

This publication is part of the *xTREME toolkit* (eXtreme events Toolkit for Rural Emergency Management Enhancement) which is available online www.resilientresearch.ca as part of a project titled “Ontario Rural Municipal Emergency Management and Critical Infrastructure: Enhancing Planning and Preparedness Capacities for Climate Change Resilience”

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Acknowledgements

We thank members of the project advisory board who provided valuable feedback on this project

Funders

Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA)

Wilfrid Laurier University



Moving Towards Emergency Management Resilience to Climate Change in Rural Municipalities

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Executive Summary

The goal of this three year project, entitled *'Rural Ontario Municipal Emergency Management and Critical Infrastructure: Enhancing Planning and Preparedness Capacities for Climate Change Resilience'* was to assess the current emergency management planning and preparedness capacities of rural Ontario municipalities to climate change-related threats across key critical infrastructure sectors. This policy brief is directed towards decision-makers, particularly at the municipal and provincial government levels. In these policy recommendations we blend identified best practices with specific examples and insights arising from the work completed for this project. After more general recommendations, this brief outlines six strategic recommendations.



2012 Wawa flood damage. Toronto Star (2012)

335 (75%) of all municipalities in Ontario are either rural or partially rural. Despite notable strengths, rural communities require differentiated and specific policy support to be able to address their distinct vulnerabilities and resiliencies and actively cope with climate change impacts, including the effects from extreme events on rural critical infrastructure. For instance, in our survey of municipal government



2011 Goderich tornado damage to town square. CBC (2011)

authorities, since the top two emergency management funding sources were local (53%) and provincial funds (40%), it is clear that any locally-needed upgrades will require the continued commitment from the rural municipalities, strongly

backed up by provincial-level support. In Ontario, consideration could be given to the United Kingdom's approach of 'rural proofing' to ensure rural needs are adequately addressed during policy development.

Particularly in rural communities, there is an urgent need for new planning and infrastructure approaches that can respond to the reality of climate change. Since climate change impacts are local and context specific, the role and capacities of municipal governments is crucial to successful adaptation efforts. In our survey of Ontario rural communities, 72% of rural municipal government respondents indicated that they expected to experience the impacts of climate change (CC) over the next ten years including an overall increase in the number, severity and unpredictability of extreme weather events.

Ontario's Climate Ready Adaptation and Action Plan mandates effective management of the extreme events associated with CC and the impacts on critical infrastructure. Dealing with these threats is especially urgent in rural communities who are already stressed by daunting challenges. Climate change adaptation encompasses adjustments in practices, processes or structures in response to projected or actual climate and extreme weather events. It is the capacity to manage and influence resilience and to act, despite uncertainty and limited knowledge.

Strategic Recommendations:

- Provide sufficient funding to allow rural communities to upgrade after a disaster event and mitigate future risk
- Support rural efforts to access targeted, community-specific knowledge about climate change impacts
- Support rural efforts to increase their consideration of climate change impacts into a broad range of decision-making contexts
- Provide targeted and differentiated support to help rural communities address the impacts of climate change
- For rural communities there is a need to broaden the definition of what is considered key infrastructure to include elements of the natural environment and to increase related opportunities to access funding to protect and upgrade such green infrastructure
- Where there are strong relationships between a rural community and its neighbours, it is important to support a coordinated approach to emergency management, climate change adaptation and the response to extreme events



Goderich tornado damage (archival photograph from 2011 provided by photovoice participant 5) (2016)

Introduction

The goal of this three year project, entitled *'Rural Ontario Municipal Emergency Management and Critical Infrastructure: Enhancing Planning and Preparedness Capacities for Climate Change Resilience'* was to assess the current emergency management planning and preparedness capacities of rural Ontario municipalities to climate change-related threats across key critical infrastructure sectors. This policy brief is directed towards decision-makers, particularly at the municipal and provincial government levels. A mixed method approach was used to maximize the validity, reliability and applicability of the study's results. Initial key informant interviews and a comprehensive, province-wide survey provided a broad overview of the resiliencies and challenges in managing extreme events across Ontario communities. To delve deeper, two case studies were then undertaken in Wawa and Goderich, Ontario. For each case study, a workshop for disaster responders was followed by participatory community research using photovoice. Photovoice puts cameras into the hands of citizens to visually record their perceptions and ideas. Follow up activities have included the development of a tabletop exercise for emergency responders and climate change projections for the case study communities¹. In these policy recommendations we blend best practices drawn from the literature with specific examples and insights arising from the work completed for this project. After a more general overview, this brief outlines six strategic policy recommendations.

Overview and General Recommendations

335 (75%) of all municipalities in Ontario are either rural or partially rural. The challenges confronting rural communities include limited economic resources to meet myriad local needs, less diversified



Goderich town square, with new trees and concert shell installed after the tornado. Photovoice participant 8 (2016)

economies, higher reliance on natural resources sectors, isolation and limited access to services including emergency management, less knowledge of climate change impacts and adaptation issues, and less technical capabilities including facilitation of planning processes. Many rural municipalities also face increased outmigration, a lower employment rate and a rapidly ageing population. Thus, despite notable strengths, such as strong social capital and social networks, strong attachments to community, deep local knowledge and high rates of volunteerism, rural communities require differentiated and specific policy support to be able to address

¹ For these and other publications associated with this project, please see:

<http://www.resilientresearch.ca/research-publications/> The results of the case study projects can be found at: http://scholars.wlu.ca/ges_mrp/6/ and http://scholars.wlu.ca/ges_mrp/5/

their distinct vulnerabilities and resiliencies and actively cope with climate change impacts, including the effects from extreme events on rural critical infrastructure.

For instance, in our survey of municipal government authorities, since the top two emergency management funding sources were local (53%) and provincial funds (40%), it is clear that any locally-needed infrastructure upgrades will require the continued commitment from rural municipalities, strongly backed up by provincial-level support. While both the federal and provincial governments have initiated programs to provide much needed access to monies to support infrastructure upgrades, it is particularly challenging for small, rural municipalities with limited staffing to undertake the needed planning and grant development work to access this funding.

Similar to the ‘rural and northern lens’ developed by the Rural Ontario Municipal Association², in the United Kingdom, new policies undergo a ‘rural proofing’ review to ensure that the needs of rural municipalities are addressed in policy decisions³. The rural proofing process encompasses four steps: 1) identifying the impacts, 2) assessing the scale of impacts, 3) tailoring the policy for rural areas, and 4) evaluation and adaptation. It might be useful for Ontario decision-makers to review both of these approaches and consider a similar strategy to use when developing policies and regulations that will have implications for rural municipalities.

Particularly in rural communities, there is an urgent need for new planning and infrastructure approaches that can respond to the reality of climate change. Since climate change impacts are local and context specific, the role and capacities of municipal governments is crucial to successful adaptation efforts. Local governments are well positioned to undertake strategic climate change adaptation planning, including emergency management initiatives, because they have the mandated responsibility to ensure the safety and welfare of their communities. Local governments can tailor adaptation approaches to address local circumstances and impacts and anticipatory, proactive planning can capitalize on existing strengths, create new opportunities and reduce vulnerabilities.



Flood damage in Wawa from 2012 flood. Photovoice participant 2 (2016)

In rural spaces, the limited economic base makes the provision and protection of critical infrastructure much more costly for businesses and local government. According to the Rural Ontario Municipal Association, in Ontario, there is an estimated \$60 billion gap over the next ten years between what municipalities currently spend on infrastructure and what is needed for maintenance and growth⁴. About 50% of that gap is accounted for by road and bridge assets. In rural spaces, infrastructure

² <http://www.roma.on.ca/Advocacy/2015.aspx>

³ <https://www.gov.uk/government/publications/rural-proofing>

⁴ <http://www.roma.on.ca/ROMA-Content/Backgrounders/2017/MunicipalInfrastructure.aspx>

problems are compounded by lagging broadband and other telecommunication deficiencies, losses in the natural resource extraction sector threatening economic stability, and lack of adequate education and health care facilities.

Infrastructure assets share several characteristics important in a disaster context: 1) the networks are constructed over generations and not easily replaceable; 2) the system must be maintained in perpetuity to protect human populations; 3) the assets have high initial and replacement costs; 4) failure in one system component has repercussions in another part of the network; and 5) since multiple infrastructure assets are inter-connected, the failure in one system can have cascading effects. Public Safety Canada states that “Critical infrastructure refers to processes, systems, facilities, technologies, networks, assets and services essential to the health, safety, security or economic well-being of Canadians and the effective functioning of government”⁵.



Tree sculpture commemorating the life lost in the 2011 Goderich tornado. Photovoice participant 7 (2016)

Critical infrastructure, as it relates to emergency management, are those elements of infrastructure that, if damaged or lost, could pose a significant threat to needed supplies (e.g., food, energy, medicines), services (e.g., police, fire, and EMS), and communication or a significant loss of service coverage or efficiency. These services and supplies are often termed ‘lifelines’ and losing capacity of a lifeline could have –harmful, life-threatening impacts on a population. The vulnerability of particular infrastructures depends on the sensitivity to climate risk (i.e., the predisposition of infrastructures to be affected due to at least three factors: the age, the composition and the design of infrastructure) and the capacity of the sector to adapt by minimizing negative impacts and/or maximizing positive opportunities. The critical infrastructure sectors assessed in this project are: *Health* (human/biota, food/water/physical safety and security); *Government* (structures, land-use planning, building codes, emergency services, transportation); *Private sector* (utilities, employment, finance); and *Information-communication technologies* (computer, cellphone, landline, internet).

According to the Intergovernmental Panel on Climate Change, warming of the climate system is unequivocal and without significant changes in policy the trend in global greenhouse emissions and associated CC will continue. Canada’s infrastructure will likely be forced to withstand more frequent and more extreme weather events, more climate variability and changes in the average conditions in which most major infrastructure operate. Increased rainfall, cold, heat and intensity of storms can all raise havoc with existing and planned infrastructure projects. Problems with port facilities, electricity-producing dams and transmission lines, highways and roads, and sewer and water lines, among other impacts, are projected under a changing climate. Climate change is also expected to increase the frequency and magnitude of many natural disasters, and this will inevitably affect Canada’s

⁵ <https://www.publicsafety.gc.ca/cnt/ntnl-scrtr/crtcl-nfrstrctr/index-en.aspx>

infrastructure. All of these factors will also necessitate the need to design, build and maintain more robust infrastructure in order to adapt to future climate changes.

In Ontario, CC is expected to lead to a wide range of year-round impacts. In summer, an increase in the number and intensity of heavy rain and strong wind driven events will likely increase severe storms and flash flooding, hail events will increase, and more hot days will intensify energy use, wildfires and smog. In winter, increasing average temperatures and frost free days could extend the planting season, reduce heating costs and decrease precipitation. In addition, freezing rain, more frequent freeze-thaw cycles, and intense winter storms are projected to increase. CC could also bring new risks such as vector-borne diseases and invasive species. Within the province, knowledge of the differences in sub-regional impacts is quite uncertain and will vary according to such factors as local capacities, the bio-geographic landscape and latitude.

In our survey of Ontario rural communities, 72% of rural municipal government respondents indicated that they expected to experience the impacts of CC over the next ten years including an overall increase in the number, severity and unpredictability of extreme weather events. The top four recent weather-related emergency events experienced were 1) high winds and/or tornadoes, 43%, 2) flooding, 39%, 3) high snowfall events, 37%, and 4) ice storms, 25%. The critical infrastructure most damaged by recent events were electrical and transportation networks as well public safety and security systems and 60% felt that this trend will continue over the next ten years. While 73% agreed that their community had



Washed-out culvert and temporary bridge from 2012 Wawa flood. Photovoice participant 3 (2016)

indicated that they had thorough knowledge of critical infrastructure vulnerabilities and only 24% felt that new critical infrastructure development had incorporated CC risk mitigation.

Climate resilience is the ability to resist, cope or recover from impacts such as extreme events and the potential to innovate, reorganize and take advantage of opportunities. A resilient community is able to thrive in an environment characterised by change where members undertake anticipatory learning to monitor and understand these changes. It can intentionally respond to unexpected events by mobilizing groups and individuals to minimize the adverse consequences and sustain and renew the community. Emergency management is a key line of defense against all extreme events and it is a crucial part of climate resilience.

Ontario's Climate Ready Adaptation and Action Plan⁶ mandates effective management of the extreme events associated with CC and the impacts on critical infrastructure. Dealing with these threats is especially urgent in rural communities who are already stressed by daunting challenges. Climate change adaptation encompasses adjustments in practices, processes and/or structures in response to projected or actual climate and extreme weather events. It is the capacity to manage and influence resilience and to act, despite uncertainty and limited knowledge.



Photovoice participant 1 holds a photograph of a damaged building, while photographing one of the many reconstructed downtown buildings in Goderich (2016)

⁶ <https://www.ontario.ca/document/climate-ready-adaptation-strategy-and-action-plan-2011-2014-0>

Strategic Policy Recommendations

Provide sufficient funding to allow rural communities to upgrade after a disaster event and mitigate future risk

From our survey, 44% of respondents ranked having the needed financial resources to protect critical infrastructure as the #1 factor most impeding effective emergency management planning. With small and often declining tax-bases in rural spaces, these results suggest a daunting hurdle that needs to be addressed.

The case study work also revealed that ‘building back better’ after disasters can prove difficult when funding is insufficient to cover the additional costs of upgrades. There is an urgent need to provide municipalities with some level of mitigation funding, rather than focusing strictly on pre-disaster asset values. In particular, Wawa officials noted that the staggering costs of reconstruction to meet the higher standards required under likely CC scenarios, substantially extended their recovery efforts and in some cases, prevented adequate recovery. On this front, Ontario policy makers could take the lead from Public Safety Canada and the United Nations. In the third edition of the ‘*Emergency Management Framework for Canada*’⁷, the strong relationship between long-term sustainable recovery and mitigation of future disasters is emphasized. In particular, reconstruction should be undertaken with the goal of disaster risk reduction. In the international agreement, to which Canada is a signatory, the ‘*Global Platform for Disaster Risk Reduction*’⁸ encourages all jurisdictions to ‘risk-proof’ development since the increasing toll from disasters could well out-pace the capacity to effectively respond and recover from these events.

Support rural efforts to access and disseminate targeted, community-specific knowledge about climate change impacts

Enhancing local knowledge about the impacts of CC is key to increasing climate resilience. From our survey, 30% of respondents ranked adequate knowledge of CC impacts as the #2 factor most impeding effective emergency management planning. This has been a difficult hurdle to overcome since Global Climate Models (GCMs) do not provide the detailed, location-specific information communities need to inform their CC mitigation and adaptation decision-making processes. Through this project, CC projections to 2100 for two communities were developed using data downscaled to the local level. Although Wawa and Goderich are both within the Great Lakes region, there were stark contrasts in the CC projections, with the latter community likely to warm more significantly across all seasons. We have also outlined the methodology to allow other communities to undertake a similar analysis⁹. Although

⁷ <https://www.publicsafety.gc.ca/cnt/rsrscs/pblctns/2017-mrgnc-mngmnt-frmwrk/index-en.aspx>

⁸ <https://www.unisdr.org/we/coordinate/global-platform>

⁹ <http://www.resilientresearch.ca/research-publications/>

the project has used the most straight-forward methods possible, some communities will still likely need technical and personnel support to be able to undertake their local assessment. This could include access to sufficient bandwidth and data, compatible hardware and software and knowledgeable staff.

Support rural efforts to increase their consideration of climate change impacts into a broad range of decision-making contexts

At the local level, communities can undertake targeted, adaptive measures to increase their CC resilience. First, recovery to disasters presents a ‘window of opportunity’ to reduce risks to future hazards. In the wake of disasters municipalities can work towards upgrading impacted infrastructure and incorporate ‘lessons learned’ into their emergency management processes. In our case studies, examples included developing better strategies to manage the volunteer surge that is common during disaster response, increasing the size of culverts to projected increased precipitation flows, rebuilding bridges to withstand future heat waves or high water levels and burying telecommunication and electrical wires to prevent wind or ice damage.

Second, during quieter times communities can proactively incorporate planning for a changing climate during regularly scheduled asset management upgrades; this is called ‘mainstreaming’ CC adaptation efforts. Our survey results indicate that currently, there is very limited focus on activities related to mainstreaming such as: planning mitigation strategies for new critical infrastructure; supporting initiatives to mitigate risk to existing critical infrastructure; encourage a wide range of local government departments to plan for climate change; changing existing land use zoning to mitigate risk and implementing bylaws aimed at changing public behavior, such as water use restrictions. Community leaders can encourage all local infrastructure managers, both public and private, to consider potential CC impacts in their decision-making processes; for instance, when planning roads, water and sewage, telecommunication and electrical networks as well as the location of key buildings such as hospitals, schools, fire departments and ambulance depots.



Washed-out rail bed that the Michipicoten First Nation intended to convert into a secondary access road. Photovoice participant 10 (2016)

Provide targeted and differentiated support to help rural communities address the impacts of climate change

Rural communities cannot be expected to undertake the needed upgrades to effectively adapt to CC on their own, especially in light of all the challenges they currently face. Climate resilience is enhanced when higher levels of government and the related policies and regulatory structures support and facilitate local efforts. Unlike urban municipalities with larger dedicated emergency management departments, 56% of our survey participants indicated that they did not have a dedicated community emergency management coordinator, instead this role was shared with other responsibilities, most often combined with that of fire chief. As identified in our survey, local emergency management planning also tended to be limited to those activities that were provincially-mandated such as hazard identification and risk assessment, as well as developing, revising and testing plans. Time for undertaking useful, but more time-consuming activities such as outreach to the managers of privately-owned critical infrastructure, public education and examining insurance and liability costs arising from extreme events received much less attention.



Newly renovated downtown building in Goderich illustrates how the town was able to 'build back better'. Photovoice participant 3 (2016)

In addition, the case study results demonstrated the inter-community differences in vulnerabilities and capacities within rural spaces. To be blunt – some municipalities need more support than others and recognizing this difference is a matter of environmental justice. For instance, Goderich, a thriving small

town, located in a more accessible Southern Ontario location, already had robust infrastructure planning and upgrades and in the wake of the tornado was able to muster extensive volunteer support and extensive donations to support recovery efforts. Today, it is virtually impossible to recognize where the damage had occurred, except through the loss of tree cover. In contrast, Wawa, located in a more remote northern location, has been experiencing economic hardship including an aging population and declining tax base due to the loss of the mines. Donation and volunteer levels were substantially less after the floods and the community has struggled to repair even the most egregious of damages. They have been able to reconstruct most critical infrastructure, including culverts and bridges, but some work has remained unfinished and the cost of upgrades has hamstrung some initiatives. For instance, extensive damage to, and contamination of, the harbor had not been addressed by 2016, four years after the floods. This has severely impacted the ecotourism industry in the area, compromised secondary egress routes and impacted drinking water quality.

For rural communities there is a need to broaden the definition of what is considered key infrastructure to include elements of the natural environment and to increase related opportunities to access funding to protect and upgrade such green infrastructure



Many photovoice participants emphasized the importance of trees as 'green infrastructure'. Goderich photovoice participant 2 (2016)

While some analysts would like to limit definitions of critical infrastructure to 'hard' technologies such as ducts, pipes and wires, it is increasingly understood that reliable, trustworthy infrastructure also includes the regulations, processes and networks of people that manage these technologies. We argue that for rural communities, this socio-economic orientation needs to be pushed ever further to include the natural environment. Rural communities are much more deeply connected to the natural landscape than their urban neighbours and the services provided by the environment are fundamental to achieving CC resiliency and wellbeing in rural spaces. Thus, policy support to protect and upgrade ecosystem services is vitally important for this 'green infrastructure'. In Wawa, for instance, wilderness trails serve as secondary access and egress routes, healthy greenspaces are vital to support ecotourism, and income and subsistence is gained from hunting and fishing. Changes to the landscape, whether as a result of climate extremes such as fire or flood damage or beaver dam building, have the potential to contribute to vulnerability. During the case study work, both communities lamented the loss of trees as a factor that reduced CC resilience. In Goderich trees had previously provided welcomed shade and habitat as well as contributing to their tourist positioning as 'The Prettiest Town in Canada'. In Wawa, loss of trees has led to ongoing and increasing problems with erosion and gullyng, further intensifying the initial flood impacts.

Where there are strong relationships between a rural community and its neighbours, it is important to support a coordinated approach to emergency management, climate change adaptation and the response to extreme events

One of the key strengths in rural communities is the strong bonds within and between communities and the unflinching willingness to help each other in times of need. These strengths should be reinforced and supported by planning initiatives that encourage voluntary efforts to undertake joint emergency management and infrastructure renewal. In the case of Wawa, for instance, ongoing coordinated emergency management planning with the neighbouring Michipicoten First Nation served as the basis of the successful joint response to the flooding crisis. Since the boundary between these two jurisdictions is an artificiality not reflective of the watershed flood management requirements, the communities have also had to coordinate their reconstruction efforts of such infrastructures as culverts, bridges and roads.



Flood damaged deep-water wharf near Wawa. Photovoice participant 2 (2016)

Conclusion

This policy brief has summarized the key findings and take away messages useful for municipal and provincial government decision-makers. It has been reviewed and adjusted following feedback from the Project Advisory Board and other key individuals. The research team wants to emphasize that outstanding work is already being undertaken to address CC by communities in Ontario's rural sector and to advocate for the 'rural proofing' and 'mainstreaming' of all CC adaption measures aimed at addressing the impacts from extreme events.



Sunset over the Goderich harbour and the Sifto salt mining plant. Photovoice participant 9 (2016)