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Using Photovoice to Understand Climate Change Adaptation in Rural Ontario

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USING PHOTOVOICE TO UNDERSTAND CLIMATE CHANGE ADAPTATION IN RURAL ONTARIO

By

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Abstract

USING PHOTOVOICE TO UNDERSTAND CLIMATE CHANGE ADAPTATION IN RURAL ONTARIO

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The examination of community adaptation and resilience approaches to address the threats of climate change in rural Ontario is becoming increasingly important in emergency management and preparedness. Community engagement becomes critical in this regard, as local experiences partly influence perceptions of climate change risks within municipalities. Photovoice is a community-based participatory research methodology that empowers participants to document their perceptions and understandings of a particular issue through the use of visual images. This technique was undertaken to understand the impacts of the F3 tornado that hit the community of Goderich, Ontario in 2011 and capture their member's perceptions on disaster recovery and climate-related threats. For this project, I worked with 10 community photographers to refine themes (n=7) related to the impacts of the extreme event on critical infrastructure as well as community strengths and challenges associated with climate change resilience. My findings indicate that the F3 2011 tornado brought vast hardship to the residents of Goderich of which they still experience five years later and that differing opinions during the recovery process encouraged controversy – hindering some of the social cohesion during rebuild. Despite the community's fast recovery, certain infrastructure such as banking and businesses remains to be vulnerable to future disaster. Most importantly, optimistic acceptance and positive outlook regarding their perception of community strength and resilience despite losses was an overwhelming theme for the participants in this project.

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1.0 INTRODUCTION

1.1 Problem Statement

The impacts of climate change are already being felt and will continue to cause changes to both extreme and average climate conditions in Ontario (Chiotti & Lavender, 2008; Wall & Marzall, 2006). Critical infrastructure represents one key area of concern and disruptions have already taken place across sub-regions of the province. While these disruptions are expected to occur more frequently and are costly to both Ontario's economy and society, the level and impact differs immensely across the province (Craft & Howlett, 2012). Flooding attributed to severe weather has damaged communication lines and transportation, with costs exceeding $500 million (Chiotti & Lavender, 2008). The extent to which Ontario will be affected by climate change largely depends on its adaptive capacity; for infrastructure to be resilient under both present and future climatic conditions, climate change must be considered in planning processes and design strategies.

According to the Rural Ontario Municipal Association (ROMA 2011), 75% of Ontario municipalities are at least partly rural. While research has been growing in this field, important knowledge gaps continue to exist regarding the distinct vulnerabilities and resiliencies in rural communities to actively manage climate change impacts, such as extreme weather events. Communities can expand their ability to respond to changing conditions by educating their members, protecting the most vulnerable, building social resilience, and developing and employing sufficient adaptation measures (Crabbe and Robin, 2006; Wall & Marzall, 2006; Chiotti, Lavender, 2008). The institutional capacity to adapt to risks largely relies on the perceived risk and ability to act in a timely fashion; effective adaptation depends on well-

informed decision-makers who have a concrete understanding of climate change risks. These perceptions of risks are partly influenced by local experiences (Sander-Regier et al., 2009; Chiotti & Lavender, 2008; Silver & Grek-Martin, 2015). As such, community member engagement becomes critical to identify research priorities, assessing the effectiveness of current adaptation measures, and influencing future strategies.

Photovoice has emerged as an engagement technique, providing cameras to community members to empower them to visually document their experiences and understandings of a particular issue (Wang & Burris, 1997). Results of the activity provide local decision-makers with the opportunity to better understand the lived experiences of the residents in their community and, when the results visibly influence future decisions, community vitality and resilience are enhanced (Nykiforuk et al., 2011). Although the broader literature on community engagement and photovoice is growing, few studies focus explicitly on the application of photovoice in the emergency-planning context (Annang et al., 2016; Crabtree & Braun, 2015).

This research is designed to study and present findings to fill this gap, focusing on the climate change threats to critical infrastructure characteristic of an Ontario rural context and the development of appropriate emergency management adaptive strategies. A photovoice project was undertaken to understand the impacts of the F3 tornado that hit the community of Goderich, Ontario in 2011 and document its members' perceptions. The questions explored were: how do the community members of Goderich perceive the recovery from the F3 tornado, specifically the impact on critical infrastructure? Do community members feel that certain areas of critical infrastructure are more threatened by current and future climatic events than others? How can information gathered by community residents improve the emergency management of critical infrastructure and improve the adaptive capacity of their community to climate-related threats?

These questions work in conjunction with the larger overall project, whose goal is to enhance municipal emergency management (EM) planning and strengthen adaptive capacities.

1.2 Research Objectives

The purpose of this research is to synthesize and discuss the perceptions of climate change threats to critical infrastructure in rural Ontario through the lens of the community member. It was the aim of this research to identify key themes and provide an analysis of these results for their application in the development of appropriate emergency management adaptive strategies within Goderich, Ontario. This work was informed by an analysis of current research as well as workshops with Goderich's municipal authorities that were undertaken by other members of the project team. In order to provide feedback for future emergency plans and management strategies to local decision-makers, the objectives of the project were as follows:

1. Identify and synthesize current academic literature on climate change impacts on critical infrastructure in rural Ontario within the context of community adaptation and resilience. Based on the current state of scholarly information, outline the benefits and potential barriers for applying a photovoice project to engage the community members of Goderich, Ontario.
2. Undertake a photovoice project in Goderich, Ontario. Engage with community members to determine perceptions, themes, opportunities and obstacles to climate change adaptation.
3. Synthesize and assess findings from Objectives 1 and 2 and present the results to emergency management municipal officials and local decision-makers as an approach to understanding community member's perceptions so it can be integrated within policy and management for future events.

Following this introduction, this MRP is divided into three subsequent sections: a literature review, overview of the methods, results, discussion, and conclusion.

2.0 Literature Review

2.1 INTRODUCTION

Extreme events and the impacts they have on rural communities represent an integral area of concern for emergency management. Increased understanding of anthropogenic climate change and its impacts on weather has led to a growing concern as to how these changes will be realized on critical infrastructure in municipalities (Craft et al., 2012; ICLEI, 2010). As a result, Dr. Brenda Murphy of Wilfrid Laurier University sought funding to establish a research collaborative to confront the issue.

This research project aimed to enhance the adaptive capacities of rural Ontario communities to increasing climate change threats from extreme events. It sought to identify the resiliencies, opportunities, and challenges facing municipalities, undertaking a holistic, mixed-methods assessment. Specific to this MRP, this research aimed to facilitate broad community-engagement, develop social capital, and enhance data richness in Goderich, Ontario. It involved the examination and implementation of a photovoice project. Photovoice was used to provide information about community member perspectives and build community resilience and empowerment for adapting to the impacts of climate change.

The following literature review provides an assessment of the academic literature on the climate change threats typical in a rural Ontario context and photovoice as an approach for community adaptation to climate change related events. The literature review is organized into three key subsections. First, a brief section on the importance and reasoning for an adaptation

and resilience approach in the context of climate change is provided, followed by definitions of emergency management and critical infrastructure. Second, the review focuses on providing an overview of the projected impacts of climate change on rural Ontario, Canada, including a brief history of Goderich, Ontario. Finally, the applicability of a photovoice project in the context of emergency management and local planning in the face of climate change impacts is discussed.

2.2 ADAPTIVE CAPACITY AND RESILIENCE

Although various definitions exist within the climate change literature, Smit and Wandel (2006) define adaptation as "… a process, action or outcome in a system in order for the system to better cope with, manage or adjust to some changing condition, stress, hazard, risk or opportunity." (p. 282). Adaptive capacity, is the ability to manage and influence resilience (Engle, 2011). Compared to mitigation, which focuses on actions that reduce or eliminate greenhouse gases that contribute to climate change, climate change adaptation involves the alterations in processes and practices in response to predicted or actual climate and extreme weather events; it requires the capacity to respond despite uncertainty and imperfect information (Gunson & Murphy, 2015; ICLEI, 2010).

In recent years, locally-based climate change adaptation has gained public attention and has rapidly become a mainstream strategy for addressing climate change threats and vulnerability (Measham et al., 2011; Preston, Westaway, & Yuen, 2011). Previously, most adaptation policy and planning had been focused at the national scale (ICLEI, 2010; Measham et al., 2011; Preston et al., 2011; Wall & Marzall, 2006). Preston et al. (2011) notes that the emergence of local adaptation is driven by the idea that the effects of climate change are experienced locally. Thus, the role of local government is considered vital to the success of adaptation efforts; municipalities must work jointly with the general public, private sector, and higher levels of

government (Gunson & Murphy, 2015). Studies have recognized the pressing need to build institutional capacity at each level, in part: contributing scientific knowledge and integrating marginalized voices; ensuring horizontal and vertical accountability; coordinating policy across sectors; and effectively transferring resources (Bruce, Egener, & Noble, 2006; Pielke et al., 2007).

According to Smit and Wandel (2006), adaptation initiatives are typically incremental, and modify pre-existing management strategies or policies; rarely are successful climate change adaptation strategies undertaken with respect to climate change alone. This is what is referred to as mainstreaming (Huq & Reid, 2004). Reducing vulnerability also appears to be most effective when undertaken in combination with other strategies and plans at various levels (Smit & Wandel, 2006) However, as Gunson and Murphy (2015) note, the capacity constraints of local jurisdictions to take on new priorities are not typically anticipated by adaptation processes mandated by higher levels of government. There is a need for the further mainstreaming of adaptation efforts, meshing them with the initiatives of local actors to identify and manage the threats and opportunities that are already being experienced (Gunson & Murphy, 2015).

Stemming from the ecological and environmental hazards literature, resilience is a term often used to describe a community's susceptibility to change (Mendis, Mills, & Yantz, 2003). Resiliency is the ability to cope with, shape, and adapt to change, such as the impacts from extreme events (Folk, 2006). It is also the potential to innovate, embrace opportunities, and reorganize. A resilient community, then, is able to flourish in an environment where change has taken place and members adopt pre-emptive learning to monitor and better understand these changes (Wilson-Forsberg, 2013). In a study examining what aspects community residents believe to contribute to building community resilience within a small rural town, Madsen and

O'Mullan (2016) found that social connectedness, optimism, and community learning were considered highly important. The authors also explored the concept of collective narrative as part of social capital, which they state has not had the same level of research compared to the idea of social networks. In this regard, social narrative originates from the social memory of a community, and as Madsen and O'Mullan (2016) note, residents who have experienced a natural disaster have a great need to make meaning of the events. Monuments and memorials are one example of a more formal collective memory, whereas dialogue between family, friends, and other residents can also be considered a way of developing ideology and values within communities. It is evident that when trying to build resilience in communities following natural disasters, resilience must be considered part of a long-term community development plan, rather than something completed within the short-term (Madsen & O'Mullan, 2016).

Following these results, Madesen and O'Mullan (2016) argue that before decision-makers develop appropriate strategies for community resilience, the notion of "community resilience", adaptation, and the various other related concepts needs to be considered first. Although it may seem explicit, resilience itself is a complex problem that requires an interdisciplinary approach – especially within the context of emergency management and preparedness following natural disasters. Additionally, natural disasters involve multiple built and social systems; many interacting strategies may exist to improve resilience that involves diverse stakeholders; and environmentally related problems are full of uncertainty due to spatial and temporal complexities (Davidson, 2015). Evidently, community resilience is not something that can be forced from a distance.

Regarding emergency management, traditional 'top-down' approaches have been criticized as having major limitations when facing disruptions of critical infrastructure (Boin &

McConnel, 2007). During a disaster, responsibility is largely assigned to the government to fix problems and restore a sense of order. However, a disconnect can occur between the government authorities leading the response efforts and community members when communication fails and reliable information about the situation is unavailable. Therefore, Boin and McConnel (2007) advocate that a shift towards long-term societal resilience and away from conventional top-down approaches is essential. Various other authors also suggest that more effective management of climate change-related risks can occur through greater inclusion and integration of community engagement, and the promotion of institutional and social learning (Mendis et al., 2003; Sander-Regler, McLeman, Brklacich, & Woodrow, 2009; Tompkins & Adger, 2004; Tompkins & Neil Adger, 2005). As such, the capacity and role of municipal governments are crucial to successful adaptation efforts within a critical infrastructure and emergency planning setting, due to the nature of climate change and its local and context-specific impacts (Gunson & Murphy, 2015; Tompkins & Adger, 2004).

Additionally, because local governments already have a mandated responsibility to warrant the safety and welfare of their communities, local governments are well positioned to undergo climate change adaptation planning, including emergency management (ICLEI, 2010). Climate change adaptation approaches can be tailored to address local conditions through anticipatory, proactive planning, utilizing existing strengths and creating opportunities to reduce vulnerabilities. Likewise, O'Rourke (2007) found that for a community to be resilient with the appropriate critical infrastructure, education and risk communication is a requirement – in addition to strong and innovative leadership, effective planning, and long-term commitment of resources to develop and manage complex systems. Resiliency, then, can be accomplished

through science, technology, and information developed by partnerships among communities, governments, scientists and engineers (O'Rourke, 2007).

Importantly, municipalities should also be aware that 'informal' volunteers and volunteer groups will likely develop following a disaster (Whittaker, McLennan, & Handmer, 2015). And, that many of those volunteers can build additional capacity in disaster response. 'Emergent' organizations are those groups that emerge when needs are not being met, or that it is perceived that needs are not being met by other organizations. 'Extending' organizations are those that have been already established; yet take on new functions during the emergency period. The authors maintain that these emergent groups are inevitable. As such, it is essential that emergency services and municipalities are prepared to coordinate with them and their activities to encourage effective response during/following a disaster, and to prevent harmful situations for both volunteers and others (Whittaker et al., 2015). Coordination and support of these groups will also allow municipalities and emergency services to capture the energy and resourcefulness that seems to result from their involvement (Winkworth, Healy, Woodward, & Camilleri, 2009).

2.3 EMERGENCY MANAGEMENT AND LOCAL PLANNING

Emergency management (EM) is crucial for protection against all extreme events and necessary as part of climate resilience. As defined by Public Safety Canada (2015a), emergency management is "the management of emergencies concerning all-hazards, including all activities and risk management measures related to prevention and mitigation, preparedness, response and recovery." In Ontario, EM falls under the Emergency Management and Civil Protection Act as its legal framework. All municipalities are expected to develop, implement, and sustain an emergency management program, and each municipality must designate a community emergency management coordinator (CEMC) to arrange emergency management activities

within its jurisdiction (OMCSCS, 2015). Four interdependent components comprise EM: risk mitigation, emergency preparedness, short-term response, and long-term recovery.

Traditionally, there has been more focus on the preparedness and response components that comprise EM; it is now recognized that forward thinking recovery measures can allow communities to overcome past vulnerabilities as well as recover from recent disaster events (Public Safety Canada, 2015a). Public Safety Canada (2015a) defines a disaster as being a social phenomenon that is the result of a hazard intersecting with a vulnerable community in a way that overwhelms their ability to cope, potentially causing severe harm to the safety, health, welfare, property, or environment components that are important to people. Disasters can occur naturally within the biological/geophysical environment, or may be triggered by human action or error (Public Safety, 2015a).

As such, effective EM should be informed by robustness, redundancy, efficiency, and self-organization – all key attributes of community resilience (Public Safety Canada, 2015a). Neither EM components nor community resilience attributes should be considered static end-states; there should be an emphasis on adaptability and flexibility.

2.3.1 Critical Infrastructure

Critical infrastructure are the processes, systems, facilities, technologies, networks, assets and services essential to Canadians' health, safety, security, economic well-being, and the effective operation of government; they can be independent or be interconnected within and across provinces (Public Safety Canada, 2015b). Examples of critical infrastructure include: telecommunications, electrical power systems, oil storage and gas transportation, and emergency services (Robles et al., 2008). Disruptions of critical infrastructure can result in loss of life, harm to the public, and adverse economic impacts; their protection is crucial. As such, Public Safety

Canada (2015b) aims to control risks, reduce vulnerabilities and enhance resilience across ten sectors: Health, Food, Finance, Water, Information and Communication Technology, Safety, Energy and Utilities, Manufacturing, Government, and Transportation.

According to ROMA (2011), Ontario has an estimated $60 billion gap over the next ten years between what municipalities spend on infrastructure and what is needed for maintenance and growth. Roughly 50% of the gap is accounted for by road and bridge assets (Rural Ontario Municipal Association, 2011). In disaster response, decision-making often relies upon physical infrastructure such as telecommunications, electricity and fuel. Craft et al. (2012) note that networks are constructed over generations and not easily replaceable; systems must be continually sustained to protect human populations; they have high start-up/replacement costs; failure in one system component may have ramifications in another part of the network; and since many are interconnected, failure in one system can have cascading impacts. In their review of provincial plans and infrastructure ministry documents, an important gap in current provincial policy was also revealed. There was inadequate mention of climate change adaptation efforts specifically related to infrastructure. They assert that there is a need for new planning and infrastructure approaches with the ability to withstand the reality of climate change (Craft et al., 2012).

In rural and northern areas of Ontario, extreme weather can have significant impacts on critical infrastructure. These impacts are complicated by lagging telecommunications, losses in the natural resource sector threatening the economic base, and lack of sufficient education and health care facilities (ROMA, 2011). Boin and McConnel (2007) note that because few major infrastructural failures have occurred in Western societies, it is also a major challenge to predict with much precision the possible consequences. This poses a major challenge in future planning

and infrastructure approaches regarding the impacts of climate change. Additionally, as society becomes more technologically advanced, it is important to consider whether increasing reliance on large, complex systems for critical infrastructure services are further increasing vulnerability to unforeseen events – especially when a technological divide forms between urban and rural spaces. In this instance, the divide refers to an economic or social inequality regarding the access, use, or impact of information and communication technologies between urban and rural spaces. According to Egan (2007), technology indeed has benefits and reduces vulnerability; however, new vulnerabilities are created with technological advances, with unknown consequences. Correspondingly, Egan (2007) also notes a shift of managerial burden from experts on critical infrastructure to computer engineers, who are often not as knowledgeable about the systems they are increasingly responsible for.

Specifically to rural areas, Wilson-Forsberg (2013) maintains that establishing and protecting critical infrastructure is costly due to limited economic resources. For efforts to be successful, projects must emphasize the provision of locally appropriate options, extending existing projects and delivering both short and long-term benefits. Following previous findings, it is also important to include a broad range of local actors that include EM personnel, elected officials, critical infrastructure sectors and local community members, in order to encourage local democratic processes and increase data richness (Cole & Murphy, 2014; ICLEI, 2010; Mendis et al., 2003; Pomeroy, 2011).

2.4 RURAL ONTARIO CONTEXT AND CLIMATE CHANGE

As stated previously, 335 (75%) of all Ontario municipalities are either rural or partly rural (ROMA, 2011). These communities are a vital part of what constitutes Ontario; however, unique challenges do exist that threaten their ability to plan for, manage and respond to risks and

uncertainties – especially regarding climate change. As such, a distinction must be made between rural and urban spaces when exploring issues that affect policy. These challenges include: fewer diversified economies, limited economic resources to meet local needs, greater dependence on natural resource sectors, fewer technical capabilities such as facilitation of the planning process, less information about climate change impacts and adaptation issues, and remoteness and inadequate access to services including emergency management. Rural communities also experience lower employment rates, aging populations, and youth out-migration (Cole & Murphy, 2014; Morris, 2009; Rural Ontario Municipal Association, 2011; Sander-Regler et al., 2009). Additionally, it has been found that in some municipalities, lower perceived risk levels for disasters can be a challenge within education and emergency management (Cole & Murphy, 2014). Despite these challenges, community strengths exist that involve strong attachments to community, strong social capital and social networks, local knowledge, and high rates of volunteerism (Cole & Murphy, 2014; Mendis et al., 2003; Sander-Regler et al., 2009). Considering these challenges specific to rural Ontario in conjunction with their unique strengths is crucial in order to develop more effective strategic best practice recommendations for emergency planning and preparedness in the context of climate change risks.

The impacts of climate change are already being felt across the globe through rising temperatures, shifting rain patterns, increased storm intensity and rising sea levels (Burch, Sheppard, Shaw, Flanders, & Cohen, 2010; IPCC, 2012; Sander-Regler et al., 2009). A temperature increase above $2°C$ relative to pre-industrial levels has generally been defined as being "dangerous anthropogenic interference with the climate system", and an increase in temperature beyond this level would cause even further detriment (Lemmen et al., 2008, p. 429). According to a report by the International Energy Agency (2013) global mean temperature is

likely to rise between 3.6 and 5.3°C if current climate policies continue; this is well over the 2°C threshold.

In Ontario, annual temperatures have increased by as much as 1.4°C since 1948 and research has reached consensus that changes are expected to result in a wide range of impacts year-round (Chiotti & Lavender, 2008). In summer months, the magnitude and frequency of heavy rain and strong wind events will increase, likely causing severe storms and flash flooding. Hail events are expected to increase, and with hotter days, energy use, wildfires and smog episodes will also intensify. During winter, the rise of average temperatures and frost-free days could extend the growing season and delay the start of winter, reduce heating costs and decrease precipitation. Additionally, intense winter storms and freezing rain are also expected to increase. Climate change could also introduce other risks such as vector-borne disease and invasive species (Chiotti & Lavender, 2008). Although consensus has formed regarding the varying impacts Ontario will experience, uncertainty does exist regarding the specific differences in sub-regions (IPCC, 2012). Factors such as local capacities, biogeographic landscape and latitude will influence these impacts.

Rural and resource-dependent communities are especially sensitive to changes in climate. Due to their remoteness and inadequate access to services, climate change risks such as drought, forest fires, warmer winter temperatures, and flooding have and will continue to cause repeated evacuations, the disruption of transportation links, and stressed economies (Chiotti & Lavender, 2008). Non-climatic stresses can further complicate the impacts of climate change, such as changes in policies and priorities dictated by higher levels of government (Sander-Regler et al., 2009). According to Chiotti and Lavender (2008), rural communities will become increasingly

vulnerable as the average age of residents rises, population declines, and youth leave to seek opportunities elsewhere.

Successful adaptation of Canadian resource-dependent and rural communities to both climatic and non-climatic stresses is related to their local economic trajectories, social vitality, and the ways in which local organizations, institutions, and social structures interact horizontally and vertically (Lemmen et al., 2008). In their study examining the various forces that influence the capacity of Canadian rural communities to manage, plan for, and respond to future climate change-related risks, Sander-Regier et al. (2009) concluded by suggesting that for successful future capacity and planning regarding climate change risks, the interaction between climate change researchers and rural communities must be expanded. By doing so, climate change information can be generated that is consistent with the spatial and temporal scales employed in rural community planning (Sander-Regier et al., 2009).

According to the IPCC (2012), an extreme weather or climate event is defined as being "the occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable." (p.116). They can be caused by drastic or abrupt changes in temperature and precipitation or gradual, prolonged shifts in baseline conditions (ICLEI, 2010) However, as the IPCC (2012) notes, extreme events are typically the result of a combination of factors, making it a challenge to attribute a single extreme event with a specific source. Globally, these events have risen from an average of 150/year to approximately 300/year (ICLEI, 2010). In Canada, scientific models suggest that the projected interval of time between future extreme weather events will shorten and their magnitude will increase. These events will result in serious disruptions to critical infrastructure in municipalities, such as transportation (Craft, Howlett, & Crawford, 2012). For example, the

Peterborough Flood that occurred on July 15, 2004 resulted in an estimated cost of $200 million. Homes were flooded, gas lines disconnected, and sewer systems and roadways inundated (Boyle, Cunningham, & Dekens, 2013). The 1998 ice storm in Ontario, Quebec, and Atlantic Canada also cost an estimated $5.4 billion in damages (Boyle et al., 2013). As such, infrastructure must be protected from climate change threats and ensure that communities can continue to deliver vital services.

Tornadoes are one extreme event that may become more frequent or more severe under the effects of climate change. According to Cao and Cai (2008), roughly 80 tornadoes are reported in an average year within Canada that result in, on average, two deaths, 20 injuries, and tens of millions of dollars in property loss. Peak tornado season in Canada is June-August, although given the necessary atmospheric conditions, they can occur at any time of the year (Environment Canada, 2015). For example, Ontario experienced its first tornado of the season – and earliest recorded tornado in Ontario - on March 16, 2016 near Mount Forest (Dunn, 2016). The southwestern portion of Ontario in Canada, delineated by Lakes Erie, Ontario, and Huron, is at greatest risk of tornadoes, (Cheng et al., 2013; Etkinet al., 2001). According to an assessment of tornado frequency and intensity, F3 tornadoes within Ontario are infrequent in general (Sills & Ashton, 2011). Additionally, due to its location and marine air, areas such as Goderich rarely witness a tornado, let alone a significant one. Recently, tornadoes are appearing in areas where they otherwise would not be, and since southern Ontario accounts for roughly 35% of Canada's cumulative population, potential tornado hazards pose a substantial risk to millions of Canadians (McGillivray, 2010).

2.5 CASE STUDY: GODERICH, ONTARIO, CANADA

Goderich is a small community located on the eastern shore of Lake Huron in rural southwestern Ontario, with roughly 7500 residents (Figure 1). Self-described as “Canada’s prettiest town”, and as the largest settlement in Huron County and the seat of government, Goderich offers essential municipal and economic services to local community members and the surrounding rural population. Services include the Huron Chamber of Commerce, the Goderich Town Hall, Canada Post Office, the Goderich Public Library, various financial institutions, and many shops and restaurants fundamental to the town’s tourism sector and economy. The most unique feature of the downtown area is “the Square”, which is actually an octagon that hosts Court House Park.

Figure 1. Map of Goderich, Ontario. (Silver & Andrey, 2013).

The economy of Goderich has been strongly tied to three primary economic sectors: agriculture, manufacturing, and tourism. The salt mining industry is one of the oldest in Ontario, producing 150 million tons of salt to date. Additionally, Goderich is home to the largest

underground salt mine in the world (Sifto Salt Mine). Tourism is a major contributor to the economy as well. Total visitor spending tops roughly $60 million each year (Vigliotti, 2015).

Similar to other rural areas, Goderich has a declining population and the rate of population increase is well below the provincial average (Figure 2). This negative population growth is caused by a net positive out-migration pattern, typical of rural communities. Younger residents often leave to go to urban areas for economic opportunities and higher education. The median age of the population has also become higher than Ontario's average (Figure 3) and it is probable that it will continue to rise as the population ages.

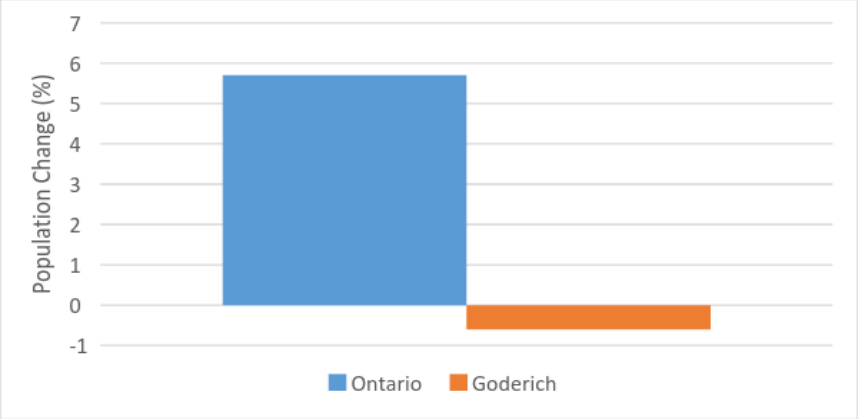

Figure 2. Population Growth Rate, 2001-2006. Source: Statistics Canada 2011 Census Profile: Goderich

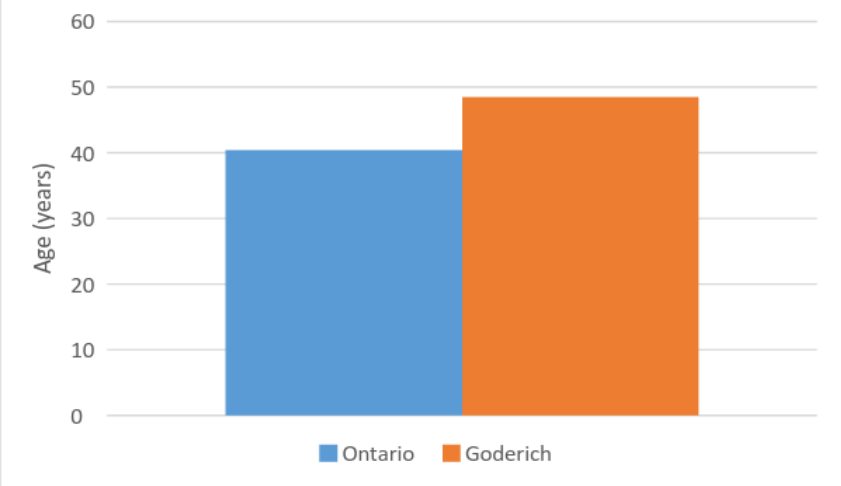

Figure 3. Median Age of Population. Source: Statistics Canada 2011 Census Profile: Goderich

Goderich experiences a range of weather disturbances yearly, due to its location on Lake Huron. Blizzard and snow squall warnings are usual in winter months, whereas severe thunderstorms often develop in summer months. These storms are typically characterized by high winds, hail, and heavy rain. While several other communities in southern Ontario have outdoor warning sirens for tornados, Goderich does not (Silver & Andrey, 2014).

2.5.1 21 August, 2011 Goderich Tornado

On August 21, 2011, Goderich was hit by a violent storm and F3 tornado with maximum wind speeds of 280 km h^{-1}, passing through central downtown. Environment Canada had issued a tornado warning for Goderich, Ontario as well as surrounding areas; approximately 10 minutes after the warning was issued, the storm touched down directly into the town's center. A state of emergency was issued immediately and for ten days, hydro, telephone, and natural gas services were interrupted (Environment Canada, 2013).

Three days later on 24 August 2011, a second severe wind event struck Goderich bringing high winds and torrential rain to the community, worsening initial damages. A second tornado warning was issued by Environment Canada for Goderich and surrounding region; however, no actual tornadoes were reported in Goderich.

The impacts of the initial tornado and second storm were devastating. There was one fatality, approximately 40 injuries, hundreds of people were displaced, landscapes were destroyed, and commercial and residential buildings sustained damages estimated at over $100 million (Environment Canada, 2013). According to Environment Canada (2014), the 21 August tornado was the strongest to impact southern Ontario in 15 years. Cumulatively, the cost of the Goderich tornado caused $130 million in overall damages and $75 million in insured damages (IBC, 2015). Following the tornado and subsequent storm, community groups such as the

Goderich Trees Project were established to aid in the disaster recovery process (Goderich Trees Project, 2013). This specific group looked to replace mature uprooted trees, aiming to help restore the landscape.

Several studies have examined the impacts of the tornado on the community of Goderich (Laycock, Mahone, & Filson, 2014; Sills & Ashton, 2011; Silver & Andrey, 2014; Silver & Grek-Martin, 2015). In a study focusing on the role of sense of place within disaster recovery, Silver and Grek-Martin (2014) found that community residents had experienced both negative and positive outcomes of the event. While many residents relayed feelings of guilt, loss, and worry due to a disruption in their shared landscape, they also expressed strong feelings of social cohesion and optimism (Silver & Grek-Martin, 2014). The impacts of the F3 tornado and successive severe storm in Goderich were also used in another study looking at the influence of previous disaster experience on decision-making for protective action (Silver & Andrey, 2014). It was found that there was a lack of warning infrastructure in the region, as only 8% of participants in Goderich received the Environment Canada tornado warning. Despite this, there was a significant increase in those taking protective actions during the successive storm on 24 August 2011. This reflects that the initial tornado did contribute to some degree of community learning or increased sensitivity among respondents (Silver & Andrey, 2014).

Laycock et al. (2014) also looked at the impacts of the tornado on community engagement and connection in Goderich. The authors' results revealed that a community's capacities could be strengthened as a result of disaster. Similar to the study by Silver and Grek-Martin (2014), it was demonstrated that the community's social cohesion was not destroyed. However, as the authors noted, strengthened community engagement in Goderich was only temporary (Laycock et al., 2014). According to Laycock et al., (2014), the tornado did not result

in the long-term enhancement of social networks, community engagement, or a sense of community connection; the event of a disaster in itself cannot be considered an adequately motivating force to enhance long-term engagement.

2.6 PHOTOVOICE

Photovoice is a participatory research approach, first introduced as "Photo Novella" by Wang and Burris in 1994. Previously used in many health-related studies as a method for personal and community change, photovoice is said to be an empowering tool that permits individuals to reflect upon their community strengths and weaknesses. Authors such as Garziano (2004) have used this method in Community-Based Participatory Research (CBPR) due to its ability to collect in-depth information from participants. The technique puts cameras into the hands of community members, allowing them to document their observations and perceptions through photography and develop subsequent narratives. Photovoice attempts to establish an equitable partnership among stakeholders, involving them in all aspects of the research process; participants are empowered as they direct the focus of research for a community through their images (Wang & Burris, 1997).

Photovoice has three primary theoretical underpinnings: (1) feminist theory; (2) critical consciousness theory; and (3) documentary photography (Wang & Burris, 1997; Wang & Burris, 1994). All three frameworks highlight individual and community participation as the purpose of social action. Photovoice first directs change at the individual level, where perceptions such as self-worth are transformed, before focusing on the community level and then the institutional level to encourage change through policies (Wang & Burris, 1994).

Building upon feminist theory, photovoice empowers participants to become the "experts" of their experiences rather than the subjects of research, and provides the opportunity

for marginalized populations to refocus their identities. Critical dialogue and education is encouraged between participants as well as non-participants, to create social change. Through this process, photovoice aspires to raise critical consciousness of the topics of focus and reach audiences such as policy makers to influence change (Carlson, Engebretson, & Chamberlain, 2006; Wang & Burris, 1997; Wang & Burris, 1994; Wang, 1999). The results of photovoice activities can provide local decision-makers with a better understanding of the lived experiences of the residents in their communities. Community approval of the tool often increases when participants feel that the results have the potential to be visibly influential in future decisions and enhance community resilience (Nykiforuk, Vallianatos, & Nieuwendyk, 2011). Thus, photovoice has the capacity to promote more effective municipal emergency planning in disaster response, as it engages community members in the research process and aids in identifying key of areas of concern.

The photovoice method has been used in a wide range of research projects including the health status of Chinese village women (Wang, Burris, & Ping, 1996), people with intellectual disabilities (Jurkowski, 2008), black gay men and lesbians (Graziano, 2004), and Indigenous communities (Castleden, Garvin, & First Nation, 2008). According to Powers and Freedman (2012), the number of academic, peer-reviewed articles on photovoice has been growing each year - notably so in 2007 - and several literature reviews on photovoice have been published (Catalani & Minkler, 2010; Hergenrather, Rhodes, & Bardhoshi, 2009; Kuratani & Lai, 2011; Powers & Freedman, 2012). Adaptations of the technique have also been seen in the literature. For example, Keremane and McKay (2011) implemented a ‘PhotoStory’ project, which focused more on the narratives rather than the photographs provided by the participants.

As Powers and Freedman (2012) also note, although research on photovoice is still limited, the technique is increasingly being used across the world, relating to an array of social justice and environmental issues. For example, the literature on photovoice has concentrated on a variety of environmental issues, including: sustainable management, climate change, the conservation of natural resources and ecosystems, and environmental health risks. Studies took place in areas around the world, such as Australia, Canada, and Fiji, and the number of participants in each project ranged from 6 to 45.

One study was found where photovoice was used within the development of disaster reduction strategies and is therefore most applicable to this study (Crabtree & Braun, 2015). These authors found that photovoice was successful in aiding a vulnerable community in Hawaii to develop locally appropriate disaster reduction strategies, thereby increasing community awareness, engagement, and adaptive capacity (Crabtree & Braun, 2015). Although not directly related to disaster reduction, Annang et al. (2016) used photovoice to gather major themes related to the perceptions of community members of the long-term impact on their quality of life following a disaster. Key themes included: residential and business vacancies, economic decline, demand for cleanup and modernization, safety concerns, and rehabilitation. Unlike this research project, Annang et al.'s 2016 study did not work in conjunction with municipal officials and emergency management personnel; however, the authors did urge emergency response agencies to utilize their results to identify where disaster response efforts should be focused – both in the immediate aftermath and long-term recovery.

In a similar context, Annear, Keeling, and Wilkinson (2014) used photovoice as part of their methodology to develop community-generated recommendations to inform redevelopment following natural disasters. Older residents (65 years and older) identified six areas for urban

environmental redevelopment, following a sequence of earthquake disasters. These areas were not previously considered in research or policy. The outcome of Annear et al.'s (2014) research was presented to local officials to inform urban redevelopment.

2.6.1 Strengths of Photovoice Method

One of the main strengths of the photovoice technique is that anyone in the community can participate if they are able to use a camera. As Wang and Burris (1997) state "…it does not presume the ability to read or write." (p.372). This characteristic has made it popular in its use within vulnerable populations, who may not be formally educated. Photovoice projects also effectively provide a means for researchers to build an in-depth understanding of a community's issues from their members' perspective (Nykiforuk et al., 2011; Wang & Burris, 1997). The use of photographs acts as a catalyst to provide insight into the perspectives of a community member's point of view (Nykiforuk et al., 2011). In Bennett and Dearden's (2013) study examining the social and environmental change on the Andaman Coast of Thailand, photovoice revealed how a decline in the fisheries changed livelihoods, prices of fish, and social institutions in the community. In a study exploring the threats of climate change and rising sea levels on Australian coastal communities, Baldwin and Chandler (2010) found that local perspectives differed from visitors and artists; there was greater emphasis on local issues and actions rather than aestheticized views. Additionally, since community members have control over what is photographed and under what context, researchers are able to have access to information gathered from these images that may not be available to them otherwise (Wang & Burris, 1997).

Another key strength found within photovoice research studies was that participants were not seen as subjects of research; rather, they were acknowledged as being the "experts" and collaborators (Castleden et al., 2008; Healey et al., 2011; Keremane & McKay, 2011; Kerstetter

& Bricker, 2009; Nykiforuk et al., 2011). Researchers repeatedly stated that they took on more of a facilitator role to allow participants to freely convey their local knowledge, priorities, and language without their researcher bias (Baldwin & Chandler, 2010; Castleden et al., 2008; Keremane & McKay, 2011). In their reasoning for using a photovoice method in their research, Keremane and McKay (2011) note that the success of participatory research also largely relies on the attitudes of researchers for building trust and encouraging solidarity.

Several studies also claimed that using photovoice within their research promoted a sense of ownership and empowerment since community participants were involved throughout the research process (Castleden et al., 2008; Healey et al., 2011; Pierce & McKay, 2012). Healey et al. (2010) claimed, "A goal is that research participants and collaborators should 'own' the research process and use its results to improve the quality of life in the community." (p.91). Some authors also mentioned the importance of developing partnerships with local groups to connect with the community and gain approval of community leaders before commencing research (Castleden et al., 2008; Keremane & McKay, 2011; Maclean & Cullen, 2009). Developing connections and buy-in was important for this project, with the larger project team leaders establishing the relationships with decision-makers and the Community Emergency Management Coordinator (CEMC) that facilitated the photovoice research.

Most studies reported having active participation throughout the research process, which can be enhanced through active facilitation by researchers in the process. The degree of meaningful participation and decision-making also varied in different stages within each project, such as selecting exhibition locations, planning, and coordination of the project (Healey et al., 2011; Keremane & McKay, 2011; Lardeau et al., 2011). In this regard, meaningful participation is where the voices' of participants are recognized and not excluded or ignored. Active

participation was seen to be encouraged when photo data collection involved prompts by the researcher to allow participants to broadly interpret the area of focus in order for meaningful data. For example, in her study exploring the gendered nature of water, Thompson (2011) asked participants to answer, "What do you have in this place (community, culture, and environment) that is important to protect future generations?" (p.44). Other studies reported that images chosen to discuss and that best represented the community in the photovoice project were done so by participants (Castleden et al., 2008; Healey et al., 2011; Keremane & McKay, 2011; Thompson, 2011). To encourage active participation, and to follow best practices, researchers should act as a facilitator throughout the project (Carlson et al., 2006; Keremane & McKay, 2011). In this sense, the researcher should observe, listen, step back and allow participants to do the storytelling, and learn from the photographs, narratives, and discussions.

Within the literature, authors asserted that photovoice supported proactive actions to address specific concerns and support social change. Some studies reported immediate changes in behaviour, such as cleaning up graffiti, while others identified capacity building outcomes and a role in developing individual and collective action (Powers & Freedman, 2012; Castleden et al., 2008; Baldwin & Chandler, 2010; Healey et al., 2010). In some projects, participants were trained to lead their own photovoice research in the future (Healey et al., 2011). Participants gained social capital and confidence, experienced changes in perception related to research topics, and developed self- and collective-efficacy to respond to environmental concerns (Baldwin & Chandler, 2010; Castleden et al., 2008; Maclean & Cullen, 2009).

Some researchers asked participants for their viewpoints on the effectiveness of photovoice as a research tool and its ability to achieve outcomes; each found photovoice to be effective and worth implementing (Baldwin & Chandler, 2010; Castleden et al., 2008; Keremane

& McKay, 2011). Castleden et al. (2008) noted "photovoice effectively balanced power, created a sense of ownership, fostered trust, built capacity, and responded to cultural preferences." (p. 1393). Additionally, according to Baldwin and Chandler (2010), seeing images and captions in their photovoice project resulted in 69% of their audience being stimulated to take action.

2.6.1 Weaknesses of Photovoice Method

There are several limitations of photovoice noted within the literature that must be addressed by both the researchers that intend to utilize this tool and their community partners. Wang and Burris (1997) identified the following disadvantages: potential to promote inequality, limited documentation, personal judgment for photo selections, and complex data analysis. These criticisms are founded on the premise that limitations exist in what the participants can document due to any perceived risks related to power dynamics in the community. Although photovoice aims to address inequalities such as those dealing with social status, the extent to which photovoice may also encourage disparity merits scrutiny; money, support, and editorial control may still remain that can influence the information gathered from participants.

Bias can exist throughout the process and the selected population samples may not be representative of the broader community (Nykiforuk et al., 2011; Wang & Burris, 1997). As Wang and Burris (1997) explain, choices are made during the photovoice process, "… who used the camera, what the user photographed, what the user chose not to photograph, who selected which photograph to discuss, and who recorded whose and what thoughts about whose and which photographs" (p. 374). For example, Crabtree and Braun (2015) found their sample size represented roughly 20% of their studied community's population. It becomes important to establish what was documented at the participant's level, but also address how background or external factors may have influenced decisions during the researcher's analysis and discussion.

Although collecting photographs is easy, summarizing and analyzing the information can be difficult (Wang & Burris, 1997). The process of abstraction must take place in order to define what participants have documented and what the visual evidence means. Researchers are invariably involved with some of their own interpretation of the photographs in addition to the narratives provided by participants and a greater number of photographs taken requires significantly more time to identify recurring themes and patterns throughout the project. Ambiguity of photographs further complicates this process, especially if researchers are unable to receive clarification from the participant that recorded it (Markwell, 2000). To account for these challenges, Nykiforuk et al. (2010) recommended that the number of photographs should be capped. Although a minimum or maximum number of photographs was not defined, Flum et al. (2010) set a maximum of 25 photos. Using the SHOWeD method, coined by Wang & Burris (1997) will also assist in gathering as much information about why the participants took each photo, assisting in the analysis process. Particularly, participants are asked to describe:

(a) What do you **S**ee in the photography?

(b) What is **H**appening in the photograph?

(c) How does this photograph relate to **O**ur lives or other members in the community?

(d) **W**hy do these issues currently exist within the community?

(e) What can we **D**o about these issues?

Furthermore, the results should be presented back to the community to encourage additional community feedback and maintain accountability and transparency in the research process (Nykiforuk et al., 2010).

In a critique of previous photovoice projects in the literature, Catalani and Minkler (2010) identified several other weaknesses. According to the authors, methodologies in photovoice

research projects are rarely described in detail, if described at all. Although other challenges are often discussed such as ethics and participation, little or no discussion of study limitations regarding research rigor exists. There was also a lack of consistency for reporting the level of community participation during the photovoice project in terms of inclusion within proposal development and/or application of findings. Lastly, there was a lack of follow-up studies that evaluated the long-term impacts of photovoice on communities or on individual members (Catalani & Minkler, 2010). To prevent a similar critique in this MRP and research study, and to follow recommendations from the literature, all elements of the project were carefully documented and reported. This will allow others to evaluate its rigor in the analysis.

External factors can also have implications on photovoice research studies. In their study exploring community perceptions on built and social environments in a health-related context, Nykiforuk et al. (2011) identified the geography of the community under study as being a challenge. Where studies were focused on areas with smaller populations it was easier to recruit participants, unlike in larger and more urban areas. This aspect will be relevant to this particular case study in rural Ontario due to the location and demographics of the case study. In contrast, photographs and narratives collected in urban areas represented more diverse locations and issues than those in concentrated semi-rural areas (Nykiforuk et al., 2011). Likewise, Castleden et al. (2008) acknowledged how seasonality and weather can affect what participants choose to photograph and when. Time is another constraint, typical of qualitative studies; participants may feel pressured to contribute with the photography and interview exercises (Castleden et al., 2008; Crabtree & Braun, 2015). This could impact their decision to participate or not. External challenges or limitations to the project should be stated within analysis and discussion of findings. To overcome some of these challenges during the photovoice project in this MRP,

allowing sufficient time for participants to be involved in the photography exercises becomes important – at least several days. Additionally, recruitment strategies should be multimodal and utilize the knowledge and expertise of community partners (Nykiforuk et al., 2011). In this study, participants were recruited through a variety of methods. Phone calls, emails, and Facebook, were utilized. Additional help was utilized by a previous CEMC to attain a list of potential participants who were later contacted by the project manager. Participants themselves also assisted in bolstering participation levels in the last few days of recruitment before the project commenced.

Accessibility of cameras and film developing was another issue raised; purchasing cameras and potential replacement costs can influence a research budget (Castleden et al., 2008). The quality of photographs may not be of standard (e.g. photographs may be out of focus or over-exposed), and purchase of cameras and possible replacement costs of lost or damaged cameras can be expensive. Providing a sign-out sheet with the information of participants may also help identify who is responsible for what camera. Additionally, offering information on proper photography techniques can assist in overcoming quality issues that may result from inexperienced photographers. To enable memory retention, Castleden et al. (2008) also suggested that interviewing should take place immediately following the return of a participant's' camera; ensuring that film-developing services are accessible should also be necessary.

Following some of the ethical challenges raised by Wang and Redwood-Jones (2001), researchers in the literature considered the potential threats of maltreatment of research participants in photovoice. To help counteract these threats, approval through the ethical review board was considered important, as was informed consent from all participants, and training participants regarding the ethical treatment of subjects in photos (e.g. humans). Some studies

also required informed consent to be gathered from any human subjects in photos (Castleden et al., 2008; Healey et al., 2011; Keremane & McKay, 2011). As Castleden et al. (2008) mentioned, "…photography can be an intrusive activity and may lead to unintended consensus." (p. 1396).

2.7 CONCLUSION

There is substantial literature that suggests that the impacts of climate change on critical infrastructure in Ontario are likely to escalate and that rural communities face distinct vulnerabilities. With proper implementation, photovoice is a useful method to enhance community resilience and adaption and help inform local emergency management strategies. As stated throughout the literature review, the consideration of local contexts is essential for decision-making and management strategies regarding climate change-related risks (Baldwin & Chandler, 2010; Burch et al., 2010; Gunson & Murphy, 2015; Measham et al., 2011; Wall & Marzall, 2006). In relation to photovoice being used within a critical infrastructure and emergency management context, this current research will contribute a new case study focus for the use of the method (Annang et al., 2016; Annear et al., 2014; Crabtree & Braun, 2015). Thus, this research will contribute to the academic literature by undertaking a photovoice project to understand the impacts of the F3 tornado that hit the community of Goderich, Ontario in 2011 and document their member's perceptions. The remaining sections will outline the methodology, results, and discussion of this MRP's contribution.

3.0 Methodology

3.1 STUDY DESIGN

The overall 36-month project, funded by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) is aimed at enhancing the adaptive capacities of rural Ontario communities

to growing climate change (CC) threats from extreme events. This project identifies the resiliencies, challenges, and opportunities facing municipalities and undertakes a collaborative research integrating emergency management (EM) with critical infrastructure (CI) planning. It develops multiple deliverables that inform a range of target audiences. Involving an expert team of academics, students and a project advisory board (PAB) consisting of EM specialists, the specific objectives of the overall project are to:

1. A-C) Assess the current emergency management planning and preparedness capacities of rural Ontario municipalities to CC-related threats across key critical infrastructure sectors;
2. Develop a tabletop exercise focused on a realistic extreme event scenario;
3. Develop an eXtreme events Toolkit for Rural Emergency Management Enhancement (xTREME); and
4. Finalize deliverables, KTT, and strategic audience publications.

This MRP research study focuses exclusively on objective IC of the larger three-year study, which involved undertaking a photovoice project in Goderich, Ontario, to understand the impact of the F3 2011 August tornado on community members and document their perceptions.

3.2 SELECTION AND DESCRIPTION OF PARTICIPANTS

Following best practices in the literature (Wang, 1999; Castledon et al., 2007; Keremane & McKay, 2011), a purposive recruitment and snowball approach was used to identify ten participants in Goderich, Ontario and involved assistance by a former Community Emergency management Coordinator (CEMC) to identify potential participants. Facebook, phone-calls, and emails were also used. Participant recruitment and data collection took place during May 2016. Proposed criteria for the selection of participants, aimed to capture a wide range of experiences,

including: extensive experience with, or impacts from, the extreme event, and gender, age, and geographic location within the community. Due to either time constraints or other restrictions, ten participants eventually agreed to participate in the project and all were accepted. The accepted participants did not entirely capture the age and geographic location criteria, due these time constraint limitations. Two participants were younger adults, four were middle age and four seniors. All participants were relatively within the same geographic location within the community, which was within close proximity to the downtown core. Participants were given a CN$100 honourarium as an incentive following the completed workshop.

3.3 DATA COLLECTION

Two workshops were employed. The first was arranged to be located at the town hall since it was a convenient location for all participants and meeting times were offered over three days to allow all participants an opportunity to attend. Once they agreed to take part, each participant was provided with an informed consent, and timelines were discussed, input was gathered for photograph themes, ethical issues were outlined, personal safety was discussed, and camera functions and photographic techniques were reviewed. An information sheet was developed to provide additional information regarding photography techniques, and general information regarding the project and scope (see Appendix A).

Participants received a digital camera to take up to 25 pictures related to the identified themes over a three-five day period. Using a provided template (see Appendix B), each picture was submitted electronically with an accompanying write-up that explained what theme was being represented and why the particular photograph was important. The narrative template for each photograph followed the SHOWeD method to describe pictures, as is often done with photovoice (Annang et al., 2016). Particularly, participants were asked to describe:

(a) What do you **S**ee in the photography?

(b) What is **H**appening in the photograph?

(c) How does this photograph relate to **O**ur lives or other members in the community?

(d) **W**hy do these issues currently exist within the Goderich community?

(e) What can we **D**o about these issues?

Guiding themes related to the impacts of the extreme event as well as community strengths and challenges associated with climate change resilience (n=5) were identified by the graduate researcher prior to the first workshop to provide general ideas for participants.

Guiding themes:

1) Disaster Impact: Can you provide some examples of the events' impacts on your community, particularly its infrastructure?
2) Disaster Recovery/Reconstruction: Can you provide some examples of how your community has rebuilt since the event happened?
3) Challenges: Can you provide some examples of problems or weaknesses related to infrastructure that could make your community vulnerable to extreme weather events in the future (as projected with climate change)?
4) Capabilities: Can you provide some examples of your community's strengths to deal with future extreme weather events including avoidance/reduction of impacts, and better preparedness/recovery?
5) Advice: Can you provide some examples of how to improve your community's abilities to better deal with extreme weather events in the future?

While the participants were encouraged to not photograph people, if they wished to do so, they were expected to supply s/he with information about the project and have the person(s) in the

picture sign a standard release form. Only one participant photographed a person; however, it was not chosen for the final five photos to represent each theme. When the participants dropped off their cameras and completed templates, an interview with each community photographer was conducted to review their pictures, focusing primarily on their 'top' five, to keep the interviews to a reasonable length. The interviews provided additional information about the pictures and allowed for the collection any standard release forms. Interviews ranged from 25 minutes up to an hour in time length. These interviews were audio-recorded for record keeping purposes and to make reference to during the write-up stage. A full transcription was not undertaken, nor were any direct quotes used. Interviews were conducted over three days at various times, to accommodate the schedules of participants. Participants were asked to sign a standard release form allowing the use of their pictures for this project.

A second and final workshop was held to review all photographs once two sets of all photographs have been printed. Each participant was provided with a printed set for his or her own uses. Previous to the workshop, the student researcher hand-coded the photographs (n=250) to identify key emergent themes that were informed by photograph narratives and interviews. She then divided the assembled photographs into the themes that they represented. This process took place to reduce the length of the final workshop and to provide a foundation of ideas for participants to work from and modify. For a theme to be established, there had to be sufficient photographs that captured that theme – at least five - as well as having its importance established by participants during the interviews and within their narratives. Some themes were captured by an excess number of photographs whereas other themes had the minimum. Not all photographs were captured by these key themes and an additional analysis was later conducted on the remaining photographs. A draft of the five photographs that best represented each theme was

also identified and, to be inclusive, the research was able to include images taken by all photographers.

At the final workshop, the draft themes as well as the five selected photographs for each theme were explained to the eight participants that attended. Participants were asked if they would like to make any changes to the themes. For instance, one theme was originally titled "Banking and Finance" which was changed to include businesses as well. Other themes were modified to include other pictures chosen by the participants and exclude photographs initially chosen by the student researcher.

Once the themes were finalized, participants were provided with the full set of pictures for the identified theme to come to a consensus regarding the five pictures that best represented each theme. Through an iterative process of comparing and contrasting photographs, seven key themes (Table 1) and the five preferred pictures for each theme were finalized (Appendix C) and reflected the views and perspectives of participants. The draft top five photographs organized by the student researcher was very close to the finalized versions of the themes. Only a few images were excluded with replacement and one theme's title was modified. Lastly, participants provided a rationale for their choices and the information they wanted to be included for the final photo exhibition, through brief written explanations for each theme (either full sentences or bullet points). Using the participant rationales and interview data, the student researcher, with assistance from other team members, developed the draft write-ups for each theme for the final photo exhibition to be held in the fall of 2016, found in Appendix C. The drafts were then circulated to the participants for approval. The workshop was also audio-recorded; a full transcription was not undertaken nor any direct quotes were used for the final write-up. Participants received a hard copy of their own photos.

Table 1. Themes with Examples	
Banks and Businesses:	Banks were all damaged due to their location at the downtown center; businesses downtown were also damaged; businesses were able to rebuild in new and artistic ways
Vulnerable Infrastructure:	Communication lines could be damaged or destroyed if the water tower be affected; limited communication among fire department; need for backup communication lines or generator; tornado warning not known by most residents before it hit
Memories and Recovery:	Public art and wood carvings to represent the disaster and impact on the trees; plaques to commemorate lost heritage buildings
Opportunities and Recovery:	Not every homeowner had the ability to rebuild due to insurance; others who were able to rebuild were also then unable to afford the new taxes on the buildings; controversy regarding public art and the new courthouse structure
Trees as Critical Infrastructure:	Community identification with local trees; trees to provide natural stability and prevent mudslides; able to provide protection against wind and sun; mental and spiritual benefits on the community
Damages and Things Lost:	Damaged trees; buildings; heritage homes; important documents and household items
Personal Awareness:	Home renovations such as hurricane clips and cement cold rooms; watching the sky; consistent keeping updated with the weather

The identified pictures, their accompanying write-ups and group rationales formed the basis of the project's feedback to decision makers as well as became that community's photovoice exhibition. The chosen photographs, with captions describing their importance were incorporated into posters, printed at WLU and appropriately mounted for display. The local art gallery was chosen as a suitable local location, to host the exhibition in the community. Where possible, the exhibition was left on display for at least a week and the exhibit was donated to the community. The event was locally advertised and all local authorities and participants were invited to attend the opening. A virtual copy of each community exhibit was archived at Laurier's Scholar's Commons.

3.4 DATA ANALYSIS

As mentioned above, audio recordings were not transcribed and all data was downloaded from the recorder and stored on a password-protected computer. Following their download, the data from the recorder was permanently deleted. All notes, printed photographs (except those mounted in the final exhibits), and sheets with participants' comments will be shredded after five years following the completion of the study.

In this research study, data was collected in the form of visual and text data in the form of photographs and narratives, generated by the participants. Audio recordings created from the interviews and final workshop and the field notes taken by the graduate researcher were also used as data. A preliminary round of free coding by hand took place, followed by a more detailed round of coding using an excel worksheet to refine the emergent themes classified by participants. Since there was a vast amount of data, it was important to listen to each of the interview audio-recordings and review every page of the field notes, photographs, and narratives before commencing the coding process. During this phase, the graduate researcher created an initial list of ideas within the data to influence some of the data analysis.

For the purpose of this study, coding was performed using a data driven approach, aiming to identify identifiable patterns by reading and rereading the data. Any trends or ideas within the data sought to outline the analysis before the finalized analysis took place. Using the excel spreadsheet, each of the themes identified by participants were listed with each participant's basic participant characteristics, strength of support of theme, and any additional commentary. (Table 2). Strength was judged by how popular images, word uses, and sentiments were within each aspect of the photovoice project (i.e. photographs, narratives, interviews) in relation to the specific theme. This approach provided an initial understanding of people's perspectives in

relation to their characteristics and other photovoice participants. Another table was created to document any additional themes that did not make it into the overall photovoice themes. Both tables were written using participant interviews, photographs, narratives, and other recordings to provide depth of each theme. It was through an additional iterative process of comparing and contrasting that the seven key themes were refined, in addition to the identification of several others that emerged through the process. Even if information did not have overt relevance to the research, but held an important pattern in the data, it was accredited, further studied and organized within an "additional theme" section.

Table 2.
Summary of the Results.

Theme	Number of participants who identified theme	Age groups of participants who identified theme	Importance of perspective
Banks & Businesses			
Vulnerable Infrastructure			
Memories & Recovery			
Opportunities & Controversy			
Trees as Critical Infrastructure			
Damages & Things Lost			
Personal Awareness			

The descriptions or information that formed a particular theme within the final seven were reviewed several times to ensure that each theme brought meaning and insight to the entire data set and to the research. Each theme sought to form one or other parts of the story that

participants wanted to tell through the data collected. Themes were named based on their role to the story told by participants.

To provide tangible mechanisms that contribute to local decision making and resilience, once all results from the initial workshop and the photovoice activities are drafted, a teleconference will be organized consisting of the case study authorities and key project leaders to review the climate change risks and critical infrastructure outlined in the local EM plan. Lessons learned from the data results will be outlined and a high level analysis of likely future threats associated with climate change will be provided, which can be incorporated into the community's emergency plan. The analysis will be provided by the CC modeling expert on the project team. The project team will also present the draft results to local municipal/band councils, as appropriate. The MRP and plain language summaries suitable for posting online and an academic article will be produced, with the results available for EM audiences through web-postings and other options (e.g. Rural Ontario Municipalities Association).

4.0 Results

The following section presents the results of the photovoice project, informed by the photographs and narratives generated by each of the ten participants and the interviews they engaged in, and is organized into two categories: (1) emergent themes and (2) additional themes.

4.1 EMERGENT THEMES

Seven themes emerged in response to participants' perceptions of how the disaster affected their community in regards to emergency management and disaster impact: (a) Banks & businesses, (b) vulnerable infrastructure, (c) memories & recovery, (d) opportunities & controversy, (e) trees as critical infrastructure, (f) damages & things lost, and (g) personal awareness (Table 2).

Each theme was identified from particular fragments of data that helped connect specific ideas or perceptions conveyed by the participants.

As seen from Table 3 opportunities & controversy, damages & things lost, and trees as critical infrastructure were the most salient themes that emerged from the analysis. Although trees as critical infrastructure was one of the major themes, only two participants strongly captured it within their photographs, leaving six participants identified as being in the neutral group. . The theme least represented by participants was that of personal awareness; half of both the middle aged and senior participants and none of the young adult participants identified it within their information and interviews. This theme was also seen to have the weakest importance amongst participants.

Table 3.
Summary of the Results.

Theme	Number of participants who identified theme	Age groups of participants who identified theme	Importance of perspective
Banks & Businesses	7	Young adult = 1 Middle Age = 3 Senior = 3	Weak = 3 Neutral = 3 Strong = 4
Vulnerable Infrastructure	6	Young adult = 1 Middle Age = 3 Senior = 2	Weak = 4 Neutral = 3 Strong = 3
Memories & Recovery	7	Young adult = 0 Middle Age = 4 Senior = 3	Weak = 3 Neutral = 0 Strong = 6
Opportunities & Controversy	10	Young adult = 2 Middle Age = 4 Senior = 4	Weak = 0 Neutral = 4 Strong = 6
Trees as Critical Infrastructure	8	Young adult = 2 Middle Age = 3 Senior = 3	Weak = 2 Neutral = 6 Strong = 2
Damages & Things Lost	10	Young adult = 2 Middle Age = 4 Senior = 4	Weak = 0 Neutral = 5 Strong = 5
Personal Awareness	4	Young adult = 0 Middle Age = 2 Senior = 2	Weak = 6 Neutral = 1 Strong = 3

The following sections will provide a more detailed description concerning each key theme and the additional themes that emerged through data analysis.

4.1.1 Banks and Businesses

Seven out of ten participants noted that the 2011 F3 tornado caused significant damage to their community banks, which were all located in the downtown core of Goderich – an area directly hit by the tornado. During this time, residents were unable to have access to banking services and were inconvenienced if they did not have cash readily available. Although buses were offered through the municipality to transport residents to banks in neighbouring communities, not all were able to spend the time to use the buses since their time was taken up when dealing with the disaster's impacts in other aspects of their lives. Participants commented that banks should be dispersed throughout their town so that not all would be affected simultaneously should another disaster strike. However, participants noted that after the event, each of the affected banks was rebuilt in their original locations, increasing the potential of future risk. Businesses located at the downtown center were also affected by the event. For example, one participant's business sustained minimal damages compared to other businesses, yet they were unable to resume their operations until months later partially due to a neighbouring establishment that was undergoing construction. Despite this setback, the participant also noted that the event provided an opportunity to build a new façade that was modern and art forward in nature – something that never would have happened if the disaster had not taken place. Participants noted that a lot of thought was put into Goderich's recovery and if the process had taken any longer, the town likely would have lost many more businesses. Also important to note, was that although most participants identified that most of the downtown businesses were affected and were unable to

reopen for a lengthy period of time, economic decline was not directly brought up as being a major concern.

4.1.2 Vulnerable Infrastructure

Tornado damage was inconsistent across Goderich, as some areas and streets were more severely impacted than others. As such, participants were able to identify the areas that were not significantly affected by the event, but that were at particular risk and important to consider if they had been damaged. Six participants captured this theme – most of who had personally been affected by the event (e.g. home damaged) or had indirectly been affected (e.g. impact on career). One participant's partner worked as a first responder during the emergency after the tornado. The participant was uniquely situated to identify several vulnerable areas such as concerns regarding the communication lines within one agency. As identified by other participants, other areas, such as the post office and salt mine were directly affected by the tornado, and remain vulnerable to future events. Participants highlighted that the town could have suffered far worse, had the salt mine been completely destroyed rather than damaged. Some participants also mentioned climate change and variations in weather, such as pollution, erosion, severe rain, and flooding, and questioned what that could mean for Goderich in the future. It was also highlighted that had the tornado struck weekends earlier when a major annual festival was held, the number of injuries and losses of life could have been far more devastating.

Another area of concern for a participant was the single access road to the harbor and boardwalk. Many residents had been on the boardwalk when the event first struck, resulting in a traffic jam immediately following the event, and fallen trees/debris everywhere. Had the single access road been damaged, those people would have been stuck. Preventative measures and

backup plans are necessary and participants questioned what measures are, or will be, in place to protect and prevent against future disaster.

4.1.3 Memories and Recovery

Due to the extent of the damage of the 2011 tornado in Goderich, many photographs depicted or symbolized the event and the impacts it had – captured by seven out of ten participants. Many photographs focused on either plaques or signs in memory of the community's losses, or certain objects or structures that symbolized the recovery process (i.e. courthouse clock and the shadow of the soldier war memorial). Most of the participants recognized the reality of the situation and the losses suffered, but chose to approach the situation with optimism, as illustrated by photographs capturing memorial pieces of art or signage and plaques. The shadow of the soldier statue reminded participants of the town's and residents' mortality and what it takes to survive (and they did). The captured images of tree trunk carvings, which served as public art, were a way participants saw to create something positive and beautiful after the tornado's damage. An image of the metal tree sculpture commemorated the individual who was killed by the event – designed and constructed by a local iron-maker and artisan. One participant highlighted, in particular, that in areas where the tornado's impacts are seen or where it is memorialized, you can also remember the event and see how the community has changed for the better. For other participants, this theme allowed the ability to showcase how rapid the town's recovery was.

Images of the book, "Not Like Any Other Sunday" were also showcased in this theme. One participant noted how it illustrated an example of "documentation", which they stated was crucial for understanding what happened, how people reacted, and what can be done to move forward. Other participants noted that including images of the same book acted as a way to

represent how individuals helped in the recovery process, capturing roughly 162 accounts of what they recalled happened as the tornado tore through the town.

4.1.4 Opportunities and Controversy

All participants captured this theme, with extensive commentary around the idea of optimistic acceptance despite losses. Following the tornado, many opportunities arose for the improvement of buildings and restoration of landscapes. If the tornado had never occurred, these decisions for infrastructure or landscape improvement may never have occurred. Participants identified that is was important to balance practicality and aesthetic values within the town's recovery process and discussed some of the controversy regarding re-imaging Goderich's identity – particularly, with the new bandstand at the downtown core. In this example, participants commented that many residents were unhappy with the structure once it was constructed despite many meetings held for public input. Participants described that the new bandstand lacked protection on its sides, limiting its use to just good weather. Others stated that the new structure did not capture the town's heritage in the same way, commenting that some residents described it as being "out of place". One participant described the ways in which many residents were unable to understand the initial creative value of the bandstand, yet felt hopeful that as its usage increases so will people's' understanding. There were also some complaints regarding the amount of concrete put into the park and lack of grass when the new bandstand was built. Participants explained that previous to the tornado and the rebuild process, there were many problems within this area, including trees dying/suffering due to the amount of human traffic as well as those driving on the grass during markets, compacting the tree roots. The new bandstand may have more concrete, but it also allows people to use those spaces and avoid the grass, providing some protection.

There were also cases of contrasting views regarding aesthetic and practical use. For instance, one participant mentioned how a new wall was built on the pier at the main beach to protect the beachfront from waves or thrown ice in the winter. Despite this advantage, the participant noted that some residents are not too happy with the structure blocking the view of nature. The same participant also commented on some of the dune grasses that were planted near the beach to protect against erosion, while also offering animal habitat and safety. Again, while there are practical benefits, it also takes away from the aesthetic of the area and also creates issues of making spaces useable, since it occupies a fair amount of room.

Participants noted that many dwellings were rebuilt, although not every homeowner had the funds to do so. In other cases, some homeowners did have the chance to rebuild yet could not afford the new taxes. Some were forced to sell their rebuilt homes and move elsewhere. When repair was not possible, relocation was an alternative chosen for some (e.g. Chisholm TV & Stereo). As one participant noted, the new home of Fanshaw College, where Chisholm TV & Stereo once was, reflected the "post tornado" reality – that some were able/chose to continue elsewhere, but some did not.

Although the town square lost countless trees, many saplings have been planted around the courthouse. Participants noted that, immediately following the disaster, the area looked like a warzone. Yet, careful reconstruction, re-sodding, replanting, and rebuilding has helped make the square look as though it was never severely damaged. Downtown Goderich showcases how heritage can be maintained, despite the damage, and with the added benefits of better accessibility of buildings, and rebuilding those damaged to new building code standards. The old opera house was another topic amongst participants. The historic building had been vacant for 50 years, but is now restored featuring decorative brickwork, and newly occupied. Like several

other new buildings, this particular one consists of a business (i.e. IDA pharmacy) on the lower floor as well as apartments to house residents on the upper level.

Participants were clear that part of adapting to the reality of the disaster is to recognize the importance of the past, but also to recognize the need to put some of the past behind and to set things in motion for future generations. In some instances this included removing some of the old with the physical restoration of buildings or landscapes and establishing more modern and accessible structures. There was also a sense of mental/spiritual cleansing among residents – particularly with the town's identity. There was acknowledgment that in their town's recovery process, controversy and disagreement was a large part of it; however, the resulting opportunities provided much more to the community and several participants saw the event to be the best thing to ever happen to them.

4.1.5 Trees as Critical Infrastructure

The loss of trees in Goderich brought attention to their importance within the community. Participants emphasized the aesthetic role of trees in the town, bringing life and beauty. When the trees were uprooted, had fallen, and were dying, it was acknowledged very early in the town's recovery process the importance of replanting to replace some of what was lost. Additionally, devastated mature trees often became the subject of public art in memory of the tornado, as seen by wooden carvings made of damaged tree trunks. The majority of participants (eight of ten) included this aspect within their photographs. The photographs taken by participants also brought attention to the role trees have in stabilizing slopes, providing habitat, as well as sheltering the town from wind and sun.

The participants emphasized that green infrastructure is crucial and that trees had been previously taken for granted. They not only mentioned how they cleanse and cool air, reduce

energy use and protect homes and businesses during storms but that they also have substantial health benefits and the ability to lengthen lifespans of built infrastructure such as roads and sidewalks through the provision of shade.

4.1.6 Damages and Things Lost

All ten participants commented upon the community-wide physical damages and destruction that had affected their quality of life, including home damages, impacts on employment, and general sense of loss. This theme in particular was one of the strongest and most captured through the vast amount of photographs. As illustrated by participants, the damages were greatly variable. Photographs captured images of restored buildings within the downtown core; the loss of trees; residential areas; and some had even captured some of the impacts endured on the outskirts of town such as Benmiller – a historic pioneer village. The Sifto Salt mine was another area that sustained damages and participants recognized that Goderich could have suffered far more financially had the elevators at the mine been destroyed and not just impaired.

Damages from the tornado were also not only immediate, but were sustained in the days following the event due to additional rain and wind. Immediately following the tornado, residents were neither allowed to retrieve items or tarp properties of damaged businesses and dwellings, for obvious reasons of safety. Although participants recognized why they were unable to gather items or secure buildings, they maintained that for future events some sort of plan should exist to allow them access to damaged property within a reasonable period of time. When designing this plan, it is clear that a balance must be struck between ensuring an area's safety for entrance and the need for residents to secure their properties.

Other photographs were more symbolic of what was lost. For example, several participants aimed to capture the loss of a church that many residents had ties with by

photographing the empty lot that it replaced. Not only did these images signify what was not rebuilt during the recovery efforts, they also brought attention to some of the participant concerns regarding safety and aesthetic appeal. For one participant, her images aimed to showcase the damages she felt personally, including the impact on her family's dwelling and garden.

Other participants either brought in additional old photos of the initial damage when the tornado struck to showcase how things have been rebuilt since, or they chose to include these old photographs within the recent image, side by side as a comparison. Due to the extensive reconstruction efforts, it was understood a non-resident might not be able to tell that any damage had taken place, without the old photographs as reference. The images used to compare the initial damage and what has been rebuilt served as a reminder of the many large and small changes following the disaster, and also to show that there are residents still struggling to find restoration and resolutions to damage.

Photographs of trees and forested landscapes were another popular subject topic within this theme, especially within the Maitland Cemetery. Participants noted that fallen trees left on the ground have value including providing homes for wildlife and that the enrichment of the soil as the trees decay. The number of images capturing trees highlights, again, the importance that natural vegetation has within the community. Recognizing the severity of the tornado was also a large part of the recovery process for residents. For participants, it was important to recognize what was lost in order to build for the future and to then witness how far the community has come. Patience and tolerance became a large part of this process, and some photographs showcased that even five years later, not everything is restored.

4.1.7 Personal Awareness

Following the event, four participants highlighted that their behaviour and awareness had changed following the 2011 F3 tornado. Most participants were unaware of any measures to be taken to ensure their safety prior to the accident. Even following the event, many participants remained unaware of certain measures that they could personally undertake. However, during the interviews and second workshop one participant in particular discussed that the family had rebuilt their new home with many disaster safety features, thereby increasing their preparedness for another event. Hurricane clips were installed on their new roof and a cement cold room was constructed in the basement that can be used as an emergency shelter. In the final workshop, it was clear that many other participants did not know what hurricane clips were, nor did they know what other preventative measures that they could personally implement in their own lives and homes to increase emergency preparedness.

Whereas other participants did not mention in detail specific safety measures they may have taken, most identified that they had become much more aware of their surroundings and paid closer attention to the sky and weather. Some participants commented that they had previously enjoyed watching storms, which is no longer the case as storms trigger stress and anxiety. Participants now are more consistent with the checking the weather channel, especially if they observe any sort of light bulb flicker and are quick to react and find shelter in times of bad weather. One participant also noted the need for municipalities to provide the public access to more information regarding how homes can be built or renovated to better withstand future events.

There was recognition for the need for open dialogue and public access to personal safety information and what can be done for emergency preparedness at the residential level. Lessons

were learned from the event, and from other participants, that can better prepare them for future events.

4.2 ADDITIONALTHEMES

Several other important themes were identified that were informed by photographs, narratives, and interviews, during data analysis beyond those initial seven themes that form the photo exhibit.

4.2.1 Managing Response and Recovery

During the interviews, a few participants brought up the importance of managing people and volunteers following a disaster – immediately and within the months following. One participant in particular identified that there is a strong need for a dedicated strategy and coordination of people and volunteers in the event of a future disaster. In this regard, it was mentioned that well-intentioned individuals sought to do what they could in the recovery and clean-up process. This involved members of the community donating items, as well as the development of a volunteer group focusing on planting mature trees on private property. While these efforts were appreciated within the town, there lacked a strategy to communicate what individuals can donate and what was actually needed. Additionally, a participant noted that any developing volunteer groups following a disaster should have the proper education regarding liability and safety concerns, as well as direction from the municipality for what they can do in order for their services to be maximized.

In addition to managing volunteers following a disaster, participants recognized the importance for municipalities to enforce strategies to guide residents away from severely damaged areas immediately following the event. One participant noted that immediately following the tornado residents were wandering downtown, not knowing where to go. First

responders cleared the beachfront immediately from fallen debris, where there is a long boardwalk that residents go for leisurely activities. This was recognized as being a very important and a crucial step that the municipality took. Clearing this area provided residents with a familiar place to go not only for their own well-being, but also allowed municipal officials and first response the ability to do their jobs without the hassle of people wandering aimlessly in the downtown core.

4.2.2 Long-Term Support

Community residents, families, and first responders are still affected by the disaster in Goderich, five years later. Highlighted in this study is the idea that municipalities need to be continually reminded of the suffering and trauma that still exists after the event and that recovery is ongoing. Participants noted that there was a lot of support in the months immediately following the event; however, long-term support is something that needs to be improved upon. One participant's partner is a first responder who was gone from their house and family for the first 72 hours and frequently away during the following week. Their own house was damaged from the event, as were other homes of first responders. As such, much of the stress regarding the family's recovery was delegated to the partner. The participant highlighted how it is sometimes forgotten that while local first responders are there on the front lines to assist in the recovery process, they may also be suffering on a personal and family level. Despite these concerns, the participant did recognize the tremendous amount of acknowledgement that the first response organizations received for their efforts – all while dealing with personal damages and losses.

Although support and debriefing was provided immediately after the event, some participants realize that municipalities should be required to offer Post Traumatic Stress Disorder (PTSD) screening, support, and debriefing services long after these events. As one participant noted, PTSD is costly to the municipalities and devastating to families. Residents in the community continue to be triggered by rain, thunder, tornado warnings, etc. Support needs to be sustained even after the event is out of the news and when those who aren't dealing with it, forget.

4.2.3 Transparency

Some participants recognized that there is a need for further transparency in some aspects of the recovery process. For instance, one participant specifically questioned where funds came from for certain projects and how much they cost, such as with the new bandstand or wooden carvings. Although they questioned this process, it was recognized that these structures were appreciated despite some of these issues. In contrast, several other participants noted that there were several public meetings during the rebuilding process to answer many of these questions and to provide input. One participant in particular noted that public input is only valuable to the extent people in the community make use of it. The bandstand was one example that received extensive controversy, yet several participants suggested that it wasn't until it had been finally built that residents took notice and began complaining. Participants maintained that many of those complaints emerged from residents who had not attended the meetings during the design and consultation process.

There was clear recognition among participants that municipalities have to go above and beyond in order to be as transparent as possible during the rebuild and recovery process in order to involve residents and address their concerns. However, it was also stated that residents have

the responsibility to be informed about the availability of public meetings and to actively participate in those events. Evidently, participants recognized that a balance must be struck between the efforts of municipalities to provide the necessary information and opportunity for input, in addition to residents, themselves, taking responsibility to self-inform and to participate in these public input meetings.

4.2.4 Uncertainty and Education

The study also brought attention to the uncertainty some residents are experiencing regarding future weather events and what these impacts might be. The threat of another tornado is not the only fear that residents hold; participants brought up issues of water contamination and erosion. Following this, most participants revealed that the detrimental impact of the tornado truly exposed just how important having access to information regarding emergency preparedness is to educate residents, and some felt that the municipality had lacked providing adequate information in this regard. For instance, most community members mentioned that they were told that their town would never be impacted by a tornado due to their location on top of a cliff; rather, if one ever did develop, the storm would bounce over their town and hit neighbouring municipalities. Yet, August 2011 proved that to be false. As such, residents, themselves, did not receive much information in how to respond once the tornado actually took place.

Interestingly, despite the participant assertions that they were not aware of any preparations for a tornado, one participant, who is friends with an individual who was involved in town council and during the immediate tornado response, mentioned that a tabletop exercise/'worst-case scenario' had been undertaken two years previous to the 2011 event. This tabletop exercise was also mentioned at the workshop with municipal officials, held by the larger project team. Luckily, the exercise had planned for a very similar event – a tornado to hit the

center of Goderich. The difference was that the tornado had arrived from the east in the scenario, rather than from the west, and over the water. When the actual tornado struck, the municipality was able to use similar strategies they had created from that exercise. The participant highlighted that they were very fortunate to have had that strategy and that it likely contributed to the town's fast recovery and response. Additionally, the same participant mentioned that the town lacked adequate warning for the tornado – from the town and Environment Canada. For instance, s/he noted that s/he had received a phone call from a relative in Oakville warning him/her to take cover from the tornado, before having received any sort of warning from the community. Since the tornado, participants claimed that they are now aware that they need to prepare themselves for anything, and are looking to the municipality for some assistance in providing further information in what to do during and following differing disasters, and other environmental risks.

The uncertainty that has emerged as a result of the tornado and the recognition of where the town had lacked services regarding emergency management, previously, has also raised awareness regarding the need for increased education within the town. For instance, a participant mentioned that high schools are now educating its students on tornados, other disasters, and have even established their own tornado drills. It was also mentioned that local businesses are training employees on how to handle customers in the case of another tornado, or other disaster. Highlighted in interviews, was the idea that residents are now more able to hold the municipality to a higher standard when it comes to educating and adapting for uncertainty. Likewise, participants have recognized that town has already begun to do so.

4.2.5 Community and Neighbouring Support

Participants also provided commentary on the ways in which people came together within the town in the days, weeks, and months following the tornado to help one another. Although this theme did not emerge from the pictures, most participants did have commentary that identified the importance of community and neighbouring support for their timely recovery. This theme also highlights an important photovoice best practise – to include narratives in addition to the pictures. Participants noted that they personally received assistance from neighbours, friends, and family, especially for housing if dwellings were lost or severely damaged. One participant described the extent to which people in the community came together and the amount of support both in town and from neighbouring communities. For instance, because the tornado affected all of the local banks, neighbouring communities offered Goderich residents the ability to receive financial services in these towns. When a local church could not hold services due to tornado damage, another church allowed the uprooted congregation to use its facilities. The Zehrs grocery store in the town brought in refrigerator trucks to help residents store items, and the local Tim Horton's had mobile units for people to pick up coffee. Another participant recognized that recovery occurred relatively quickly because of the town council, the committees, and the individual people involved who had the willingness to create new and improved infrastructure and the foresight to consider what the future needs of the town will be.

5.0 Discussion

The focus of this study was about the factors that make rural communities resilient and able to adapt to disasters. Although the broader disaster literature is vast, there is limited research that examines how community members perceive disaster recovery and emergency management within a critical infrastructure context. Following the ideas of Madsen and O'Mullan, the concept

of "community resilience" and related terms needs to be considered before strategies to promote it, are developed. Within the domain of environmentally related problems and natural disasters, challenges exist due to spatial and temporal complexities, and also the nature of these events; they affect numerous built and social systems (Davidson, 2015). Community resilience, then, is not something that can be built from a distance, nor generalized for every community.

Promoting community resilience needs to be in distinct collaboration with each community itself (Madsen & O'Mullan, 2016). Using photovoice for this project provided this collaborative approach, offering the student researcher the unique opportunity to understand how residents within Goderich perceive their own recovery, vulnerabilities, and resiliencies, following the F3 tornado that hit in August 2011. The results of this work, as seen in the previous section, informed themes and offered the student researcher insight on best practises and lessons learned. This information will be provided to local and provincial government agencies to inform appropriate strategies that promote community resilience and community action. The following section focuses on the understandings associated with the findings of the research as they relate to the study's literature. Limitations of these findings are also presented.

5.1 ADAPTATION INITIATIVES AND IMPORTANCE OF PRE-EXISTING STRATEGIES

Smit and Wandel (2006) noted that it is typical for adaptation initiatives to modify pre-existing management strategies. As learned from this study, Goderich's municipal officials were fortunate enough to have developed a tabletop exercise specific to the impact of a tornado on the town, only two years prior. Having known a member involved in the process, a participant recognized how much the municipality benefited from the strategies developed through that exercise. In other words, timely response and recovery is much easier to accomplish when there have been strategies already in place, highlighting the importance of pre-existing plans. Had the

tabletop exercise not been created, the municipality and its residents may not have been as fortunate to recover as well as they had. The tornado was a wake-up call and as a result, has encouraged Goderich residents to consider the repercussions that other disasters may have on the town and how to better prepare for them – both as a municipality and as individuals.

5.1.2 Importance of Environmental Information

That being said, the findings also show that residents perceive there to be a lack of adequate information regarding some of the climate change risks and how to prepare for them. Most notably, several participants mentioned that they had been previously told their town would never suffer impacts from a tornado due to their location on a cliff. Interestingly, this corresponds with the results from Cole & Murphy (2014), who note that rural municipal residents had low perceived risk levels towards potential disasters; this was considered a challenge in the delivery of public education with regard to disaster and emergency management. The results also suggest that was a disconnect between what information residents believed to be available and what steps the municipality had already been taking regarding pre-emptive emergency preparedness strategies (i.e. tornado tabletop exercise). As only one participant made comment on the strategy, it appears that not all residents were aware of this information. This finding echoes research stating that a characteristic failure for many top-down emergency management approaches is the breakdown of communication and reliable information sharing between governmental authorities and community members during a disaster (Boin & McConnel, 2007).

The results also demonstrate the importance and accessibility of environmental information in rural communities, which has also been discussed within the literature (Boin & McConnel, 2007; Sander-Regler et al., 2009). Particularly, that successful capacity building and

planning in rural communities is strongly influenced by the delivery of locally geared information regarding environmental and climate change (Sander-Regler et al., 2009). It has also been found that previous disaster experience encourages risk awareness and promotes improved emergency preparedness strategies (Cole & Murphy, 2014). Participants mentioned that, since the tornado, they have recognized the ways in which their town was, and remains to be vulnerable, to future climate risk (i.e. communication lines, housing, businesses, financial services). They are more aware of their environment, the weather, and have considered other potential environmental risks that may be applicable to their town (e.g. erosion). And, some are looking towards the municipality to provide more information regarding preventative measures and related means of being prepared on a household level (i.e. hurricane clips, cold rooms, insurance coverage). Following the findings of Cole and Murphy (2014), experience with the tornado in Goderich can be considered a strength of the town. Participants have ascertained that it has heightened risk awareness and it has encouraged them to make appropriate preparations for potential future risks as well.

5.2 COMMUNITY RESILIENCE

Wilson-Forsberg (2013) described a resilient community as being able to flourish in an environment where change has occurred and where its members begin to monitor and understand these changes. Indeed, this study's findings confirm this notion, as participants described in detail how their local environment has changed and how they personally have adapted to these changes. This included becoming far more familiar with changes in weather and developing their own emergency strategies (e.g. going to the basement in times of bad weather). The findings also suggest that Goderich residents experienced an increase in risk communication and education, which follows the description of a resilient community by O'Rourke (2007). For instance, both

high schools and local businesses are doing more to educate students and staff on what to do in the case of a tornado, or other disaster. Moreover, the findings showed signs of resiliency, described by Mendis et al. (2003), in which focuses on the ability to innovate and embrace opportunities. Participants described how experiencing the tornado encouraged innovation and improved infrastructure for future risk, illustrated by more accessible buildings, the new wall at the pier, usage of dune grass to prevent erosion, etc.

Another of the themes that emerged from this study was "Memories and Recovery", in which participants described the ways in which the town, or they as individuals, chose to remember what happened. This was exemplified through sharing personal stories of loss, such as those observed in "Not Like Any Other Sunday", as well as the several memorial pieces created within the town in dedication to the losses the town suffered. Similar to the results found by Madsen and O'Mullan (2016), the members of Goderich had a strong sense of place and belonging. The dedicated memorials within the town allowed residents not only to remember its impacts, but also to provide strength and imagery to get them through difficult times. Observed from the photographs, narratives and interviews was the notion and belief that residents in the town were strong and resilient. It is likely that these beliefs and creation of monuments could be considered as contributing to the levels of resilience within Goderich.

5.3 IMPORTANCE OF CRITICAL INFRASTRUCTURE IN RURAL SPACES

Limitations to critical infrastructure exist that uniquely impacts rural spaces including losses in natural resource sectors threatening the economic base (ROMA, 2011). Particularly, how small rural communities typically have less diversified economies and are more dependent on natural resource sectors. One of the critical infrastructure sectors - "Finance" – as identified by Public Safety Canada (2015b), is inherently related to the theme of "Banks & Businesses". As such, the

importance of this sector was highlighted in Goderich. The findings suggest that Goderich residents consider the local businesses as being very important to their municipality, illustrated by the plentiful images that captured damages sustained as well as images capturing the ways that these buildings have been improved since. Participants described in detail that numerous businesses were unable to reopen in the weeks/months/years following the event and that some were unable to reopen at all. The findings also suggest that the Sifto Salt Mine is important for the healthy functioning of the town. In particular, participants consider it to be vulnerable to future disasters and recognize that their town could have been far more adversely affected, had the mine actually been destroyed.

The findings also suggest that there is a need for the continued improvement in weather forecasting systems as well as the mechanisms used to warn residents about impending events. Although Environment Canada (2013) claims that a tornado warning was issued for the town roughly ten minutes before the tornado struck, participants described that most residents did not receive this warning. Interestingly, one participant made mention of a scenario in which their relative, who lived in Oakville, had received warning of the tornado to hit Goderich, before the participant (and Goderich resident) had any idea. Following the 2011 F3 tornado, the community of Goderich has learned from these limitations and has, as a result, begun to move towards becoming more resourceful and independent. Several participants mentioned that they have heard that their municipality was looking into implementing improved warning systems to prepare for these types of events, and the idea of a tornado siren had been considered.

5.4 EMERGING GROUPS AND COHESION

It was mentioned that volunteers were a large part of the recovery process (most notably, the Goderich Trees Project). Several authors have also asserted that high rates of volunteerism are

one of the benefits of small rural communities (Cole & Murphy, 2014; Mendis et al., 2003; Sander-Regler et al., 2009). It is also recognized that volunteer groups are highly important and have their own implications within emergency and disaster management (Whittaker et al., 2015). For instance, untrained and uncoordinated volunteers may disrupt first response if they become the municipality's liability. Highlighted in this case study is the notion that municipalities should be prepared for volunteer groups to spring up. And, although emergent volunteer groups can provide needed services and a positive outlet for responders (Whittaker et al., 2015; Winkworth et al., 2009), some participants contend that municipalities need to be wary that not everyone may have the same level of awareness when it comes to safety and liability issues. Participants identified this as being a challenge that the municipality experienced, yet are hopeful that it will lead to more effective emergency planning and preparedness within their local situation and needs.

Also consistent with previous research findings (Cole & Murphy, 2014; Mendis et al., 2003; Sander-Regler et al., 2009), this study showed that participants acknowledged the strong sense of community support that they received, especially if they had personally been impacted by the tornado. Participants also perceived the sense of community support and volunteerism as being vital to the town's recovery and strength, supporting the idea that there is a positive correlation between social cohesion and resilience (Townshend, Awosoga, Kulig, & Fan, 2015). One participant, whose home they had lost, were fortunate to have friends and family to stay with. Others mentioned how local churches offered meeting space to congregations from damaged churches to be held at their location. Not only did participants acknowledge the degree that the local community came together, they recognized how essential the level of assistance from surrounding areas also was in the recovery process. For instance, neighbouring towns

offered financial services to a significant number of Goderich residents as they travelled together by organized bus trips. Rural municipalities have the opportunity to build on these existing strengths to increase disaster risk reduction and emergency preparedness.

5.5 AREAS TO FOCUS DISASTER RESPONSE EFFORTS

Consistent with previous research findings (Annang et al., 2006), this study identified vacancies as having affected their community following a disaster. For instance, under the theme of "Banks & Businesses", it was evident that Goderich suffered both residential and business vacancies. Similarly, participants captured the importance of this particular theme and community losses, using images of empty lots. It was not noted in their study whether most businesses and homes were restored or bounced back, whereas in Goderich most business were able to re-open within months/years. Relocating each of the banks, to their identical locations downtown prior to the tornado, was another concern. It was suggested that since these banks are situated in the same location where they had been previously damaged, they are susceptible to similar damages in the future. As most participants suggested, it is better to have related critical infrastructure more dispersed, so that not all will be damaged when located in close proximity to one another. Based on the photovoice findings, one can propose that results from this study can help determine where to focus disaster response efforts, both immediately and during the long-term recovery period.

This research also contributes to the recognition and importance of environmental restoration in disaster recovery (Silver & Grek-Martin, 2015) and the importance of recognizing natural features as critical infrastructure essential to the health, safety, security and economic wellbeing of Canadians (Public Safety Canada, 2015b). Notably, that replanting trees and enhancing the community with public art (i.e. tree carvings and sculptures, restoring historic

landmarks) became a huge aspect of the rebuild and recovery process. In the theme of "Trees as Critical Infrastructure", each participant had a story to tell regarding the trees in their community, whether it was about the volunteer groups that came together to replant lost trees, to the health benefits and how residents had lost the protection trees provided against wind and sun. While trees are not typically seen as being critical infrastructure, this was not the case in Goderich following the 2011 tornado. To the participants in Goderich, the trees signify survival and resilience - representing a new form of critical infrastructure and necessary for the healthy function of Goderich. Following similar findings, focusing on restoring these significant aspects of the community (e.g. trees, history), and can assist in promoting growth and thereby resilience in communities (Silver & Grek-Martin, 2015).

5.5.1 Differing Perspectives

The findings also illustrate the differences in perspectives regarding the recovery process following a disaster. Similar to other studies, it has been recognized that residents will inevitably experience positive and negative outcomes of a disaster, ultimately shaping their perspective on the response and recovery (Silver & Grek-Martin, 2015). Residents within Goderich are still impacted from the F3 tornado five years later and continue to identify its effects, as observed from the themes of "Damages & Things Lost" and "Memories & Recovery". Notably, "Damages & Things Lost" was one of the top three salient and strongest themes amongst participants. Within this theme, perceptions differed amongst participants in the types of photographs they chose to take and the kinds of stories they chose to tell. Ultimately, previous experience with the tornado and personal background shaped these perceptions, mirroring a similar study (Baldwin & Chandler, 2010).

5.5.2 Emerging Controversy and Contentious Issues

Related to the notion of differing perspectives regarding disaster recovery, is the idea of controversy and differences of opinion. In the study by Laycock et al. (2014) regarding the impacts of the Goderich tornado on community engagement and connection, it was found that the tornado strengthened community engagement temporarily yet did not lead to long-term enhancement of social networks and connection. Similarly, some authors have documented that the impact of a disaster may cause tensions among social groups and result in political complications in communities (Kapucu, Hawkins, & Rivera, 2014). This was demonstrated by the theme "Opportunities and Controversy", which captured some of the community tension and differences of opinion during the rebuild and recovery process. All participants noted that the community experienced a surge of support during the response period of the event, yet there are several instances where differences of opinion came out in the recovery process. It was highlighted that the tornado resulted in many opportunities to improve buildings and landscapes, yet some aspects of the rebuild were contentious – especially where practicality and aesthetic had to be balanced.

One notable example of a contentious issue that developed during the recovery process is the new bandstand, which one participant described was likely the most 'hated' piece of rebuild in the town square. It was made explicit that not all residents appreciated its modern aesthetic nor its practical use in the square, whereas others who had supported its development had differing views. Participants also discussed some of the debates regarding historical homes and the inability for some to be restored in the same way - if at all (e.g. United Church). As such, the challenge in rebuilding following a natural disaster (i.e. social tension), including the challenge of making spaces – and buildings – useable while also being in line with the community's vision

became pertinent. Although it was not possible to restore every historical building/structure that was damaged in Goderich, there was the opportunity to have the newer buildings constructed to retain some of the historical "feeling", as seen in the downtown.

5.6 METHODOLOGICAL REFLECTION

5.6.1 Limitations

As with any case study research, limitations do exist. The data accessed for this project is limited to what was photographed and what participants discussed. Anything participants chose to capture yet delete, or chose not to include within the project elements (i.e. photographs, narratives) was not accessed. In this research study, interviews were structured to allow participants the opportunity to discuss perspectives outside of what was photographed and to comment on any other issues. Data saturation was also reached for this group of participants, since similar ideas were continually revealed throughout the photovoice process.

The study was also contextually specific to the location of Goderich and its residents. As generally known, each community has unique social, economic, cultural, and geographical challenges. Therefore, the specific details of this study apply only to this particular community and cannot be extrapolated beyond the context. However, the processes and best practices learned from the community can be used to deepen understanding about rural adaptation to climate change and can serve as an example for future studies focusing on similar topics

Challenges during participant recruitment also occurred. More than twenty community residents were contacted through phone calls, email, or Facebook. However, only ten residents followed up with the project manager and graduate researcher and completed the consent process. Additionally, one participant had to withdraw from the project due to the time commitment, requiring the graduate researcher and project manager to find another participant as

a replacement in a short period of time. Due to the difficulty in gathering a wide range of potential participants to select from, all interested in the project were accepted to be involved. This project highlighted that participant recruitment is time consuming and ideally, it should take place sooner than two weeks in advance of the project start date. A longer recruitment period may have led to a more diverse/representative group of participants where additional information could be gathered from differing perspectives. There are likely to be other perspectives within the community that were not explored as part of this study, and that may not agree with the conclusions drawn from those who participated. As such, it may have been beneficial to have persons of different racial/ethnic backgrounds, geographic location within the town, and additional young adults.

Although photovoice research studies have been praised for acknowledging participants as the "experts" (Castleden et al., 2008; Healey et al., 2011; Keremane & McKay, 2011; Kerstetter & Bricker, 2009; Nykiforuk et al., 2011), it may not be the case that participants themselves see that to be true. While the graduate researcher did her best to facilitate discussion, listen, observe, and avoid directing conversation or ideas, some participants wanted direction and to provide information that they thought the graduate researcher would want. During this research study, it had to be reiterated several times that it was up to participants to share what they thought was important rather than what they thought the researcher wanted. In order to overcome this limitation, photovoice projects and similar participatory research methods should strive to continuously acknowledge and support local participants as they develop the confidence to become active researchers with a story to tell.

5.6.2 Strengths

Despite these limitations, this study had several strengths. A key strength was to include the final workshop in addition to the one-on-one interviews. Only four out of the ten participants captured the theme of "Personal Awareness", in which participants discussed the ways in which their preparedness and awareness had changed, notably, for the better since the tornado (i.e. hurricane clips, cold rooms, etc.). Not all participants had knowledge of some of the strategies others had implemented and the final workshop allowed them to have access to that information for their own uses. This follows other studies, which demonstrate some degree of social learning following a disaster (Silver & Andrey, 2014). The results of this study also follow other photovoice projects documented in the literature, such as changes in perception related to research topics, and the promotion of self-and-collective efficacy to respond to environmental concerns (Powers & Freedman, 2012; Castleden et al., 2008; Baldwin & Chandler, 2010; Healey et al., 2010).

Another strength of the project was the purchase of identical cameras for participants to use since images could be saved in the same format and size. This overcame some of the challenges that related to concerns about the difference in the quality of photographs, while also being easy and simple to use. Additionally, offering information on proper photography techniques assisted in overcoming quality issues that may have resulted from inexperienced photographs.

6.0 Conclusion

This study presented the recovery of Goderich following the F3 2011 tornado through the perceptions of community members regarding their views on the response, rebuild, as well as the identification of potential future vulnerabilities when it comes to critical infrastructure and

emergency preparedness. The purpose of the project was to synthesize and discuss the perceptions of climate change threats to critical infrastructure in rural Ontario through the lens of a community member, and to present an in-depth analysis of the identified key themes. Photovoice was integral to the project. The majority of participants in this project recognized that despite much of the community losses, they remained to be optimistic in the town's recovery and perceived resilience, five years later. Seven emergent themes were discussed: banks & businesses, vulnerable infrastructure, memories & recovery, opportunities & controversy, trees as critical infrastructure, damages & things lost, and personal awareness. Other significant concepts and ideas expressed by participants that formed themes in this project were: managing response & recovery, long-term support, transparency, uncertainty & education, and community & neighbouring support.

6.1 Lessons Learned

Along with suggestions already mentioned by the project participants, the following are additional actions and principals that the research suggests are important for developing community resilience in rural communities:

- Controversy can be inevitable within the rebuild process, especially when residents are closely tied to the town's historical identity. Municipalities should be wary of some of the challenges that may develop following a disaster within their region, as well as to acknowledge that differences of opinion will exist how 'best' to prepare; just because a town is small and rural, does not mean it is homogenous.
- Recognize the psychological impact as well as physical impact of disaster on individuals and their community.
- Municipalities and their residents must have adequate information and resources on the topic of climate change and related risks to enable a better response. In Goderich, first hand experience with a tornado has certainly increased risk awareness.
- To avoid miscommunication regarding perceived risks between municipal officials and their residents, managing climate-related risks can be improved through the use of more inclusive and engaging processes with community residents.
- Emerging volunteer groups before, during and after disasters will be inevitable. Municipalities must plan for their participation in recovery efforts. Following recommendations in other studies, emergency and disaster management need to be more

adaptive and inclusive of emerging volunteer groups in order to capture their capacities that encourage resilience (Whittaker et al., 2015).

- When designing municipalities, consider having related critical infrastructure more dispersed, so that not all will be damaged in the event of a disaster
- Utilize the unique strengths within rural municipalities (e.g. social capital, volunteerism) when developing emergency preparedness strategies.
- As Goderich has done, municipalities can do more to improve and protect trees as being key infrastructure in building resilient communities. Governments have the opportunity to update the definition of what critical infrastructure is to include green infrastructure such as trees and delegate funding to maintain and protect them.

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8.0 Appendices

APPENDIX A: PHOTOVOICE INFORMATION SHEET

LAURIER *Inspiring Lives.*

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WILFRID LAURIER UNIVERSITY
PHOTOVOICE INFORMATION SHEET

Ontario Rural Municipal Emergency Management and Critical Infrastructure: Enhancing Planning and Preparedness Capacities for Climate Change Resilience

Dr. Brenda Murphy, Mr. Bryce Gunson, Miss Kylie Hissa, and Miss Samantha Russo

WHAT IS PHOTOVOICE ?

Photovoice is a process of collecting information and expressing issues and concerns through photos. You will be provided with a digital camera to take up to 25 pictures related to the identified themes over a five-day period. Using the provided template, each picture will be submitted electronically with an accompanying write up or caption that explains what theme is being represented and why this photograph is important.

WHAT ARE THE GOALS OF PHOTOVOICE?

For our project, we have outlined the following goals:

1. Record and reflect your community's strengths and concerns regarding emergency management to climate change-related extreme events
2. Share personal and community issues through group discussions of photographs
3. Share photographs and narratives about your community with others
4. Inform the development of emergency preparedness strategies for improving the resilience and adaptive capacity to climate change-related risks of your community

WHAT IS YOUR ROLE?

In our project, we have outlined the following roles and expectations for the participants:

- Attend this opening photovoice workshop
- Take pictures within your community

- Participate in a one-on-one interview with the Master's student researcher
- Write or share verbally, statements about your photography. A template is provided to record your thoughts
- Attend the second photovoice workshop
    - Discuss pictures with the group
    - As a group, select photos for display
- If desired, attend a community event/project exhibition (TBD: Fall 2016)

PHOTOGRAPHY:

- Be mindful of your surroundings
- Don't rush your shots
- Don't be afraid to try different angles or points of view
- Keep the sun to your back, or to the side
- Is your subject in the center of the photo?
- Does your subject fill the photo?
- Subject should be in focus
- To prevent blurry photos, hold your elbows close to your sides, and hold your breath when you press the shutter (button)

Avoid…

- Taking photographs of people
- Putting yourself or others in risk
- Covering the flash

CLIMATE 101:

There has been an increase in extreme weather events in Ontario, which are predicted to increase in frequency as global temperatures continue to rise. Average temperatures in Ontario have risen by up to 1.5°C in the past 50 years, with global models projecting further increases in average temperatures, as well as higher amounts of average precipitation at current emission rates.

Examples: severe storms, heavy rain and wind events, flooding, tornados, etc.

CRITICAL INFRASTRUCTURE 101:

Critical Infrastructure (CI), as defined by the Government of Canada, is the physical and information technology facilities, networks, services and assets, which if disrupted or destroyed would have a serious impact on the health, safety, security or economic well-being of Canadians or the effective functioning of governments in Canada.

Sectors: health, food, finance, water, information and communication technology, safety, energy and utilities, manufacturing, government and transportation

Specific Examples: roads, telecommunications, electrical power systems, hospitals

THEMES:

- **Disaster Impact:** Can you provide some examples of the tornados' impacts on your community, particularly its infrastructure?

- **Disaster Recovery/Reconstruction:** Can you provide some examples of how your community has rebuilt since the tornado happened?

- **Challenges:** Can you provide some examples of problems or weaknesses related to infrastructure that could make your community vulnerable to extreme weather events in the future (as projected with climate change)?

- **Capabilities:** Can you provide some examples of your community's strengths to deal with future extreme weather events including avoidance/reduction of impacts, and better preparedness/recovery?

- **Advice:** Can you provide some examples of how to improve your community's abilities to better deal with extreme weather events in the future?

PHOTOVOICE: SAFETY AND RESPECT

As you take pictures, please keep the following guidelines in mind:

Keep yourself safe:

- Stand on solid surfaces
- Look before you step into or cross a street
- Be aware of your surroundings (e.g. bad weather)
- Do not expose yourself to any unnecessary risks (e.g. entering restricted spaces)
- Be aware of slip, trip and fall hazards
    - E.g. steep slopes or steps, wet or slippery surfaces, loose carpets
- Wear flat, rubber-soled footwear and proper clothing for the weather
    - Pack water, bug repellent, sun screen, snacks, as needed

Respect the safety of others. When you take photographs, avoid any situations that could impact someone else's safety.

Ask permission. Avoid making a person's photograph be the subject of the picture. However, if you decide to do so, always ask permission beforehand. Please have them sign the Standard Release Form.

Be respectful. If a person does not want their photo taken, respect their wishes. Do not trespass onto private property.

Be prepared.

- Make sure you have reviewed the safety precautions before heading out.
- Bring along all the necessary paperwork you may need when taking your pictures.
- Be prepared to explain the project to family, friends, or strangers, if they ask what you are doing.
    - A simple explanation is: "I am part of a Photovoice project understanding the impact of the 2012 flood on community members, where we are documenting our perspectives through pictures. Our photographs will be provided to local decision-makers to help strengthen municipal emergency management plans."

When permission is not necessary. In a public place like a park or roadside, you can take a picture of the infrastructure. You can also take a person's photo without permission as long as they are far away and/or have their backs to the camera and cannot be recognized in the picture.

SCHEDULE

MAY

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8	9	10 **Initial training Session**	11 Photo Period	12 Photo Period	13 Photo Period	14 Photo Period
15 Photo Period	16 One-on-one Interviews	17 One-on-one Interviews	18 **Final Workshop**	19	20	21
22	23	24	25	26	27	28

Important Dates:

Training Session	Tuesday May 10th 2016
Photo Period	Wednesday May 11th – Sunday May 15th 2016
Camera Return & One-on-one Interview Period	Monday May 16th & Tuesday May 17th 2016
Individual Interview Date	
Final Workshop & Group Discussion	Wednesday May 18th 2016

As per the details in the *Informed Consent* paperwork, if you have any negative emotional or psychological reactions from undertaking these activities and would like to speak to a counsellor, please contact Dr. Rosanne Field & Associates:

Counselling Services in Goderich:
Dr. Rosanne Field & Associates
Address: 66 Victoria Street N. Goderich ON, N7A 2R8
Telephone #: (519) 524-5811
For more information, visit: http://www.drfield.ca/en/

APPENDIX B: PHOTOVOICE TEMPLATE SHEET

PHOTO TEMPLATE

Name:	Photo #:	
Date:	Location of Photo:	
Themes: 1) Disaster Impact: Can you provide some examples of the events' impacts on your community, particularly its infrastructure? 2) Disaster Recovery/Reconstruction: Can you provide some examples of how your community has rebuilt since the event happened? 3) Challenges: Can you provide some examples of problems or weaknesses related to infrastructure that could make your community vulnerable to extreme weather events in the future (as projected with climate change)? 4) Capabilities: Can you provide some examples of your community's strengths to deal with future extreme weather events including avoidance/reduction of impacts, and better preparedness/recovery? 5) Advice: Can you provide some examples of how to improve your community's abilities to better deal with extreme weather events in the future?		
Please describe the photo you took.		
What is this photo about? What story does it tell?		
Why do you think this photo important?		
What issues are raised by this photo for you and your community and do you have any thoughts about how to deal with them?		
Other:		
	YES	NO
Does your photograph include any identifiable people?		
If yes, do you have the completed and signed standard release form?		

APPENDIX C: GODERICH FINAL THEME WRITE-UPS



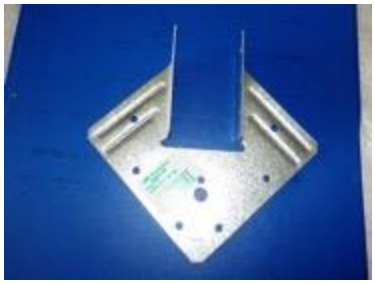
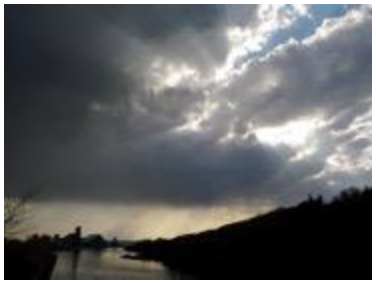



Damages and Things Lost

These photos illustrate the empty lots, complete devastation of trees, and remembrance of the damage that hit the downtown core and surrounding areas of Goderich. Although most insurance claims have been settled, empty lots still sit as a reminder of what was lost while also posing issues related to the loss of safety and visual appeal. Not all could be restored or replaced and a dwelling still stands 5 years later as a reminder of the tornado, family losses, and battles with insurance. Where once stood the United Church – a heritage building that many residents had connections to – is now a parking lot with only a plaque to remember it with. In areas formerly full of mature trees and trails, such as The Maitland Cemetery, the forests have been replaced by cleared meadows and open spaces. Residents will not again experience the mature forests that had been so common in Goderich for decades.

Trees as Critical Infrastructure

Immediately following the tornado there was the smell of gas leaks but also the smell of trees - uprooted, fallen, and dying. The loss of trees tells a story of damage but also has brought attention to their importance within Goderich. Trees have an aesthetic role in the town, bringing life and beauty. As part of the recovery process, devastated mature trees often became the subject of public art in memory of the tornado, as seen by wooden carvings made of tree trunks. They also stabilize slopes, provide habitat, as well as shelter the town from wind and sun. Goderich has recognized the importance of trees in the town's recovery, which has been demonstrated by many replanting efforts. Goderich's trees signify survival and resilience. Indeed, trees can be seen as being critical infrastructure and necessary for the healthy function of Goderich.

Personal Awareness

Despite the tornado's destruction, many people have gained a new sense of personal awareness regarding weather, environment, and emergency situations. Goderich saw the power and strength of destruction that Mother Nature has in August 2011 and, to this day, changes to the sky and wind make many residents uneasy. Hurricane clips to secure the roof and cold rooms have been installed by some residents to protect people and dwellings during future events. High school students now take tornado drills seriously and residents may be less likely to head to the beach when storms approach. Natural disasters also move seeds and displace animal populations, and residents see subtle changes in the environment everyday. One example is the emergence of the cleavers plant in a resident's backyard – a sticky weed that clings to skin, clothing, and fur. Others note that birds and other wildlife are starting to return following their habitats' destruction as a result of the 2011 tornado.

Banks and Businesses

Having vital services located together at the centre of the town has benefits as it allows people the convenience of accessibility to these services. When services are close together, residents and visitors do not have to travel far or spend additional time to run errands. However, when the tornado struck, this centralization meant that many banks and businesses in the 'hot zone' were severely affected. Goderich has several different banks and every single one was heavily damaged by the tornado, rendering them useless for days to weeks. Residents had to go to banks in neighbouring towns and although buses were provided at designated days and time, there were issues of mobility and access. Some suggest that alternate locations should have been found, rather than restoring the buildings to their identical locations following the tornado. Many larger businesses were able to adapt and bounce back in spite of apparent setbacks; however, the extent to which that was possible was largely dependent on the level of damage and amount of insurance. Additionally, it was difficult for businesses to survive in the years following the tornado due to all the damage within the downtown. Residents did not want to see or be reminded of the event and would avoid coming into the area.

Vulnerable Infrastructure

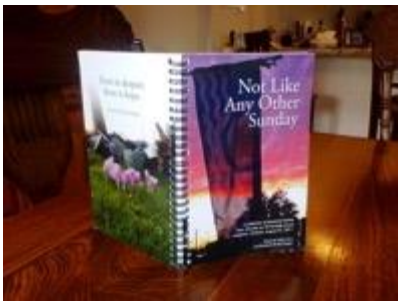
Despite extensive reconstruction efforts, areas of Goderich remain vulnerable to future natural disasters, whether they are explicitly known by community residents or to a select few. The water tower provides water pressure for a limited amount of time without power and, questions exist as to how stable the structure is or whether potential alternatives exist if it is damaged or power is lost. Some residents fear that the fire department lacks a backup generator for power outages and for radio systems that run out of battery life. Other areas such as the post office and salt mine were directly affected by the tornado, and remain vulnerable to future events. Residents experienced hour-long wait times to check if they had mail, resulting in additional frustration following the event. There is concern regarding climate change and variations in weather - pollution, erosion, severe rain, and flooding. Gibbon's street represents an area that floods every time it rains. Preventative measures and backup plans are necessary and residents now question what measures are, or will be, in place to protect and prevent against future disaster.






Windows of Opportunity and Controversy

Following the tornado, buildings can be reconstructed and landscapes restored, offering opportunities to make improvements or decisions that would otherwise never have occurred. These photographs represent the theme of opportunity and controversy and the balance that is played between practicality and aesthetic values. As demonstrated by the new bandstand downtown, there have been differences of opinion regarding re-imagining Goderich's identity, including the balance between maintaining a heritage image and more modern styles. The new wall built on the pier at the main beach can protect against waves or thrown ice in the winter; however, the view of nature is now limited. While many dwellings could be rebuilt, not every homeowner had the funds to do so. In other cases, some homeowners had the chance to rebuild, yet could not afford the new taxes – being forced to sell their rebuilt home and move elsewhere. Without the tornado, St. Patrick's Park would have been left in a state of disrepair and never restored. When the trees came down, the old fountain's piping was revealed and an opportunity arose to rebuild and restore the smallest park in town. Building accessibility and density has also increased at the town centre to follow new building codes. Again, while there are benefits that allow more people to find housing in these areas and that are accessible, there is a risk if another disaster strikes downtown.



Memories and Recovery

Signs of devastation remain, but so do symbols of memory and recovery. The chiming of the courthouse clock was silenced by the tornado, and the day that the chimes were fixed marked a small but very important step in the reconstruction efforts. The stories told by residents have helped psychological recovery as well as physical recovery efforts, with over $20,000 in proceeds from the sale of the book “Not Like Any Other Sunday” being donated to four different charities in Goderich. The loss of the courthouse trees brought light to the striking silhouette of the soldier statue at the local war memorial, and the “Not Like Any Other Sunday Grove” sign stands to represent the various individuals and organizations that planted trees following the tornado. Lastly, the plaque placed in Harbour Park reminds Goderich of the sole fatality that day. Had the tornado struck weekends earlier when a major annual festival was held, the number of injuries and loss of life could have been far more devastating.

APPENDIX D: EXCEL DATA SHEET