire fighting. Among the sample, the range of hours spent fighting the fire was 0 to 96 hours, with 69 respondents reporting no involvement in fire fighting and only one individual reported spending 96 hours fighting the fire.

Among the household survey respondents from the Valley, 17% of the 201 respondents indicated that they defended their property against the fire. Eight percent became trapped by the fire but none was injured. A similar proportion of respondents (16% of 111) in La Ronge reported that they had defended their property against the fire. In contrast to the Valley respondents, 23% of the 111 La Ronge respondents became trapped by the fire and two were injured. These two individuals did not identify the severity level of their injury.

The evacuation experiences described by residents from the two communities were very different as noted in the household survey. In the Valley, 181 (90%) of the household respondents were evacuated. Of this total, 114 were evacuated once, 50 were evacuated

twice, 15 were evacuated three times and two were evacuated four times. When evacuated, the majority or 109 respondents were not separated from their family members. For the Valley residents who were evacuated it was challenging because it included a circuitous route by using the ferry at McLure or the road system north to Little Fort, over highway 24 with the need to crest the MacDonald Summit (1,311 m elevation) to 100 Mile House. Many ran out of gas or overheated at this point and were dependent upon others for help. In La Ronge, only 51 (46%) of the household respondents were evacuated to the Uniplex building in the community. Of the total evacuated, 48 were evacuated once; one was evacuated twice while another person was evacuated three times. When evacuated, only 39 were not separated from their family members. However, the qualitative interviews confirmed that family separation was mostly related to parents who were responsible to fight the fire or deal with the evacuation of residents and children who were in the local schools.

Evacuation of livestock became a major concern at the McLure Fire site. Cattle and horse ranches in the Valley were numerous and evacuation took considerable time. There were insufficient places to safely hold animals. In addition, one of the most suitable holding areas had to be used by the military when it arrived--making the whole process lengthy and challenging. The help of friends and neighbors was essential at this time.

Overall the participants who were evacuated in both communities felt positive about the assistance they received at the registration centres. They appreciated the vouchers, free lodging and all other assistance that was provided. One issue raised at the McLure Fire site was that the concerns over privacy and Freedom of Information and Protection of Privacy (FOIP) regulations did not allow individual organizations to share information about individuals; the evacuees felt that much of the information they were asked was redundant, was requested at a time of great stress, and could have been shared. One other frustration for

those in the McLure Fire was that reports in the media incorrectly noted that the entire town of Barriere was destroyed in the fire. Discovering later that this was not true, led to a swell of emotions of evacuees from despair to relief to ongoing concern about what was really true from media outlets.

Despite the high level of security on roads, a few homes destroyed by the McLure fire were looted. Those who experienced this situation felt further violated. In addition, there was the report of at least one individual who came to assist with the rebuilding of the community who was not legitimate in his role. When this was discovered, some of the local community members ensured that he left the area and did not continue to bother those who were trying to rebuild their lives.

There were a number of groups in both communities who were identified as being vulnerable due to the fires. Those mentioned included seniors; those with pre-existing illnesses or conditions; the developmentally challenged; infants and children; those who lived in the more isolated areas, those without insurance; those who lived closest to the fire; and, the firefighters themselves. Interestingly, individuals with pre-existing mental health conditions or those with excessive stress before the disaster were not mentioned as being at-risk.

The Aftermath of the Disasters

In both communities, property destruction was the overriding consequence of the wildfires. The qualitative interviews with the participants documented the emotional and psychological reaction to these losses. In the Valley, according to the household survey, 53 respondents lost their home, with 8 indicating their home was totally destroyed, 27 lost their business or farm, 60 lost their neighborhood and 103 lost their town due to the fire. In contrast, in La Ronge, 3 respondents lost their home (1 noted it was partially destroyed), three respondents lost their business or farm, 16 lost their neighborhood and 56 reported losing

their town due to the fire. Interestingly, only 10 buildings were destroyed in La Ronge and none were municipal buildings. The household survey findings about the loss of the town contradict the actual loss of buildings. It is important to note that the question posed in the survey may reflect the perception of La Ronge residents about fire damage and their community, as opposed to the reality of the damage.

The clean-up after the fire also required extensive time, particularly for those who were evacuated and then returned to deal with property. In the Valley, clean-up and rebuilding was assisted by non-profit groups including the Mennonite Disaster Services (MDS) which helped rebuild houses, barns and other structures. The qualitative interviews include numerous examples of the amount of physical and emotional work that was required to rebuild their homes and lives.

In La Ronge, some of the individuals who lost their homes did not rebuild and left the community. Before the fire, one family was in the process of moving into their new home and had not unpacked their boxes. With the outbreak of the fire, they travelled by boat to save their home but watched helplessly from the lake as it was completely destroyed. Despite having the resources to rebuild, individuals who lost their homes still needed to deal with a number of emotional and practical issues after the fire.

In both communities, changes occurred as a direct result of the fires. Undeniably, the McLure Fire caused a great number of changes to the Valley because of its sheer magnitude. One significant change was the economic loss in the community related to the lumber industry--including the loss of the trees and the loss of Tolko Industries, one of the largest employees in the Valley. The loss led to a number of families leaving the community to seek employment elsewhere. Simultaneously, one of the schools closed, resulting in the amalgamation of the school population to create one elementary school. The school closure

had been expected due to declining enrollment, but was hastened by the loss of families. From informal discussions with community members, it became clear that there was a perception of a large turnover in the population since the fire occurred, but this is difficult to substantiate. However, according to Statistics Canada[34] the population of the Lower North Thompson District declined from 3,257 in 2001 to 2,978 in 2006 an 8.6% decrease.

The McLure Fire resulted in numerous individuals experiencing lingering personal health effects even though some of these individuals had not experienced any direct losses as a result of the fire. The qualitative interviews include various examples of reported physical and mental symptoms (e.g., extreme fatigue, nervousness and anxiety) that individuals experienced. In addition, there is the perception that fatal heart attacks increased in the months following the fire. There were also concerns about the perceived incidence of cancer in the area; participants speculated about the possible inter-relationships with the fire experience as well as the use of the fire retardants and cancer. A number of comments were made about how difficult it was to cope with the losses they experienced and the fear that it would happen again.

Both men and women who were interviewed about the McLure Fire expressed how fragile they had become since their experiences. It became clear in the interviews that individuals who were already struggling in their lives became more stressed as a result of the fire; subsequently they did not always do as well afterwards. Those with the necessary social supports fared better in some instances. There were also reports of students doing less well in school after the fire, with the assumption that there was a lack of services to help children and families cope with what had occurred in their lives. In the Mallard Fire, no lasting effects were reported among the majority of the group who were interviewed. However, individuals who lost their homes in the fire talked about feeling despair when the com-

munity members assumed that no additional assistance was needed. Homes that were destroyed by the fire were outside of the community's boundaries and were of higher real estate value compared to the larger community. The assumption was that the affected homeowners had insurance and money to rebuild. Although this may have been true for some, for those who chose to leave, they left in part because of the disconnect they experienced with the community after the fire.

In the Valley, the aftermath of the fire also affected individuals' work roles. After the fire, 65 (32%) of the respondents indicated that they had lost their capacity to work. For some, their workplace and opportunity to work in the community had ended. For example, 22 indicated that their workplace was destroyed by the fire, 16 had lost a personal capacity to work and 7 noted that their work was not needed. Eighteen of the respondents indicated that there were other reasons for not working after the fire. Many of the reasons were directly related to the fire including the decline in the customer base due to the loss of Tolko Industries Ltd.; bankruptcy of the company due to the fire; loss of clientele due to their relocation, or being unable to secure business due to the fire. In contrast, at the La Ronge site, only 6% indicated that they had lost their capacity to work after the fire, including being traumatized by the fire.

Following the fire in the Valley, people disclosed that they had continual health problems (breathing difficulties), some had had heart attacks, others had severe anxiety, depression and nervous breakdowns, many have had continual financial problems due to the lack of home insurance and loss of their home, others lost their jobs and have had to move away or stay and manage on limited incomes. After the fire, there were many changes that the individuals within the affected communities had to address. According to the household survey results, for those in the Valley, 55% of 174 respondents experienced a change in

their living arrangement, 47% of 180 respondents experienced a change in their financial income, 42% of 177 respondents experienced a change in their employment, and 33% of 171 respondents experienced a change in their health after the fire. The change in their living arrangements was identified as being the one with the greatest impact by 23% of the 202 respondents. This was followed by financial income (21%), health (13%), and then employment (10%). The respondents were also asked about the outcome of the change with the greatest impact. Sixty-two percent of 179 respondents indicated it was resolved and 31% stated it was ongoing.

The qualitative interviews with the participants indicated that there is a need for physical and social rebuilding of communities that experience wildfires of such magnitude when structures are lost. From a physical perspective, the Valley participants acknowledged that several of the houses which were built after the fire surpassed what the individuals had previously owned. In this way the community looked more attractive and the families received assistance to move forward with their lives. The rebuilding would not have been possible without groups such as MDS, the Salvation Army, which provided free meals for the community, and the Red Cross which provided resources and services including mental health counselors after the fire. In addition, for the first time ever, the TNRD provided free building permits to allay some of the cost for those who had lost their homes and other structures.

Although the McLure Fire was a stressful, challenging event, it did have its positive merits with some even going as far as saying it helped to rejuvenate the Valley area. From a social perspective, the community members felt much closer after the fire and volunteerism increased (particularly in groups such as the local Search and Rescue and the Emergency Social Services) which fostered a belief that they could move forward as a community.

There was also a greater sense of community cohesiveness since the disaster had occurred and a decrease in negativity in general. The fire served to stimulate the economy through construction projects, and there were more new homes in the area due to the rebuilding of properties based upon insurance claims or volunteer work contributed by groups such as MDS. In summary, the McLure fire is seen as a major event in the time line of their community's history.

At the time of the fire, Barriere was unincorporated but became an incorporated community in 2007. They continue to contract with the TNRD for their emergency services which includes disaster personnel (e.g., an Emergency Coordinator). After the 2003 fires, the TNRD made significant changes to their disaster plan and met with the media to discuss their experiences. As a result they have developed a comprehensive media plan to implement in any future disasters. From a local perspective, the Simpcw First Nations community has implemented an official policy that all band vehicles have no less than a three quarter tank of fuel. After the fire, there was more extensive training for the band fire fighters including using a training simulator. The Fire Chiefs in the surrounding area meet monthly to discuss any issues and keep the communication lines open to ensure that all of them can work together if there are any future disasters. The Filmon Report[35] made numerous recommendations for future wildfires and suggestions were shared by local people with the Horse Council of British Columbia to update their disaster preparation materials regarding evacuation of livestock.

In La Ronge, the Mallard Fire was a wake-up call that even though they lived next to a major northern airport with water bombers on permanent standby, they too could experience a fire. With only one road in and out of the community to the north or south, and living in a forested area which is also on the Canadian Shield, a new view of how to plan and pre-

pare for fires was needed. The neighborhood that was threatened during the fire was recon-figured to ensure that an additional road toward the highway was built--as opposed to having only one road going toward the town centre. Importantly, the elected officials of all three communities agreed to co-develop a Fire Centre that is paid for on a per capita basis. The Fire Centre includes a media room, all fire equipment and a meeting room for fire and other relevant personnel to meet. Individuals who were interviewed talked about the lessons learned from the 1999 Mallard Fire that were put into place at the time of the 2006 English Fire Complex.

The findings from the La Ronge site reveal that there were no lasting physical or emotional effects and few comments about the links between the fire and negative health outcomes. In La Ronge, after the fire, only seven respondents indicated that they had lost their capacity to work. Of these respondents, only five indicated that there were other reasons for not working after the fire (e.g., self-employed citizens took down-time from the fire, and people were traumatized by the fire). After the fire, there were many changes that the individuals within the affected communities had to address. For those in the La Ronge area, the household survey results showed that 12 (11% of 111) individuals experienced a change in their living arrangement, financial income, and their health after the fire; six (5%) experienced a change in their employment. Changes in their financial income and health were identified as being the ones with the greatest impact for nine of 111 respondents (8%), followed by living arrangements for seven respondents (6%) and parenting, child care, education, and personal achievements for four respondents (4%). The respondents were also asked about the outcome of the change with the greatest impact. Of the 48 valid responses, 36 (75%) indicated it was resolved and 12 (25%) stated it was ongoing. There were also various individual responses regarding the positive and negative impacts of the fire among

this group. Examples include having a major change in mind set and realization of their vulnerability which initiated further emergency preparedness. Consequently, community members have created a plan for evacuation and in general became better prepared for future disaster. In La Ronge, the homes that were destroyed were a distance away from the main community. The rebuilding of those individual homes was dependent upon individuals accessing their own resources. The one exception was a bush home of an individual that was rebuilt for free by a local company.

Community Resiliency and the McLure and Mallard Fires

The main thrust of the study was to examine the relationship between community resiliency and the responses to a wildfire. Not all the participants at either community site could define resiliency, but those who did saw it as a type of self-reliance or the ability to bounce back and survive. It was also viewed as an unconscious process.

Residents felt that there were specific characteristics associated with resiliency, which was viewed as an inherent process, at the individual and community level. For the individual, the most important characteristic identified was having a positive attitude, a genuine concern about one's neighbor, and possessing an ability to change. At the community level, participants argued that sound leadership needed to be present, as well as collaborative working relationships and collective decision-making. They added that a sense of belonging and community pride also need to exist. Other features identified as important were having gathering places for the community and a diverse economy. Finally, participants felt that as a collective, the community needed to demonstrate that it has the ability to change. For some, resiliency had a spiritual aspect and was completely dependent upon individual attitudes rather than material items.

In discussion about resiliency in the communities that experienced the fires, exam-

ples were provided of neighbors helping one another, homes being rebuilt and the closeness and camaraderie experienced after the fires. In the Valley, in particular, reference was made to the residents who did not give up on the community, but returned to rebuild their lives. In the household survey, all the participants were asked to respond to 15 items initially designed to construct a composite scale of resiliency, although subsequent analysis and external validation of these items showed that an 11-item scale was more appropriate to measure an Index of Perceived Community Resiliency (IPCR). Nevertheless, there were findings of strong agreement with five of these items. Findings of strong agreement with five of these items converged with the qualitative responses about resiliency from both community sites. For the 202 respondents from the McLure Fire site, there was strong agreement that people shared similar values (56%) and helped one another (89%). They also responded that there is strong community leadership (56%), a sense of community pride (75%) and that community members are able to deal with problems (70%). Of the 111 respondents at the Mallard Fire site, 45%, indicated strong agreement that people share similar values, that they help one another out (85%) and that there is strong community leadership (43%), a sense of community pride (68%) and that community members are able to deal with problems (74%).

According to those who were interviewed at each community site, resiliency could be enhanced in specific ways. At an individual level, resiliency could be enhanced with a positive, proactive attitude, demonstration of working together, volunteering and helping others. At the community level, gathering places, planned community events to allow people to get together, and a supportive political environment were considered to be vital in promoting resiliency. Other activities identified by the participants that would help enhance resiliency include: 1)additional services to help children; 2) support available to help individuals overcome tragedy; 3) sponsoring a psychologist to come to the community to talk

about loss; 4) community forums to allow for discussion and exchanges between those who have experienced similar disasters from other communities; 5) ensuring that affordable housing is available; and, 6) clearly communicating what is happening in the community. Finally, external agencies were seen as helpful in enhancing the Valley's resiliency.

Inhibitors of resiliency were also discussed with the participants. The most common response was that negative attitudes were damaging to resiliency. Other responses focused on the lack of individuals (e.g., loss of youth, insufficient volunteers and the decrease of population after the fire) who could contribute to building resiliency. There was a range of responses regarding how many people left the Valley after the fire. Regardless of the number, or the actual decrease in the population, respondents felt that there were fewer individuals available to contribute to the community's resiliency. One individual believed that community problem-solving during the fire could have been better and that leadership was lacking, since some community leaders did not step forward at the time the community needed them to do so. Other things that inhibited resiliency were exclusion of some groups, individuals not wanting change and people dividing into factions. Lack of pride was another inhibitor, as well as an overall lack of hope.

In conclusion, the study identified that there are numerous factors that influence community response to wildfires as a disaster experience. Some examples include the population size and available infrastructure within the community. For the two rural community sites included in this investigation, the lack of resources hindered their ability to address the wildfire while it was ongoing and after it was controlled. The McLure Fire site in particular was assisted by external agencies in order to address this inherent shortfall.

In addition, there was a variety of actual responses to the wildfires identified. For instance, both community sites updated emergency plans and La Ronge developed a shared

Fire Centre that would benefit all community residents. At the individual level, significant economic changes occurred within the Valley and individual health issues were noted because of the fire experience. In La Ronge, the individual impact was believed to be minimal but some of those who lost their homes chose to leave the community, in part, because they did not feel supported by the other community residents. The information generated provides support for the community resiliency model that was applied during the research including the constructs of importance of helping one another, being proactive and having the ability as a community to make changes. Ultimately, creating a sense of community was important for their community's resiliency.

The mixed method approach of this study provides a useful framework for deriving both qualitative and quantitative data on individuals and communities that have experienced wildfires. A qualitative approach is essential for deep-level understanding of the individual nuances of fire impacts, coping strategies, and resilience of people. The quantitative data derived from household surveys provides invaluable aggregate information on key impacts and social and resiliency trends in the affected communities, but if used alone, may mask some of the insights that can only be gained from a qualitative approach. In conjunction, however, these different approaches allow for a triangulated and more informed basis for policy recommendations. The following recommendations based upon our findings are offered for decision makers at the local, provincial and national levels in order to be more sufficiently prepared for wildfire disasters. The recommendations emphasize issues that are not commonly addressed in current disaster preparation discussions.

Key Recommendations for Decision Makers

Disaster Preparedness
- Develop memorandums of understanding with relevant agencies to ensure that during and after the disaster, arising issues are addressed and that lines of communication and authority are in place.
- Develop public education and disaster awareness that is appropriate for the community (e.g., including having a livestock evacuation plan)
- Create an updated community disaster plan which identifies a back-up community that could assist and transportation plans for evacuations (e.g., use of school busses).
- Maintain up-to-date maps to locate all individuals that may need evacuation.
- Establish policies to determine if large gatherings planned for the time period of an evacuation or evacuation alert should be cancelled.

During the Disaster
- Develop communication strategies so that the evacuees are updated about the condition of their homes and community during the wildfire.
- Create effective coordination of all relevant agencies.
- Ensure adequate safety and surveillance procedures are in place for vacated property.

After the Disaster
- Collect economic, social and health data in communities that experience wildfires for 5 years after the wildfire and then every 10 years for 3 more decades.
- Develop temporary programs for the school-aged population to help them deal with the ongoing issues associated with the wildfire.
- Provide financial counseling for families.
- Provide long-term mental health counseling and assistance in understanding and dealing with the inherent community changes for all community members.

Fostering Community Resiliency
- Providing opportunities for local residents to gather and reflect on the disaster experience thereby building their networks and developing opportunities for interaction.
- Organize celebrations to provide avenues for social support while also creating a sense of belonging and community
- Provide support for local leaders and develop mechanism to create the next generation of leaders within the community.

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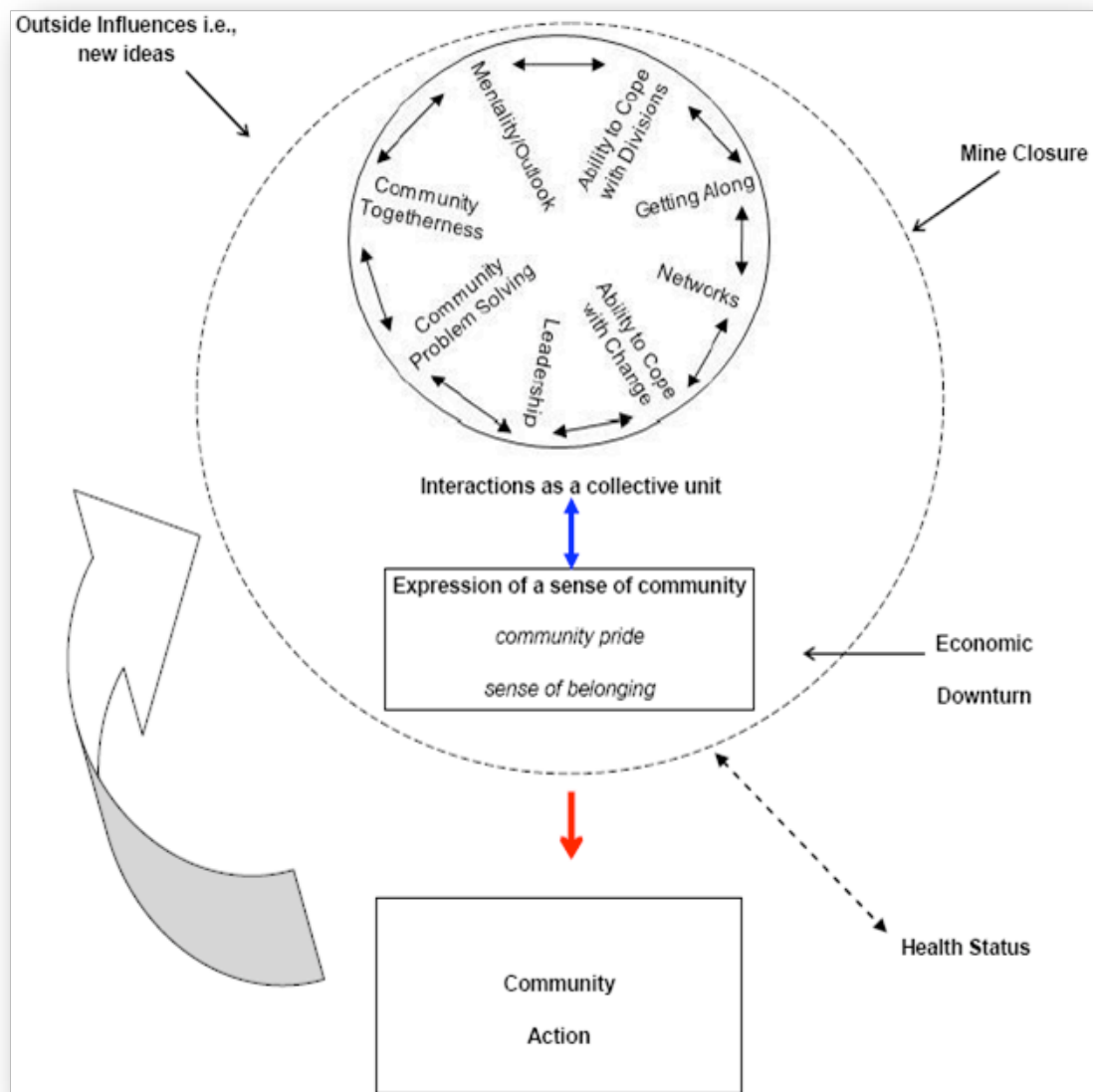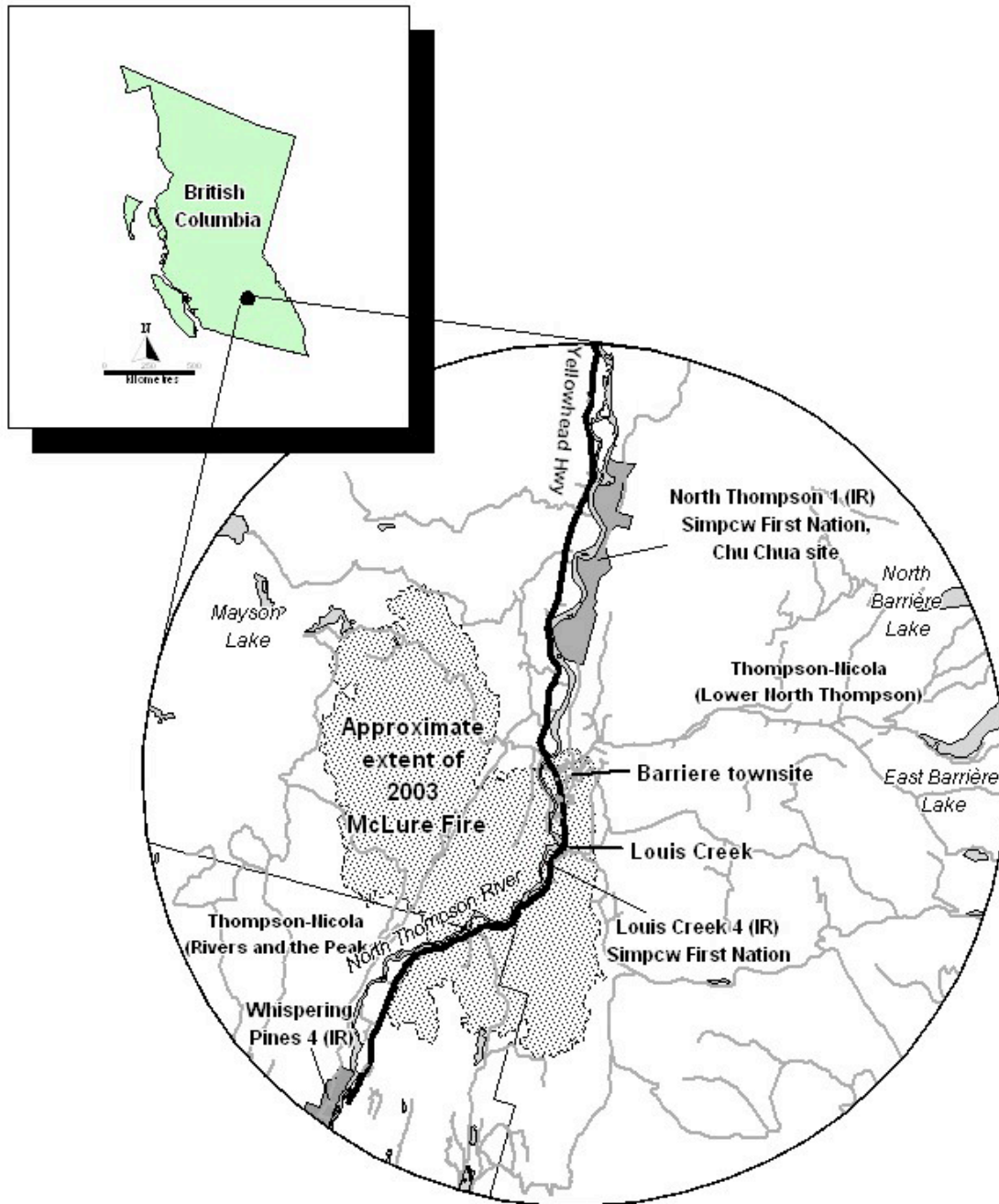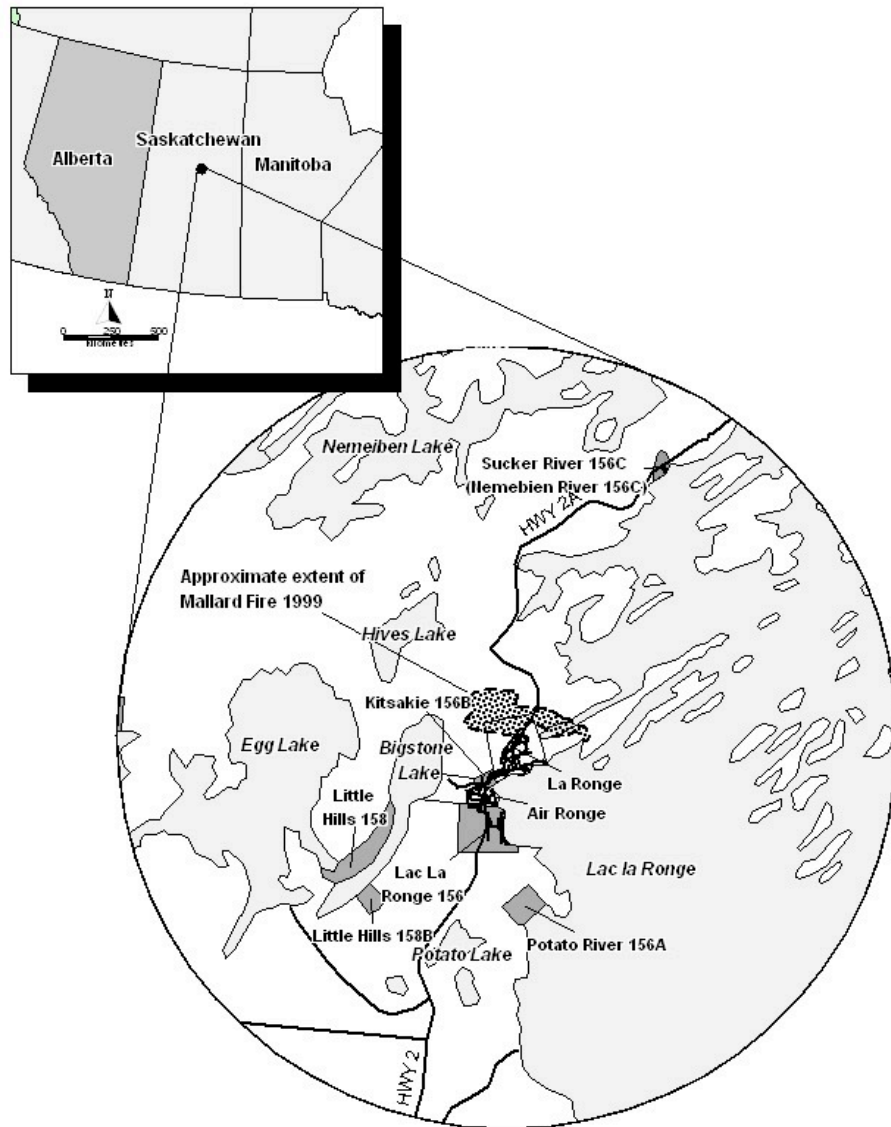
Figure 1. Updated Community Resiliency model[24]

Figure 2 Barriere Study Area

Figure 3 La Ronge Study Area