

Are You Ready?

Climate Change & Asset Management

Webinar, Carleton University

Ottawa, ON Canada



City of
Peterborough



Ontario

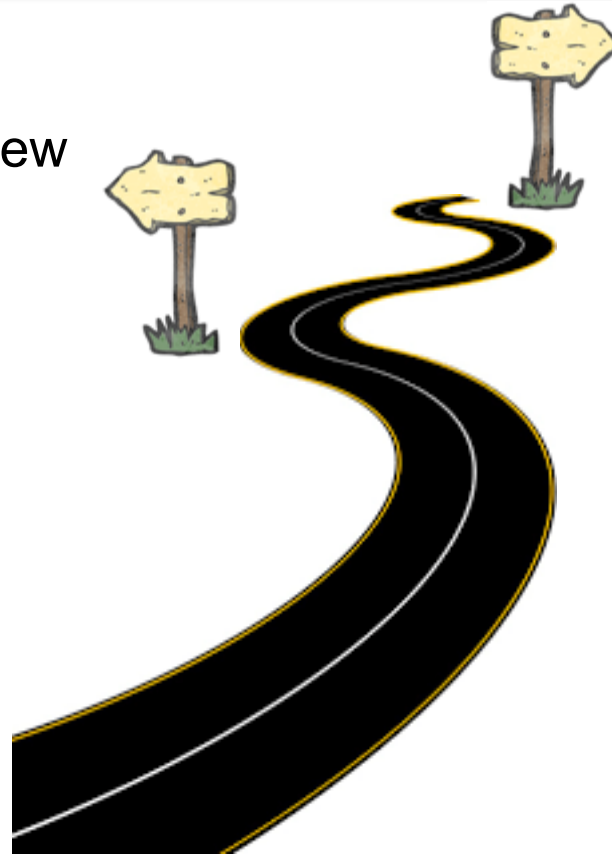


May 30, 2018
OMAFRA Project ND2015-270

Webinar Overview

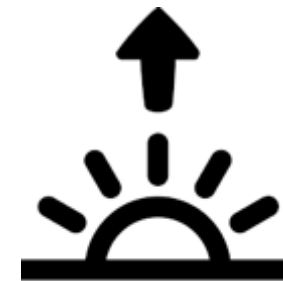
Discussion

- Project overview & context
- Preliminary study results



Introductions

- Research team



Concluding Remarks

- Summary of study outcomes
- Overview of future direction



Webinar Hinterland Who's Who



Dr. Kathryne Dupré, Ph.D.

is an Associate Professor at Carleton University in the Department of Psychology and an expert in the field of occupational health psychology.

<https://carleton.ca/psychology/people/kate-dupre/>



Amanda Mcevoy, Ph.D. Candidate

is a doctoral candidate at Carleton University in the Department of Psychology conducting research in the field of occupational health psychology.



Dr. Shawn Kenny, Ph.D., P.Eng.

is an Associate Professor at Carleton University in the Department of Civil & Environmental Engineering, an Associate Director of the Ottawa-Carleton Institute for Civil Engineering and the Principal Investigator for this project

<https://carleton.ca/cee/people/kenny-shawn/>

Acknowledgments & Research Team Members

Funding



Steering Committee



Other Research Team Members



Dr. M Richardson & Dr. S. Sivathayalan



Mr. J. Chamberland

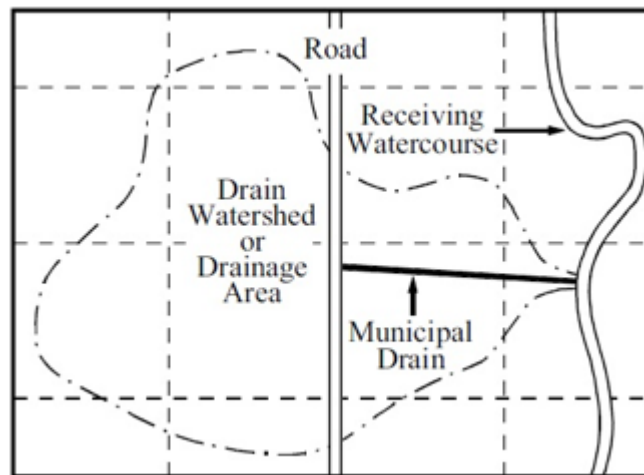


Project Context – Rural Ontario Communities



Study Focus – Core Infrastructure

- Transportation Assets
 - Roads, bridges & culverts
- Water Assets
 - Potable, wastewater & stormwater systems



Source: OMAFRA

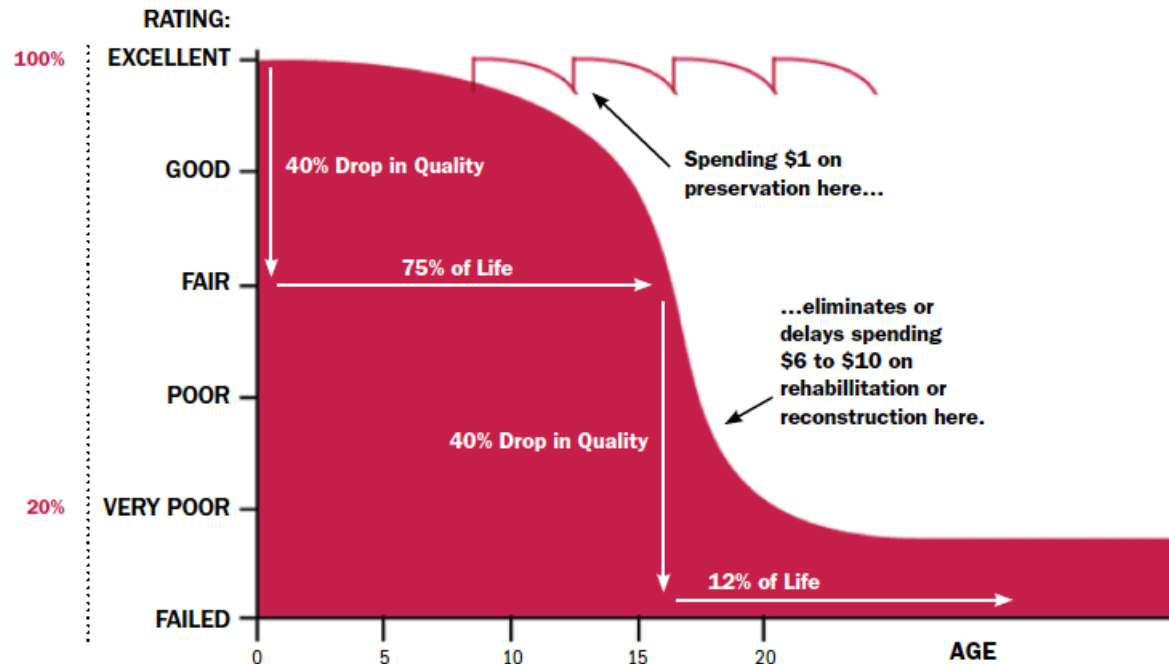
Relationship with Asset Management

- Assess Fitness

- Condition & performance evaluation

- Achieve Goals

- Meet defined levels of service
 - e.g. Average surface condition index
 - e.g. Connection-days for water main



Source: Informing the Future: The Canadian Infrastructure Report Card, 2016.

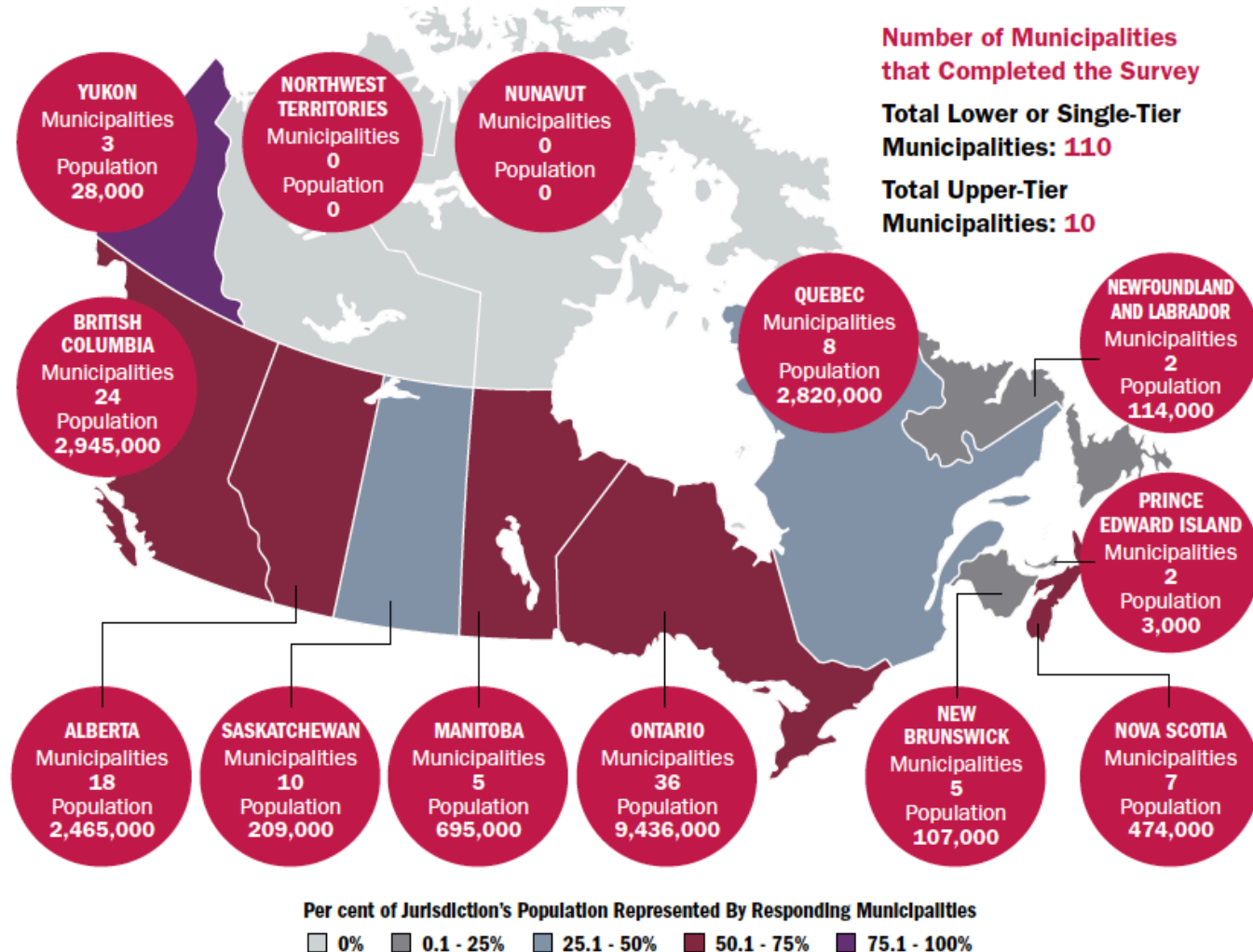
National Perspective – Asset Management Plans

91%

with in-place asset management plans

56%

Canadian population base



Source: Attribution of Extreme Weather Events in the Context of Climate Change, The National Academies Press, doi: 10.17226/21852

Extreme Weather: What's climate change got to do with it?

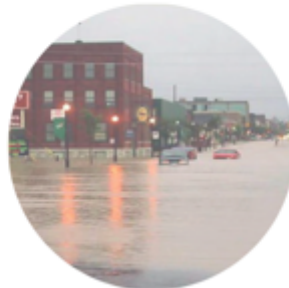
“As the climate has warmed over the years, a new pattern of more frequent and more intense weather events is unfolding in the U.S. and across the globe. Because of a rapidly advancing new area of science called ‘event attribution,’ we can now estimate how climate change increases the risk to society of some types of extreme events.”

Marcia McNutt, President, National Academy of Sciences

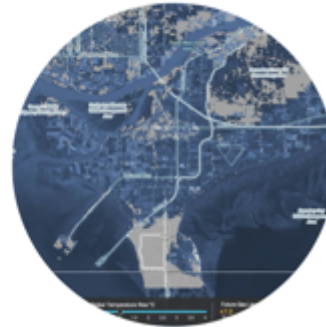
Increasing Confidence



**Severe
Drought**



**Extreme
Precipitation**

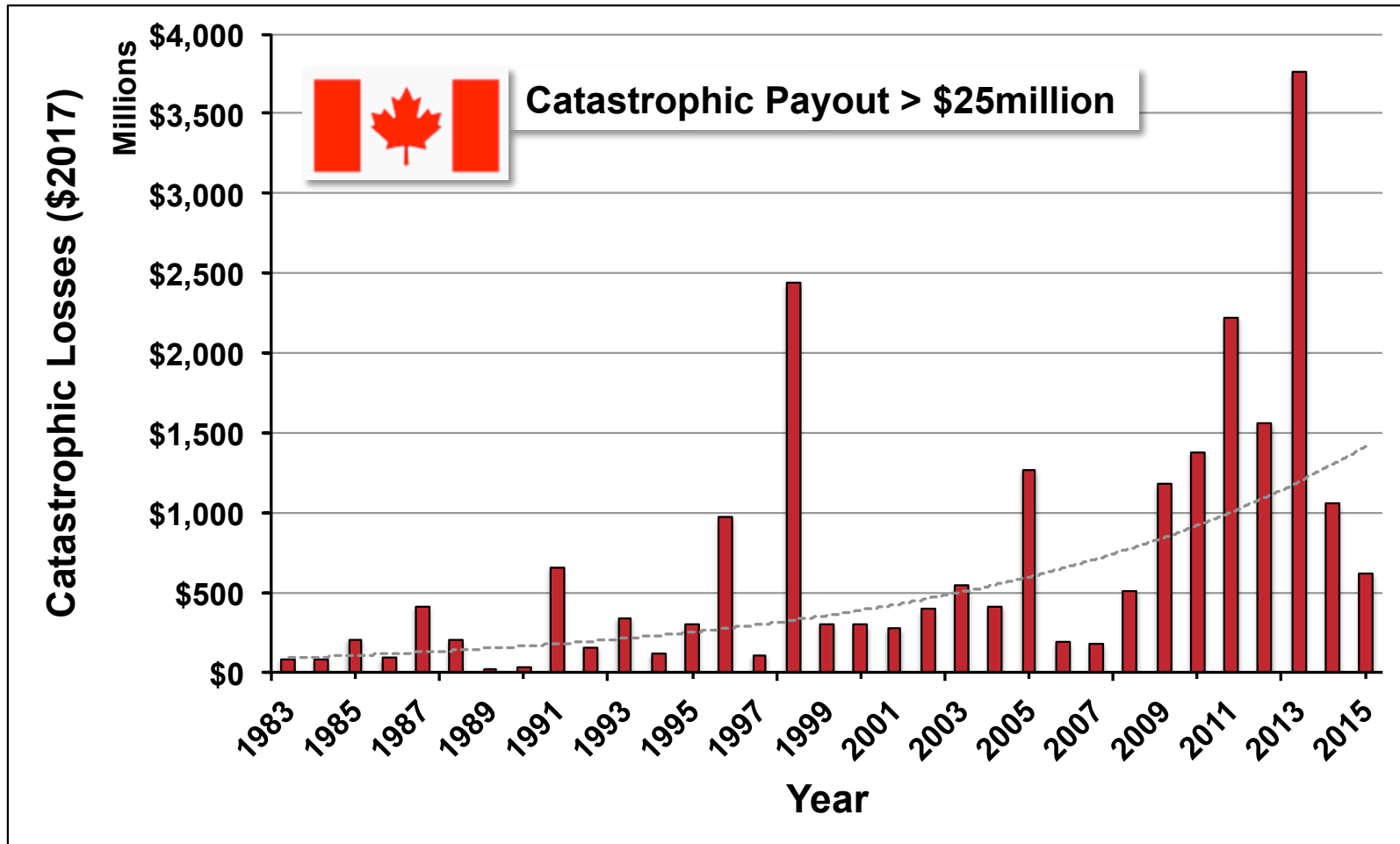


**Coastal
Flooding**



**Heat
Waves**

Extreme Weather Events – Insurance Trends



Source: Facts of the Property and Casualty Insurance Industry in Canada 2016.
Insurance Bureau of Canada, 38th Edition, ISSN 1197 3404, 66p.

Local Experience – Weather Events

2004 Peterborough, ON



Source: Melanie Kawalec, City of Peterborough

2017 Gatineau, QC



Source: www.cbc.ca

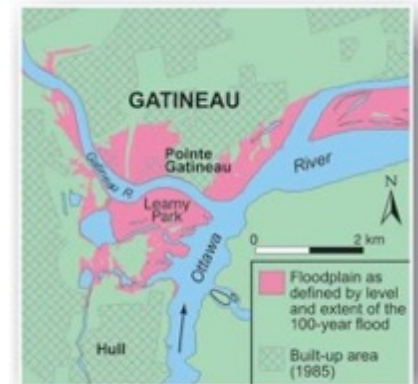
Posted: May 04, 2017 6:21 PM ET

Last Updated: May 29, 2017

2018 Ottawa,
ON



Source: Hydro Ottawa
Posted: @hydroottawa 16

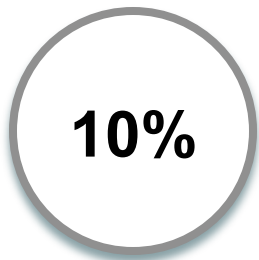


Integration of Climate Change Considerations

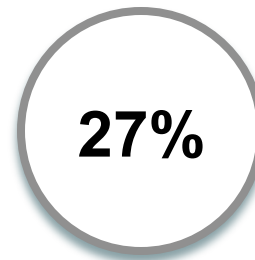
Asset Management System



Source: How to Develop an Asset Management Policy, Strategy and Governance Framework, FCM, 2018



Small municipalities
($< 50,000$ population)



Medium to large
($> 400,000$) municipalities

Source: Informing the Future: The Canadian Infrastructure Report Card, 2016.

Developing Regulatory Landscape

- Incremental
 - Builds on 2012 Asset Management Guide
- Engagement
 - Consultation, review & refinement
- Targeted
 - Strategic asset management policy
 - Asset management plans
- Phased approach
 - Requirements & milestones

Ontario Regulation 588/17

Asset Management Planning for
Municipal Infrastructure



Note: Personal views of PI Shawn Kenny

Integrated & Interdependent Elements



Project Overview



Objectives Addressed in Two Project Phases

- From the perspective of climate change effects on asset management & infrastructure
 - ① establish the current state of readiness for municipalities, and
 - ② develop a framework for use, adaptation and integration by municipalities within sustainable asset management practices.



Phase 1 – Readiness Landscape Methodology

OMAFRA Priority Area #1:

What is the current state of readiness of Ontario's rural municipalities in how they assess, measure and plan for climate change impacts in their municipal infrastructure?



Literature Review



Municipal Questionnaires



Community Perception Survey

Community Perception Survey



Overview

- Psychological approach to understanding individual perceptions, predictors, and outcomes of climate change and related environmental issues
 - Used empirical evidence to form research questions related to climate change
 - Online data was collected from residents of rural Ontario communities



<https://www.hofstra.edu/academics/colleges/hclas/psy/phd/index.html>



<http://www.airqualityontario.com/history/station.php?stationid=59006>

Organizational Psychology & Climate Change

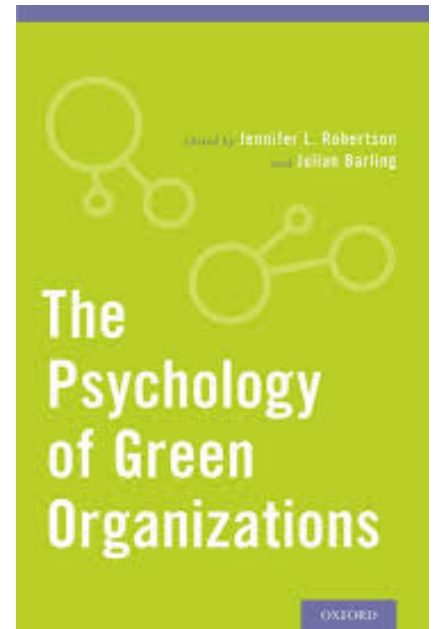
- Awareness and importance has escalated dramatically over the past decade
 - Responding to climate change is now a widespread issue for organizations and employees
 - Now capturing the attention of the broad research community
- Need empirical evidence to support organizational decisions, policies, and practices



<https://cire.mathematica-mpr.com>

What We Know

- Evidence for positive outcomes when workplaces and organizations implement “green” policies and procedures
 - Environmental (e.g., reduced carbon footprint)
 - Organizational (e.g., attract/retain talent)
 - Employee & Customer (e.g., pride in organization)
 - Societal (e.g., improved living conditions)



<http://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780199997480.001.0001/acprof-9780199997480>

What We Know

- Certain factors influence the success of environmental/ climate-related organizational policies, and individuals' perceptions of climate change
 - Leadership (e.g., Robertson & Barling, 2013)
 - Personal climate change beliefs (e.g., Chou, 2014)
 - Organization/community characteristics – resilience, attachment, support for local industries (e.g., Adger et al., 2013)
 - Personal characteristics – gender, age, education, income (e.g., Crate, 2011)

These factors may influence communities ability to adapt to climate change.



<https://www.psychologytoday.com/us/blog/why-the-wild-things-are/201512/is-your-child-climate-change>

What We Don't Know

General understanding

- Most do not fully understand the definition of climate change, or its effects (e.g., Apata et al., 2009; Buys et al., 2012; Davidson et al., 2003)
 - Is there consensus? Do people understand the relationship between weather-related events and climate change?

Support people are willing to give to green/climate-related initiatives

- Are they willing to make sacrifices?
- Do community and individual characteristics make a difference?



Understanding of Climate Change

Before implementing green policies/procedures/initiatives to mitigate effects of climate change on rural Ontario communities, we must improve our understanding of:

1. Community perceptions of current infrastructure
2. Current understanding of climate change and its effects
3. Openness to changes in procedures and policies surrounding climate change
4. Personal and community characteristics



<https://www.unomaha.edu/college-of-arts-and-sciences/psychology/research/research-participation.php>

Rural Community Perceptions Survey

Study Purpose: Examine the effects of personal and community characteristics of stakeholders (i.e., citizens) on their openness to policy and infrastructure changes that could be made to increase the sustainability of their community in the face of climate change



<http://mechanisms.energychange.info/tools/16>



<http://newsroom.unl.edu/announce/cse/3996/22189>

Rural Community Perceptions Survey

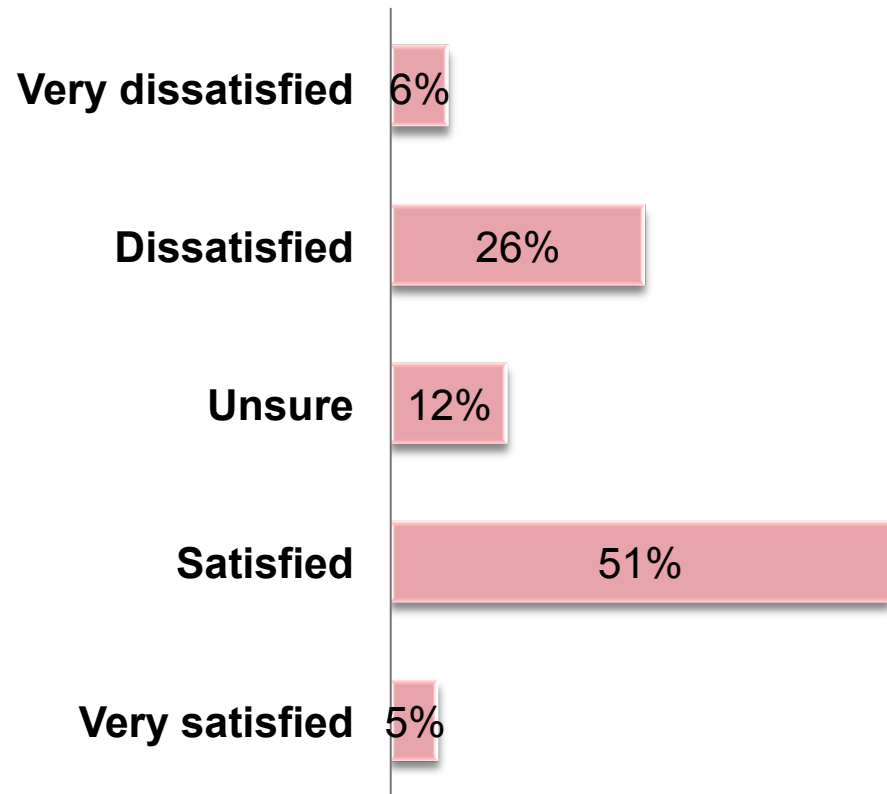
- Survey software company assisted in recruitment – surveys were sent to over 7,600 residents of rural Ontario communities (population less than 100,000 or 100 per km²)
- Online data was collected from 2,500 residents of rural Ontario communities
 - Average age was 65
 - More than half were female (60%)
 - Almost all were Caucasian (90%)
 - More than half were married (63%)
 - and three-quarters had children (74%)



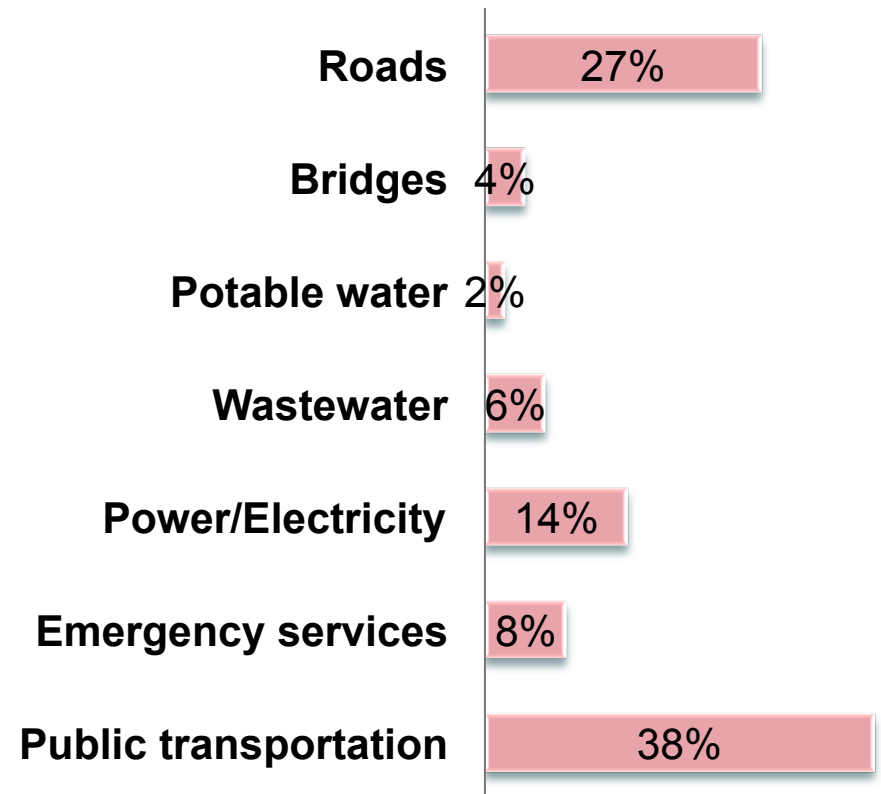
<http://www.jenningswire.com/career/podcast-workplaces-need-industrial-organizational-psychology/>

Results – Community Perceptions of Current Infrastructure

Satisfaction with Current Infrastructure

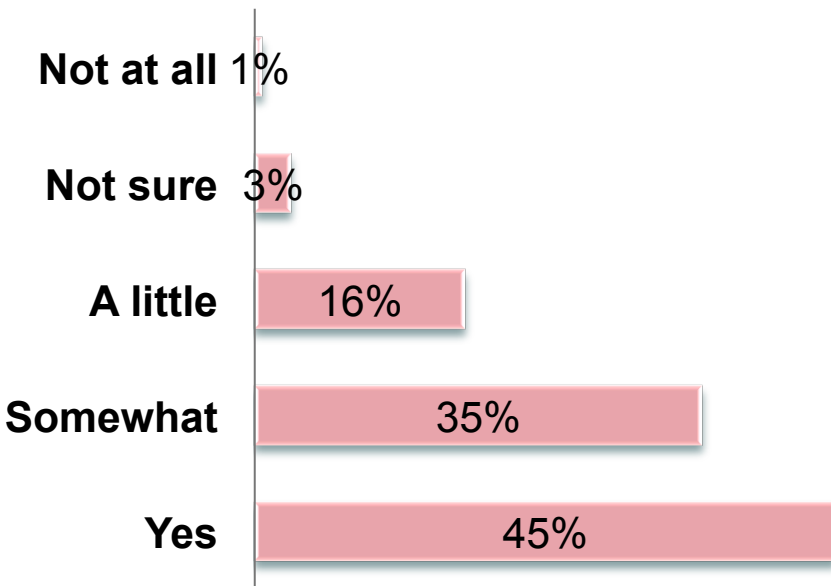


Where to Improve Infrastructure

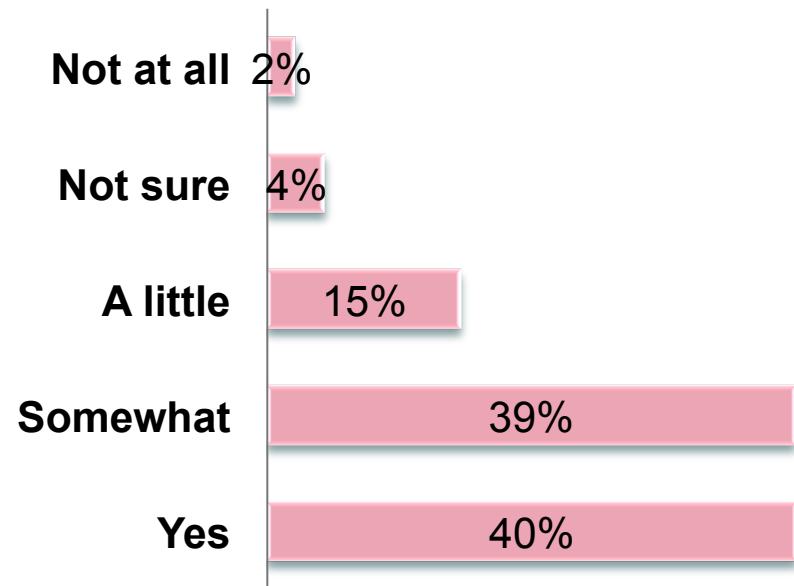


Results – Current Understanding of Climate Change

Understanding of Climate Change before Definition



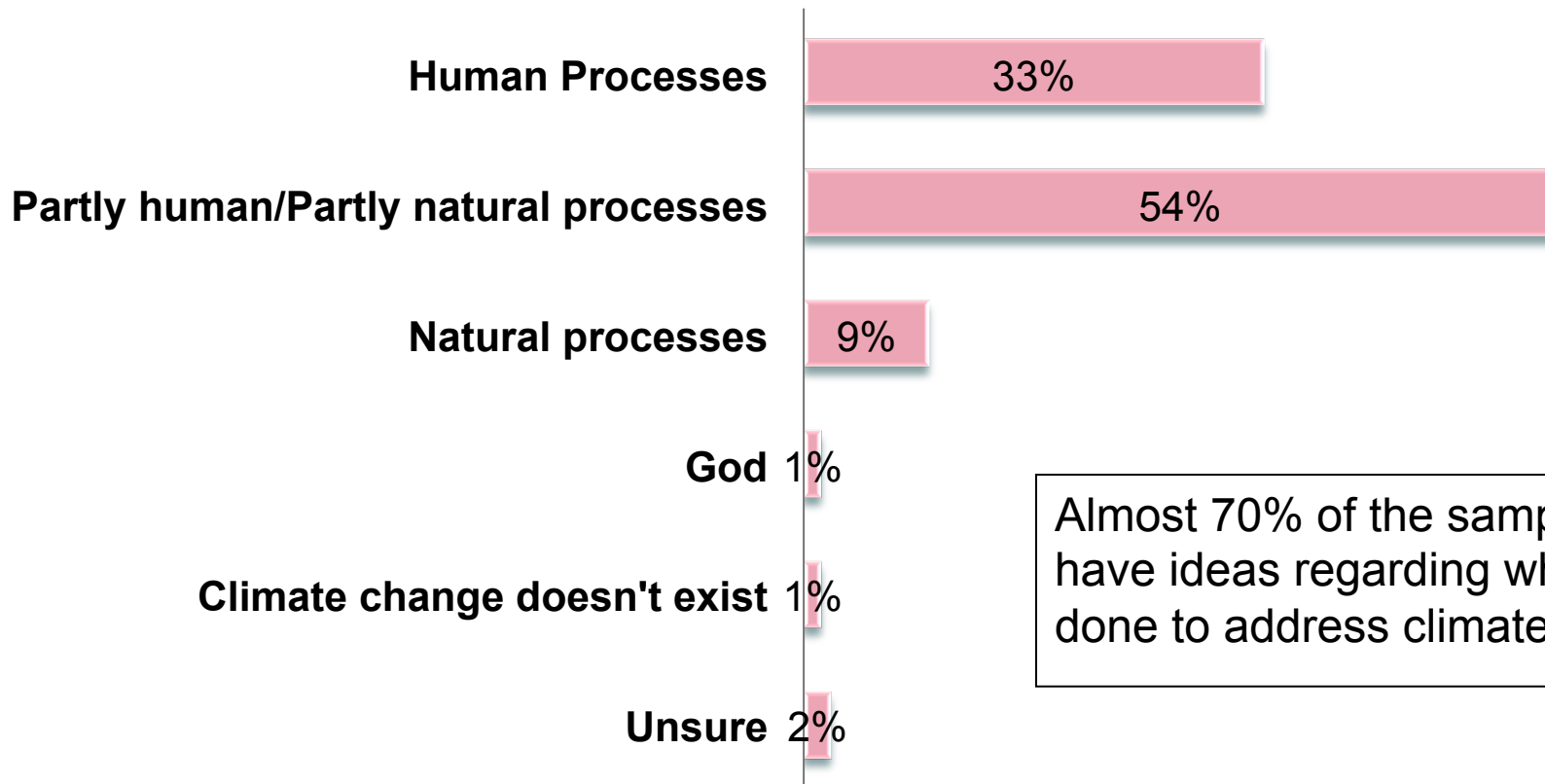
Understanding of Climate Change after Definition



Among respondents, 87% are at least a little concerned about the effects of climate change on their community.

Results – Current Understanding of Climate Change

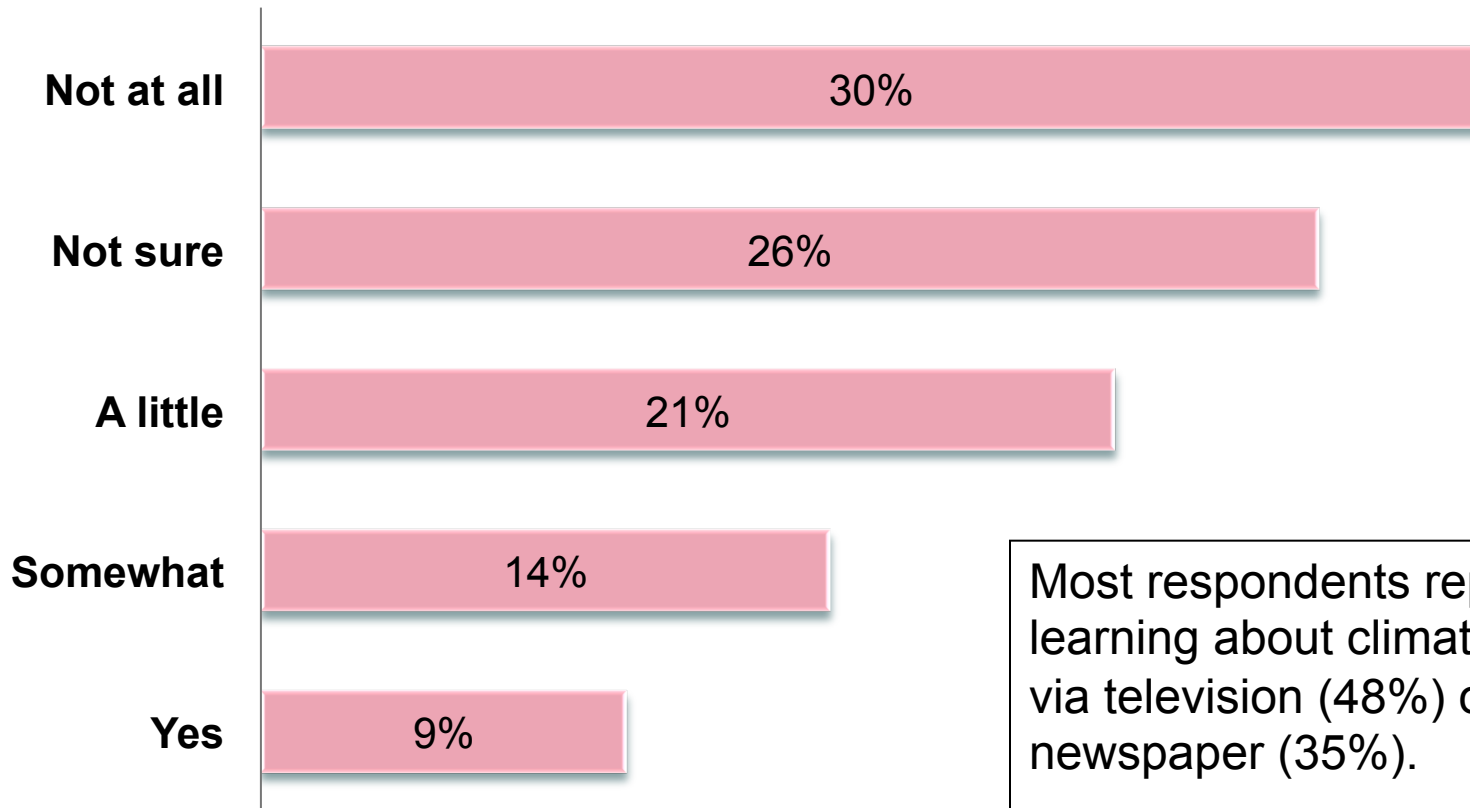
Cause of Climate Change



Almost 70% of the sample do not have ideas regarding what can be done to address climate change.

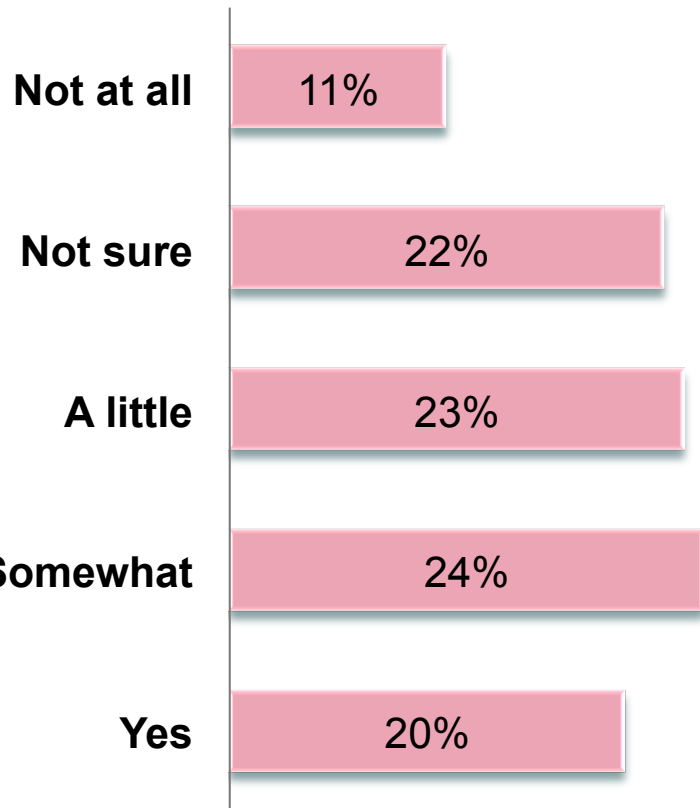
Results – Openness to Climate Change Policies

Community-provided Information on Climate Change

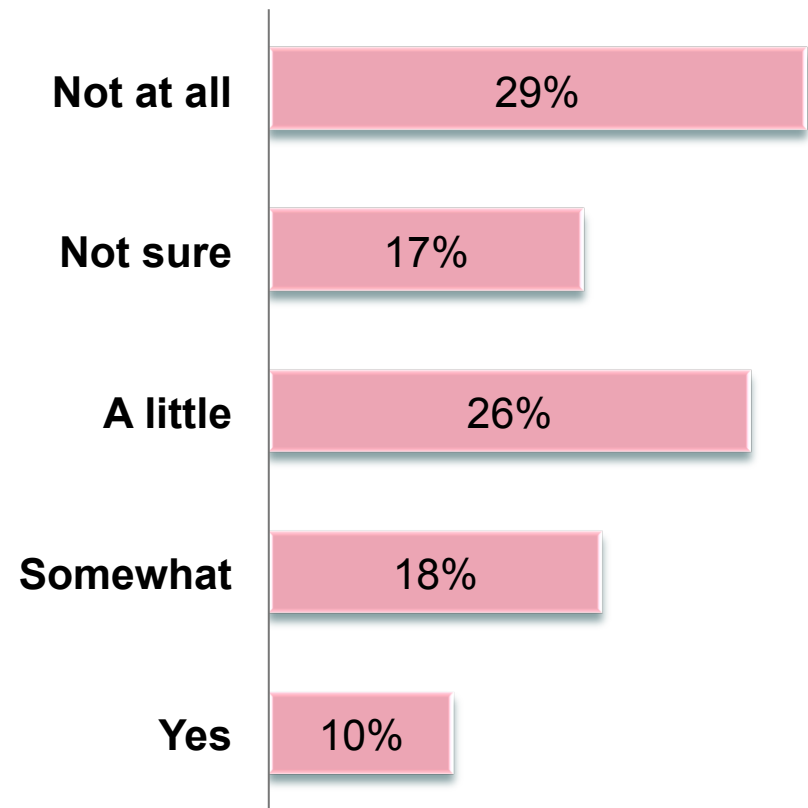


Results – Openness to Climate Change Policies

Adapt to Climate Change

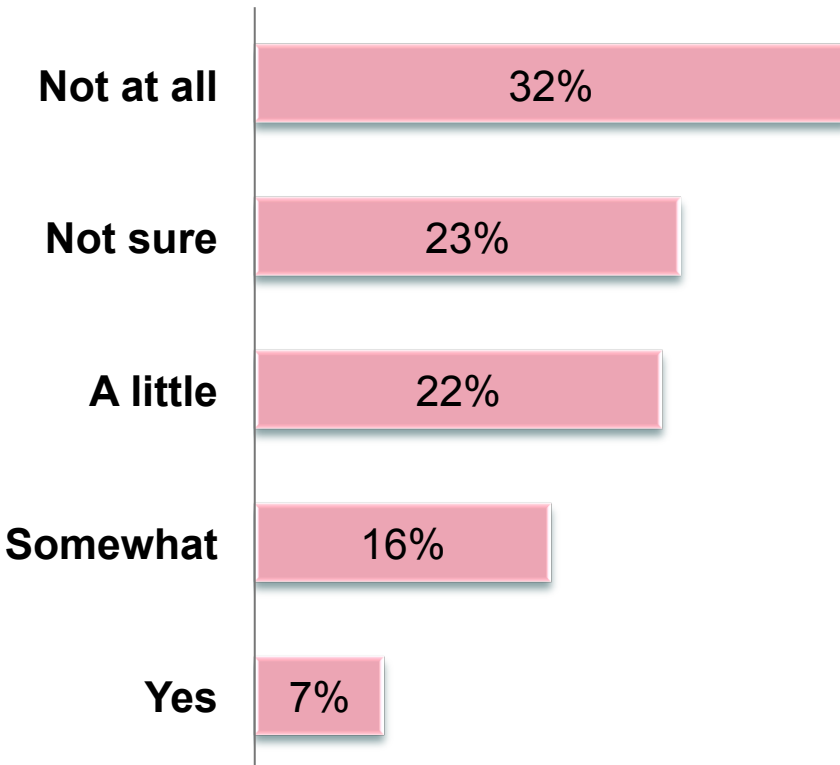


Pay More Taxes

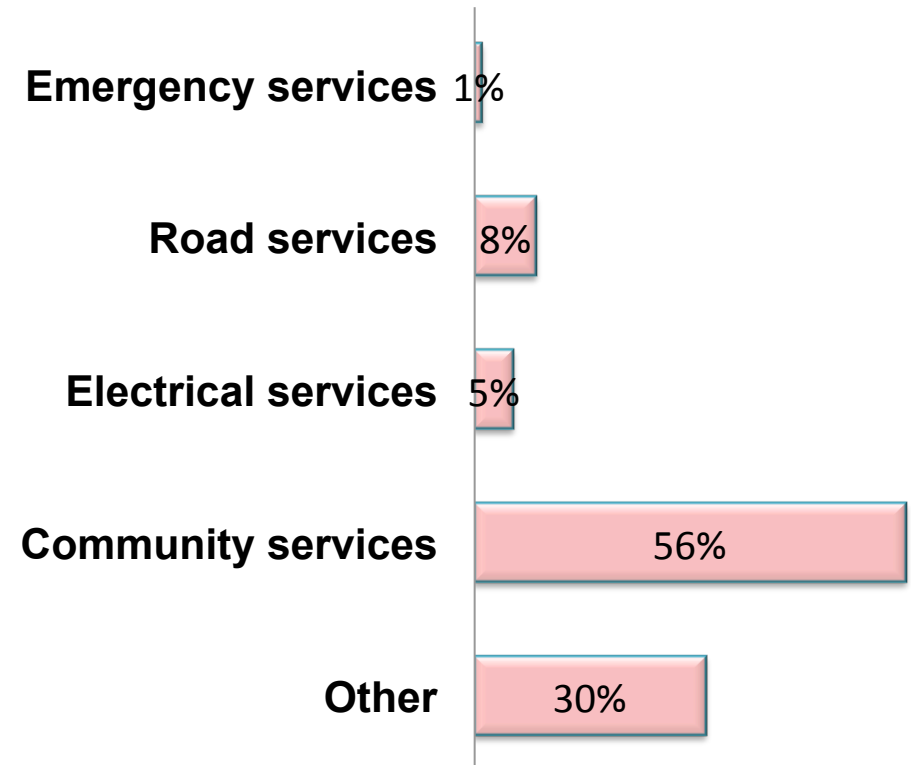


Results – Openness to Climate Change Policies

Reduce Level of Services

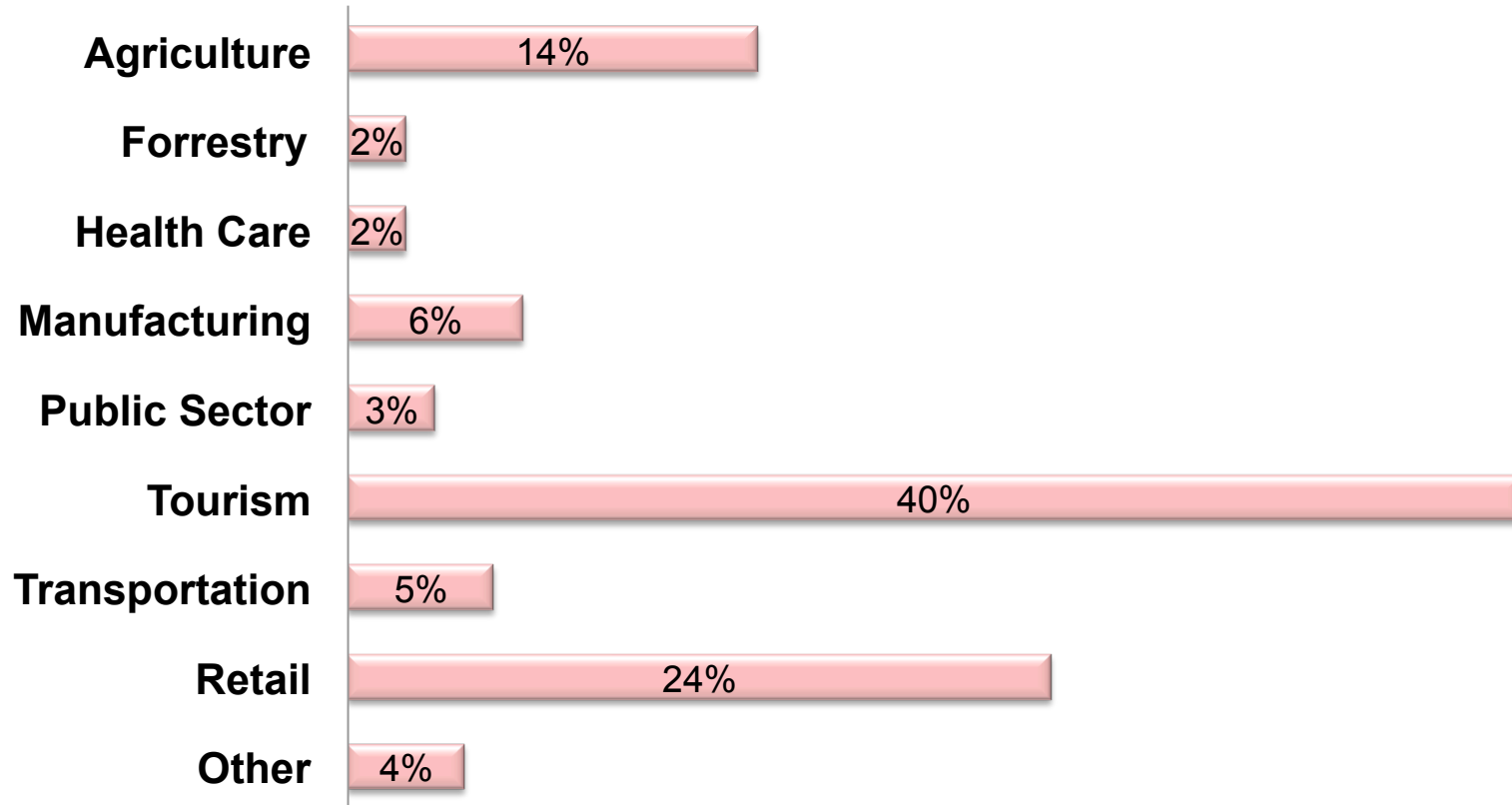


Services to Reduce



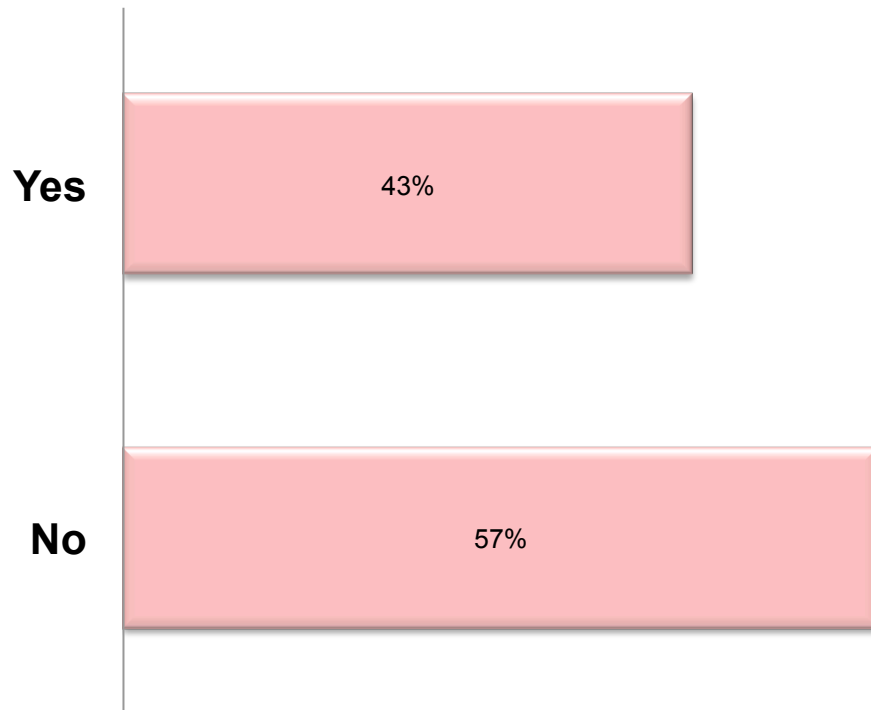
Results – Community Characteristics

Main Industries of Participant Communities

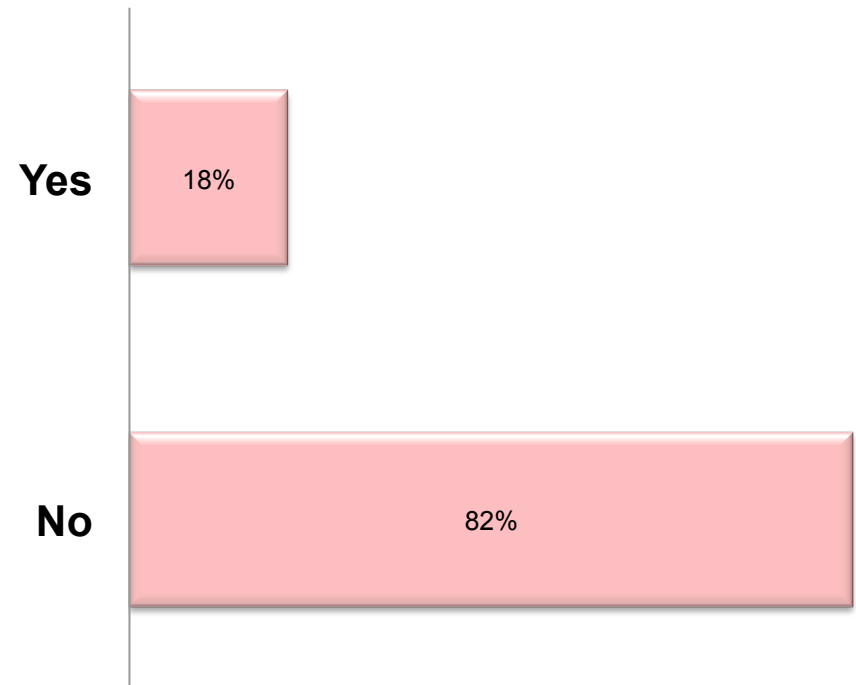


Results Community Characteristics

**If Tourism is Main Industry -
Affected by Climate Change?**



**If Agriculture is Main Industry -
Affected by Climate Change?**



Results – Community Characteristics

- Analyses suggest that individuals who are older and female may be more concerned with the effects of climate change on their community.
- Further, individuals who
 - have an understanding of climate change (i.e., meaning of climate change, effects of climate change),
 - are getting more information from their community,
 - are more attached to their community,
 - and feel that their community is more resilient,

may be more likely to believe something can be done to address climate change in their community, and more willing to pay higher taxes and reduce services to do so.

Results - Summary

Community perceptions of current infrastructure

- Many are not satisfied, but they do perceive that climate change is influencing infrastructure

Current understanding of climate change and its effects

- Many feel they understand climate change and its effects, but do not perceive that climate change affects their primary industries

Openness to changes in procedures and policies surrounding climate change

- Although many do not want to pay more taxes or receive less for services, many are open to adaptation practices

Personal and community characteristics

- Both community and personal factors are related to climate change beliefs



<https://www.unenvironment.org/news-and-stories/story/support-we-receive-get-accreditation-adaptation-fund-helps-strengthen-our>

Implications & Future Research

Inform policy makers (public and private) to better create and implement climate change related policies and practices

Improve understanding of factors (community, personal) that influence climate change perceptions and effectiveness of adaptation practices

Replication and extension of Community Perceptions Survey

- Compare to an urban sample and different types of rural communities
- Extend with additional community and personal characteristics

Effects of “Green Policies” on Employees

- Full-time adults working for green vs. non-green organizations
- Outcomes: job satisfaction, health and well-being, attitudes towards work
- Effects of green policies on attracting new talent

Conclusion

- While rural residents say that they understand climate change, they say that they don't understand the extent of its effects on their communities
- This study supports the notion that certain individual and community characteristics are related to openness to climate change initiatives
- Overall, results suggest that both understanding climate change and community perceptions may increase willingness to support climate change initiatives.



<https://www.colourbox.com/vector/large-group-of-people-vector-11420137>

Municipal Questionnaire



Municipal Questionnaire Framework

- For rural Ontario municipalities, develop insight & understanding
 - In-place asset management plans
 - Integration of climate change considerations
 - Nature and extent of climate change considerations
 - Characterization of infrastructure vulnerability

- Rural Ontario focus
 - $\leq 100,000$ population
 - ≤ 100 people/km²



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Sa Majesté la Reine en chef du Canada, Ressources naturelles Canada.

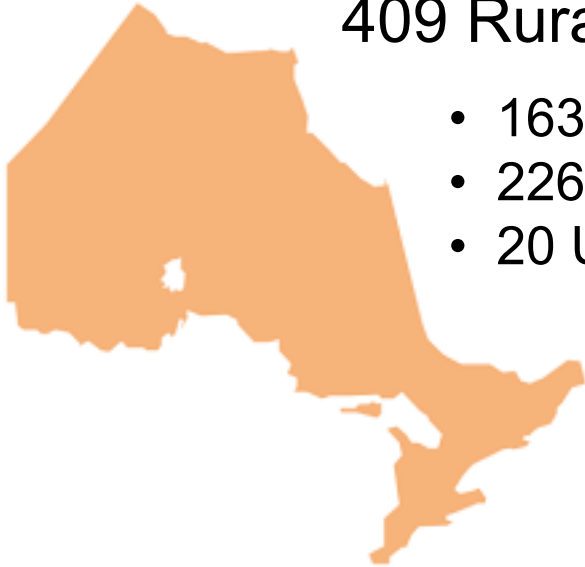
Questionnaire Cross-Section



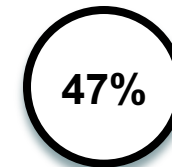
Rural Ontario Municipality Structure

409 Rural Ontario Municipalities

- 163 Single-Tier
- 226 Lower-Tier
- 20 Upper-Tier



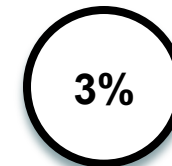
Questionnaire Respondents (N = 160)



Single-Tier



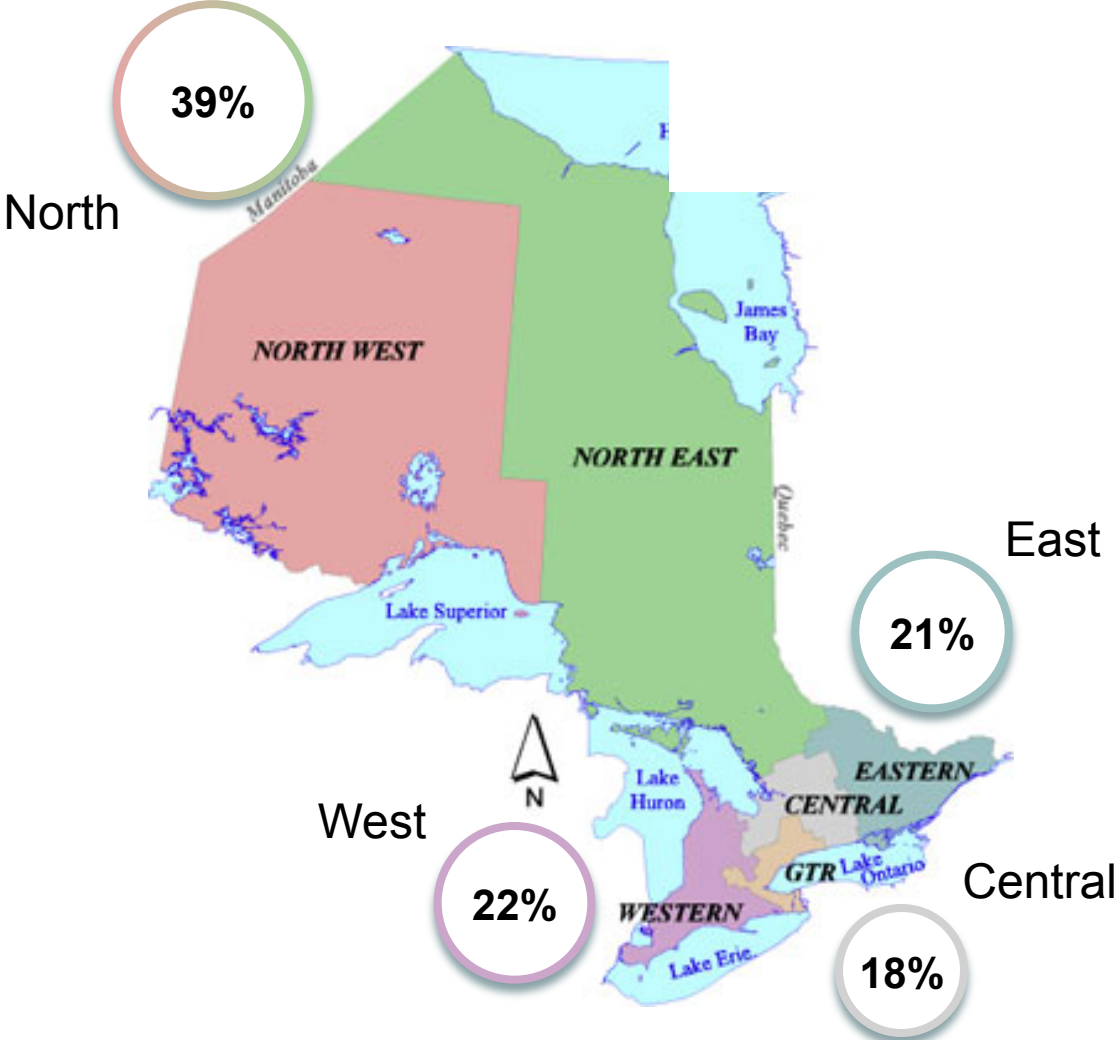
Lower-Tier



Upper-Tier

There was a 30%-40% participation rate across the 3 questionnaires conducted in this study.

General Location of Respondents



Municipal Population Characteristics

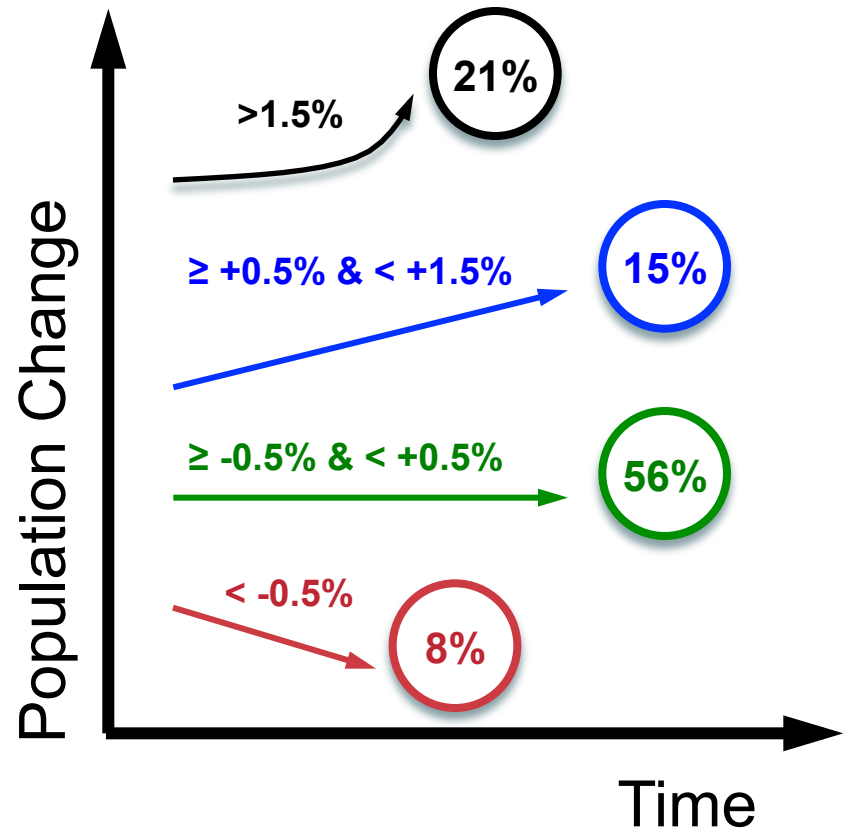
- Population



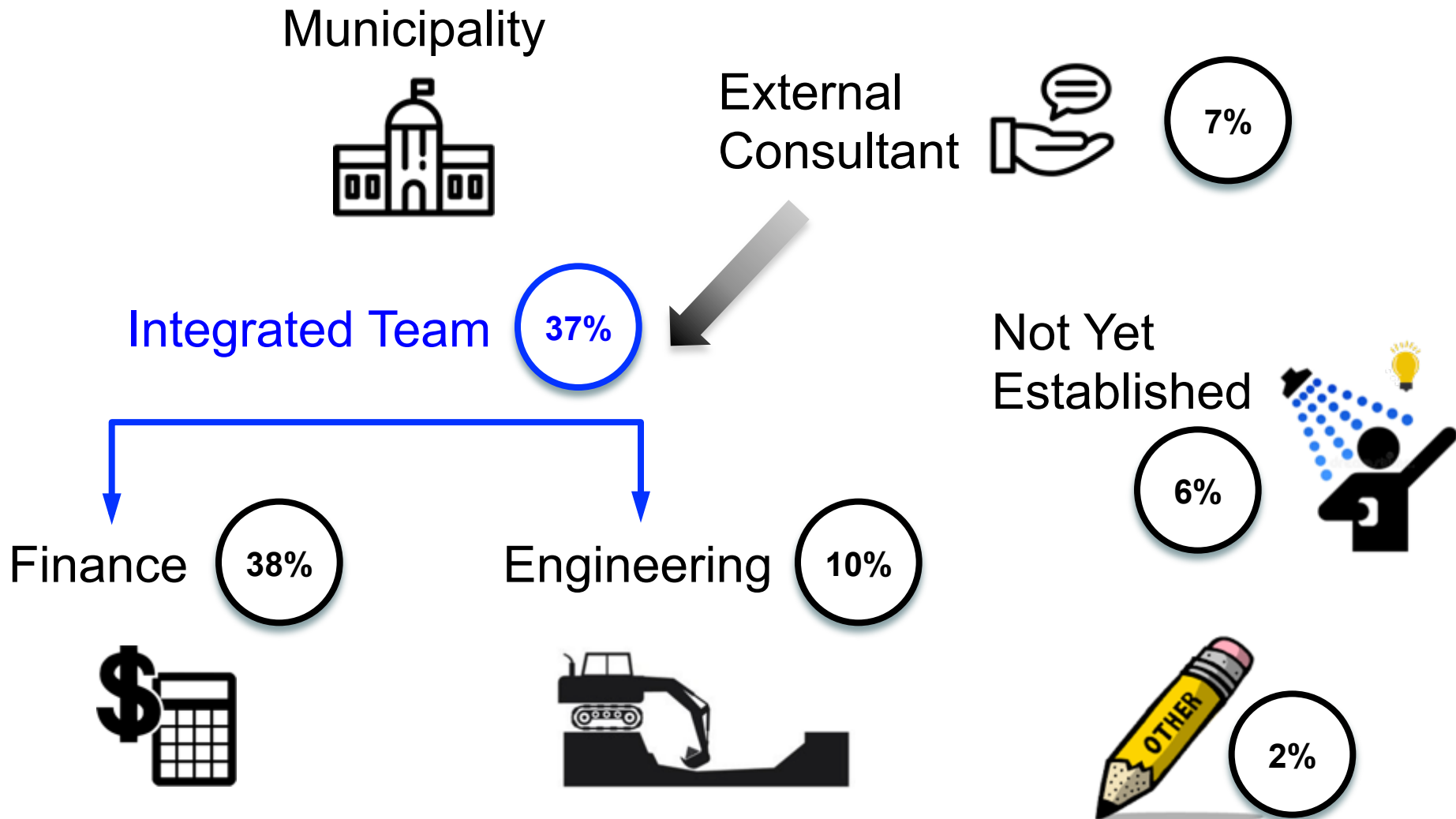
89% $\leq 25,000$

11% $> 25,000$

- Annual Growth Trends



Asset Management Function Primary Delivery



Questionnaire Outcomes Summary

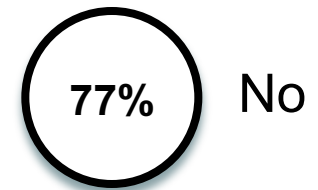
Issues Explored

- ① Integration of climate change considerations
- ② Nature and extent of climate change considerations
- ③ Characterization of infrastructure vulnerability

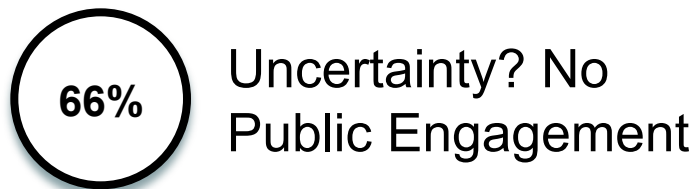
1. Integrating Considerations – Overview



Have the asset management plans integrated climate change considerations?



Are there moderating factors?



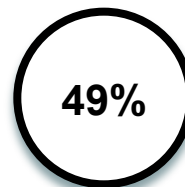
1. Integrating Considerations – Limiting Factors

What is (are) the major factor(s) limiting the integration of climate change considerations in asset management plans?

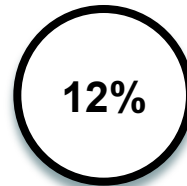
Lack of Awareness



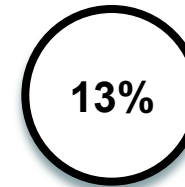
Awareness



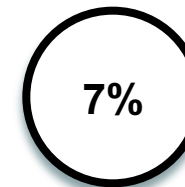
Lack of Resources



Limited Management Support



Insignificant

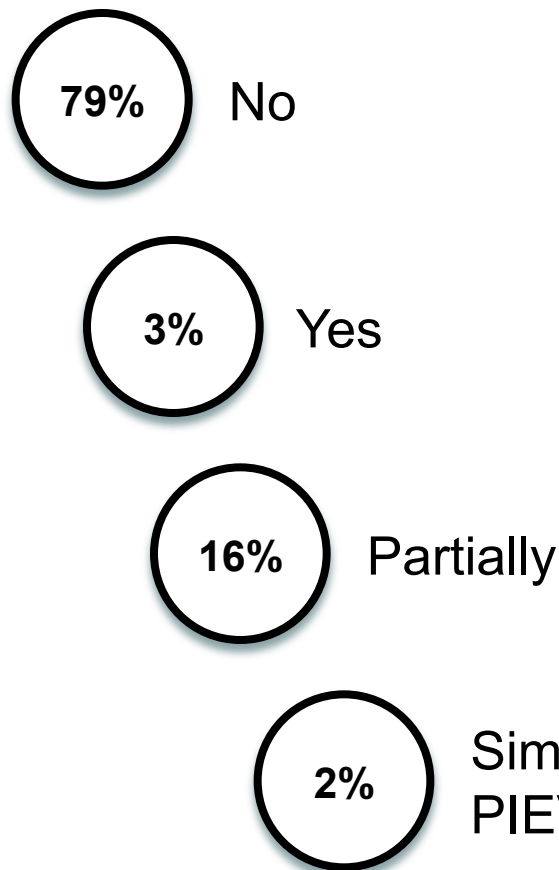


Limited Public Support

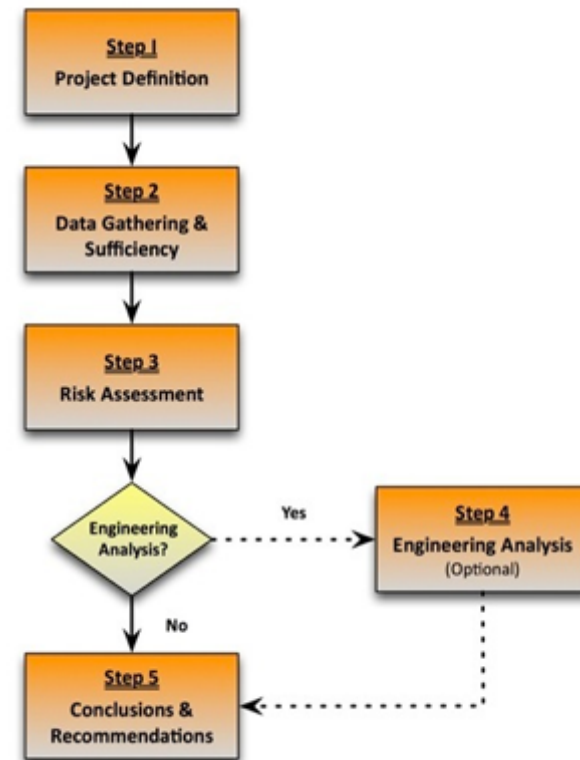
25% multiple response (N = 172) suggests acknowledgement for climate change integration but uncertainty on connecting vision, policy & strategy with systems & plans

2. Nature & Extent of Considerations

Are adaptive management strategies being used to address the inherent uncertainty with climate change effects on infrastructure?



Source: BARC Tool ICLEI
www.icleicanada.org



Source: PIEVC Protocol
pievc.ca/

2. Nature & Extent of Considerations – Overview

Step 1
Planning

Step 2
Improving
Awareness

Step 3
Assess Impacts

Front end fairly
well established

Step 4
Assess Risk &
Vulnerabilities

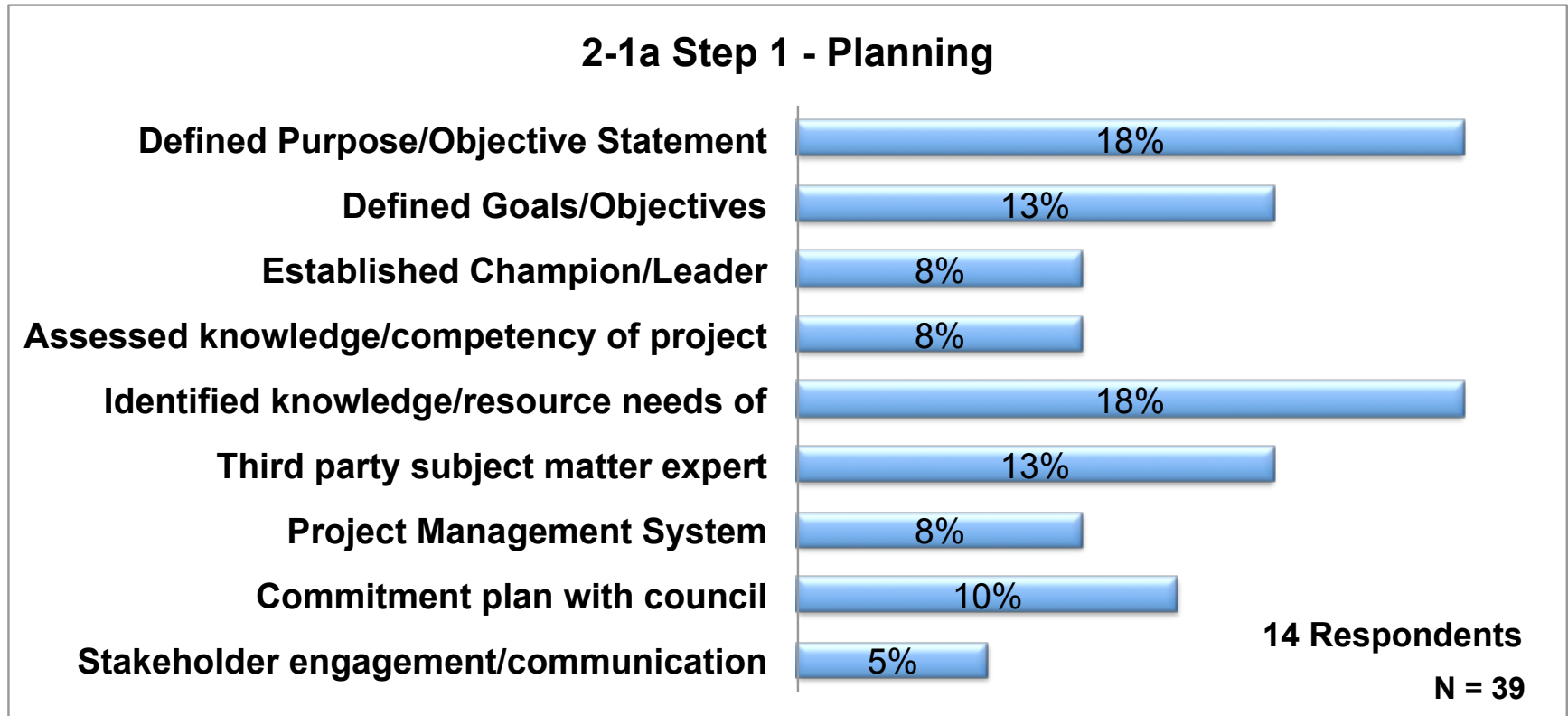
Step 5
Adaptation
Controls

Risk control has room
for improvement

For the small sample size (21%) with affirmative response on adaptive management strategies to address the inherent uncertainty with climate change effects on infrastructure

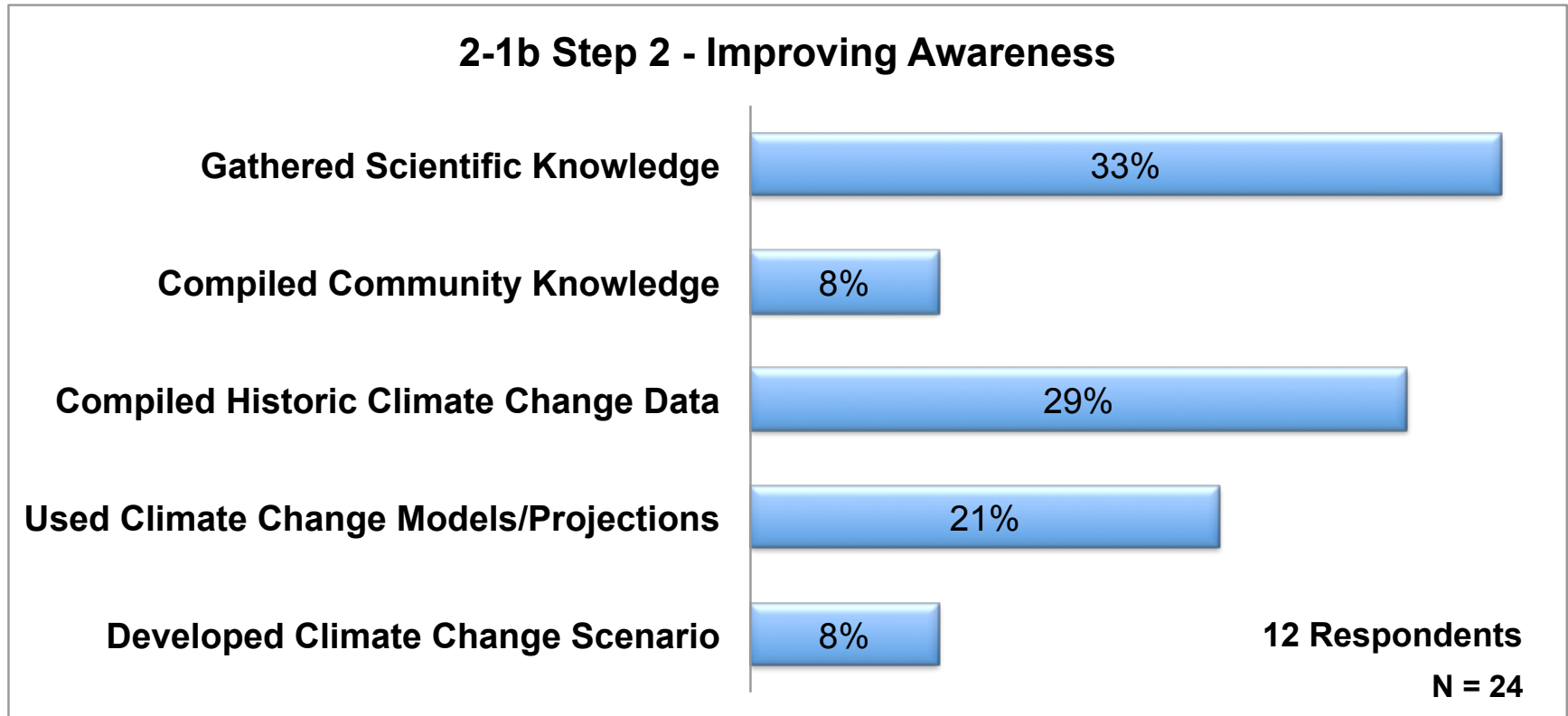
2. Nature & Extent of Considerations

From the perspective of an Adaptive Management Strategy, has the municipality implemented any elements of Step (1) Planning?



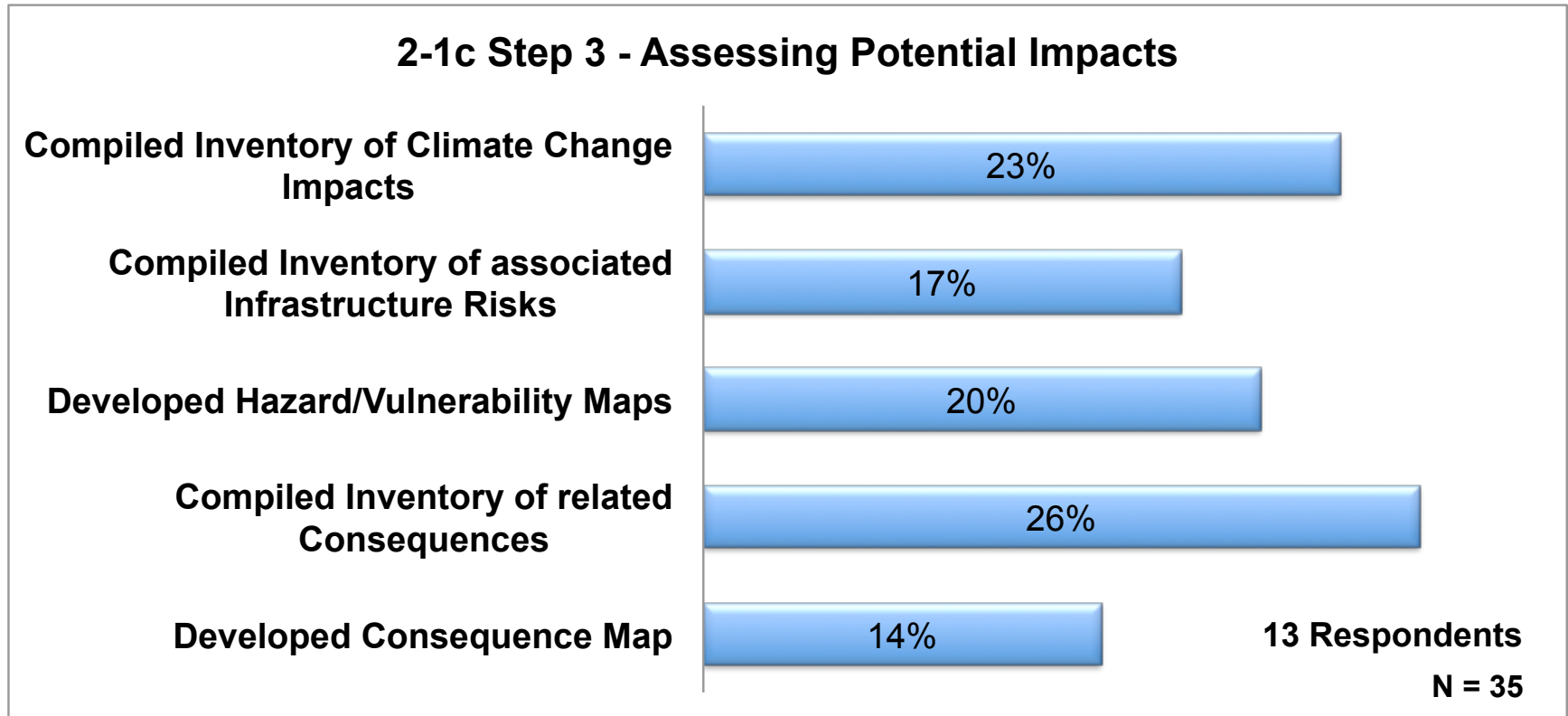
2. Nature & Extent of Considerations

From the perspective of an Adaptive Management Strategy, has the municipality implemented any elements of Step (2) Improving Knowledge?



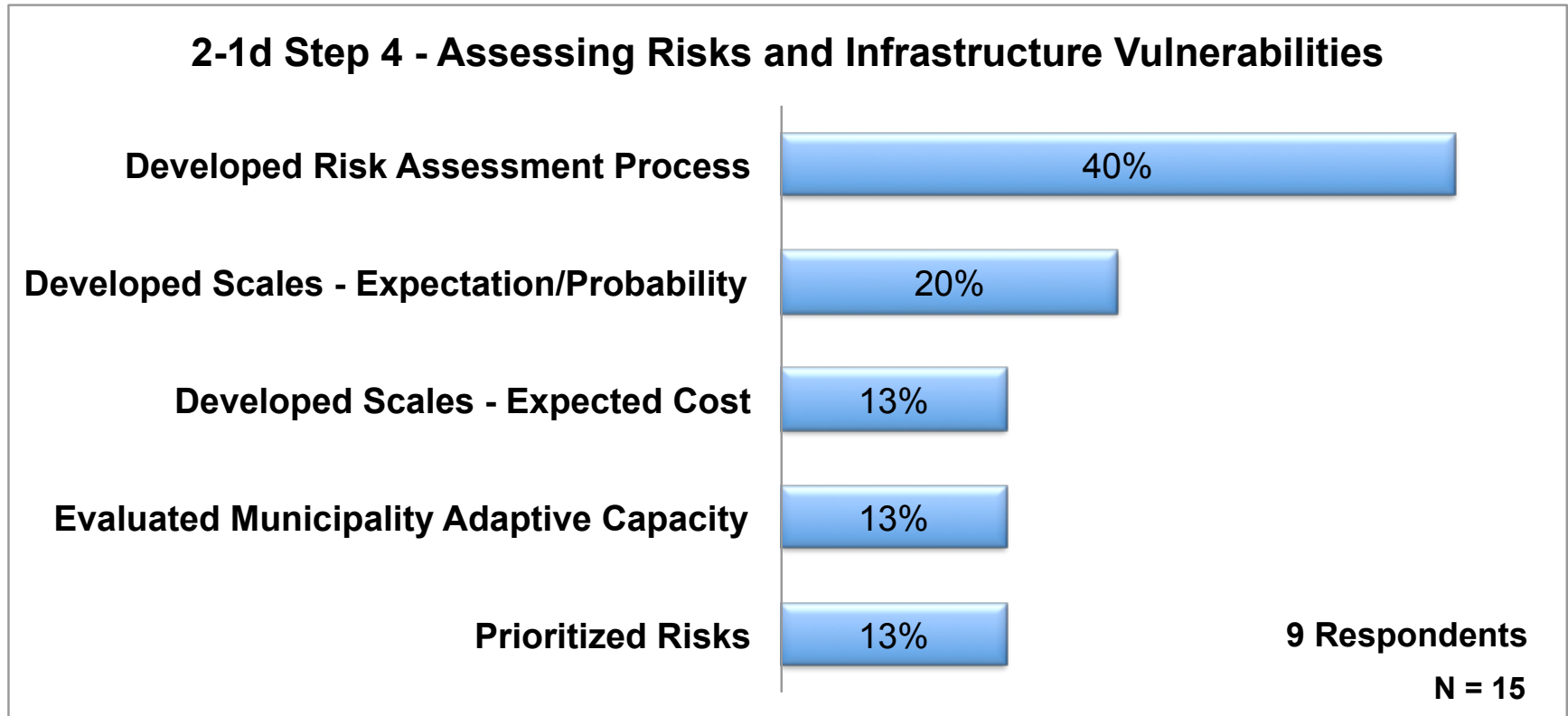
2. Nature & Extent of Considerations

From the perspective of an Adaptive Management Strategy, has the municipality implemented any elements of Step (3) Assessing Potential Impacts?



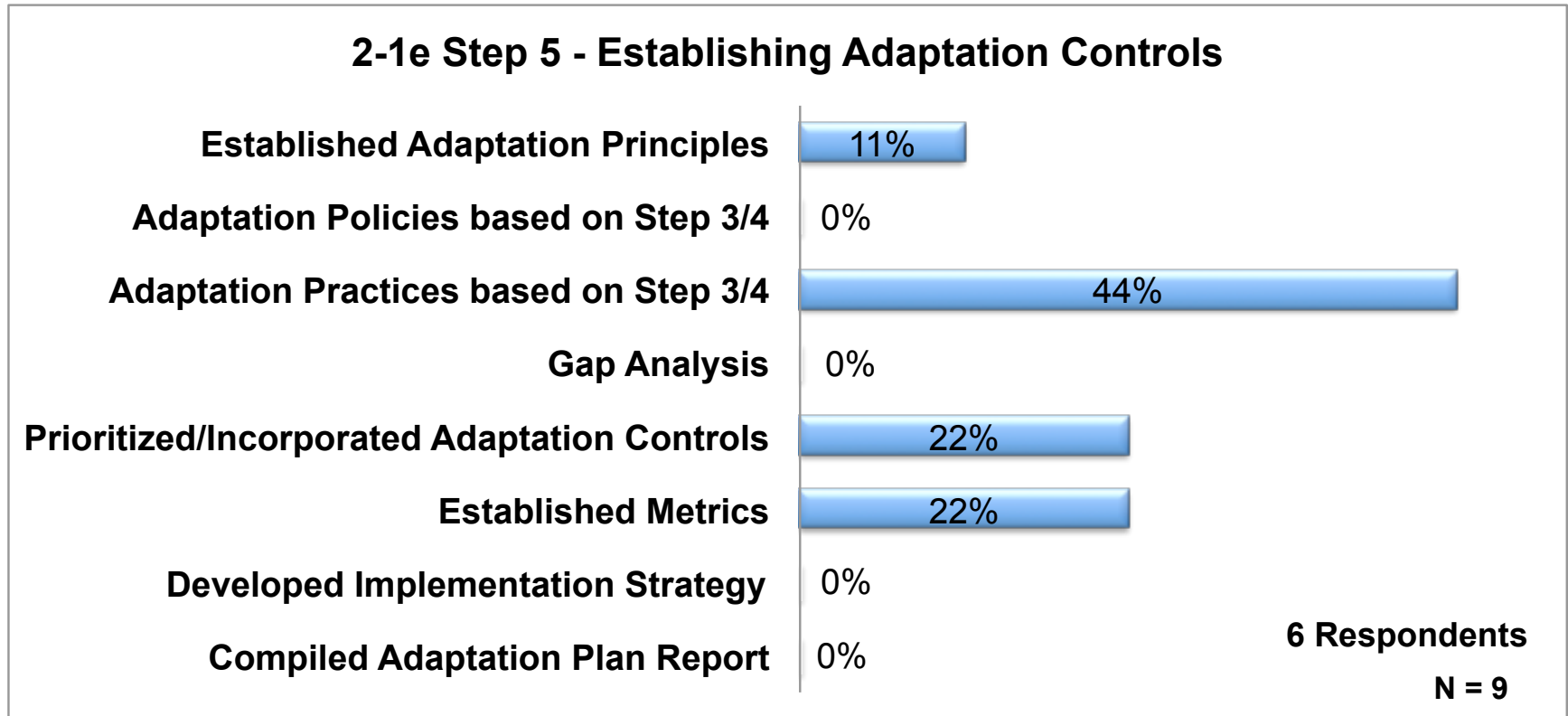
2. Nature & Extent of Considerations

From the perspective of an Adaptive Management Strategy, has the municipality implemented any element of Step (4) Assessing Risks and Infrastructure Vulnerabilities?



2. Nature & Extent of Considerations

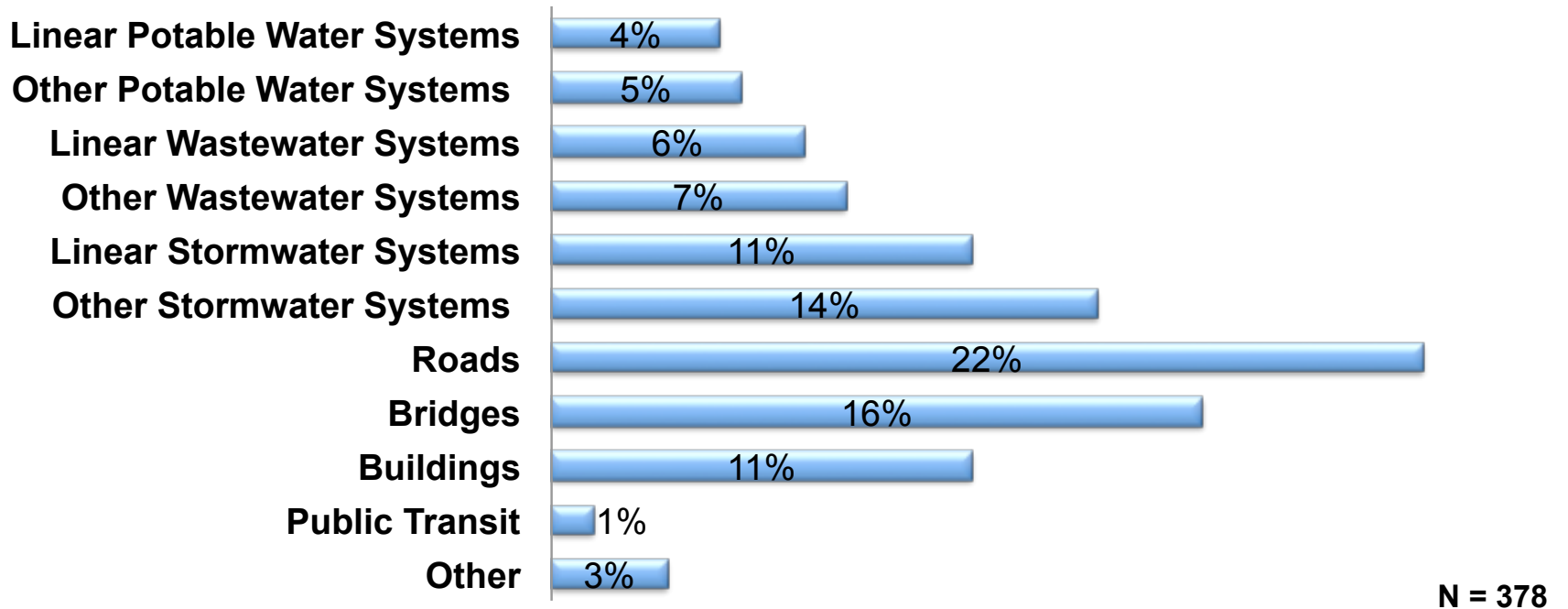
From the perspective of an Adaptive Management Strategy, has the municipality implemented any elements of Step (5) Establishing Adaptation Controls?



3. Infrastructure Vulnerability

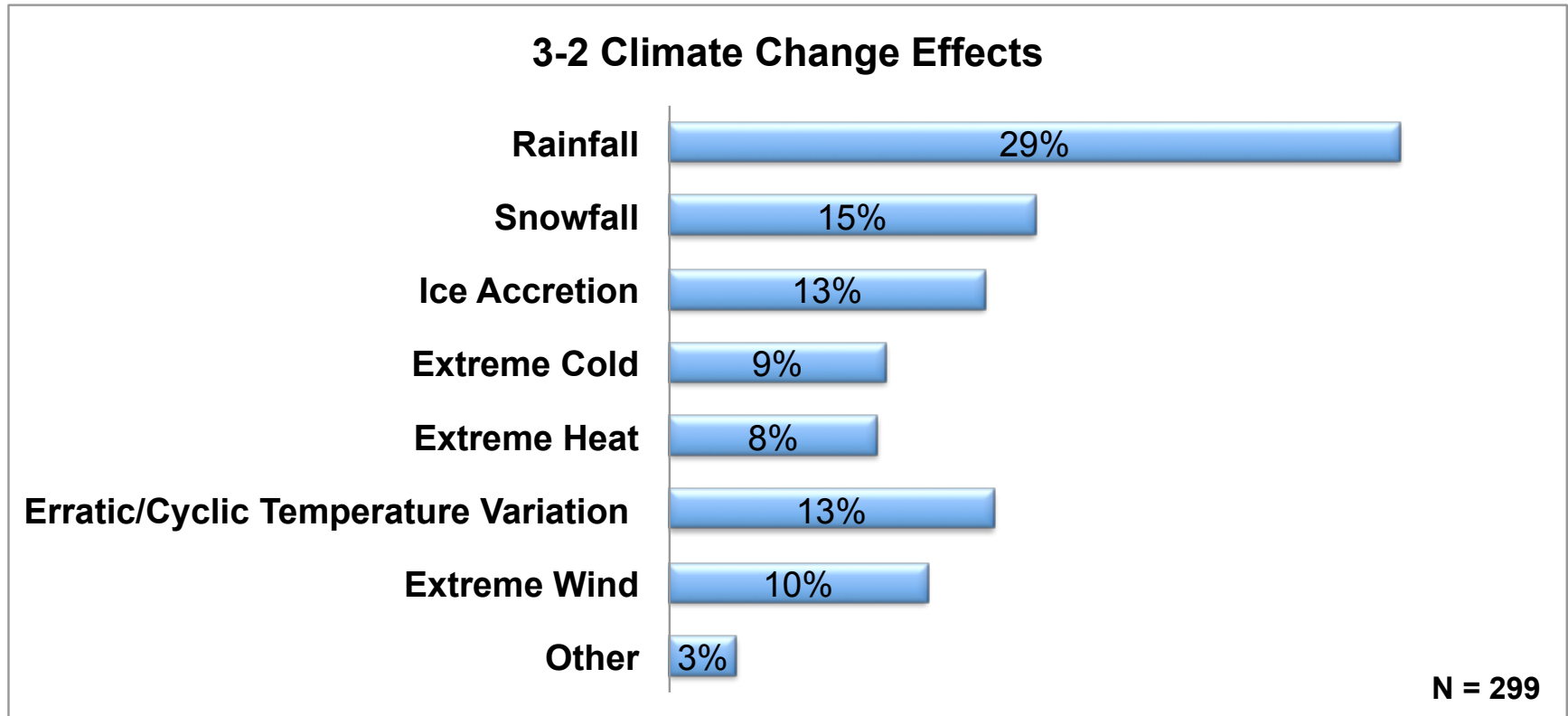
In terms of the municipality infrastructure portfolio, what elements have been impacted or perceived to have been impacted by climate change effects?

3-1 Infrastructure Impacted by Climate Change



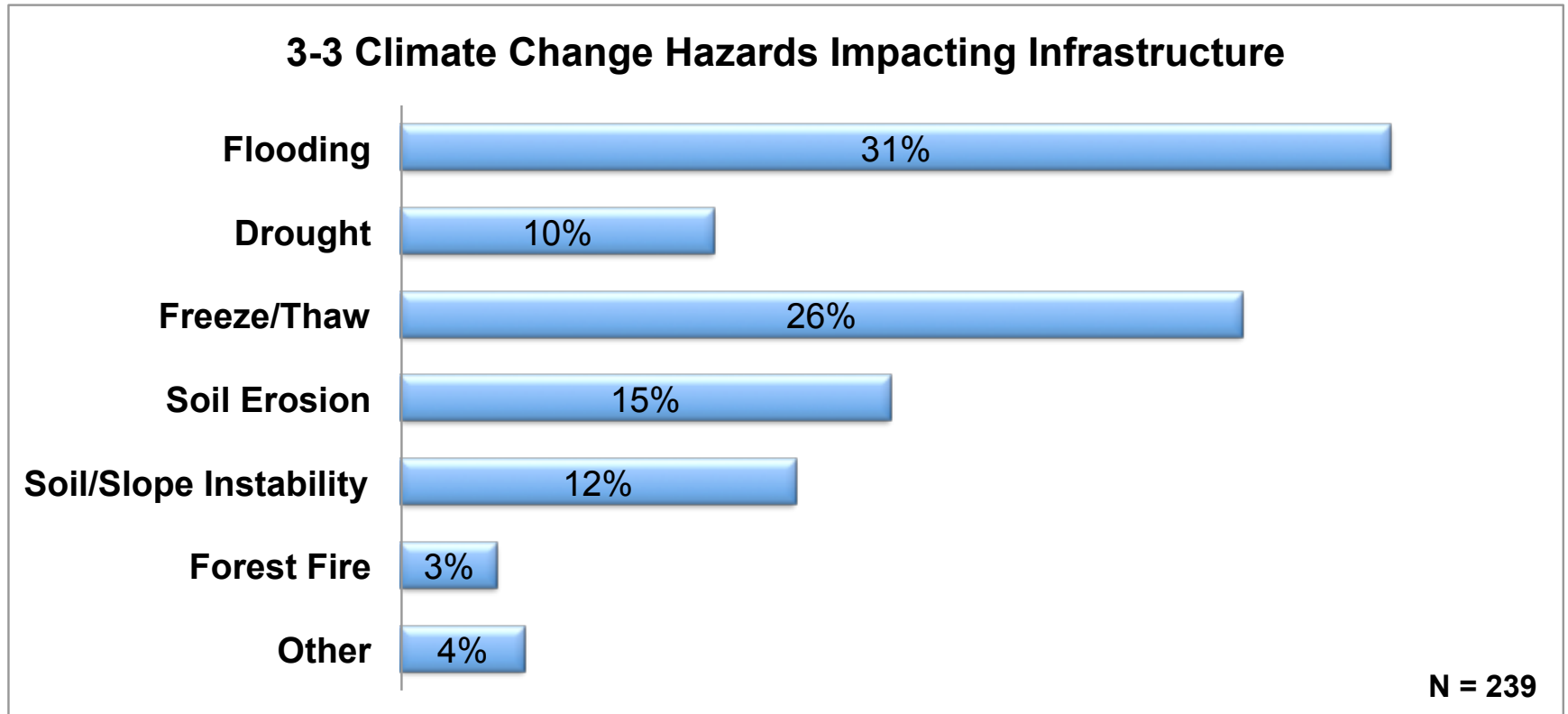
3. Infrastructure Vulnerability

In terms of the municipality infrastructure portfolio, what climate change impacts were experienced?



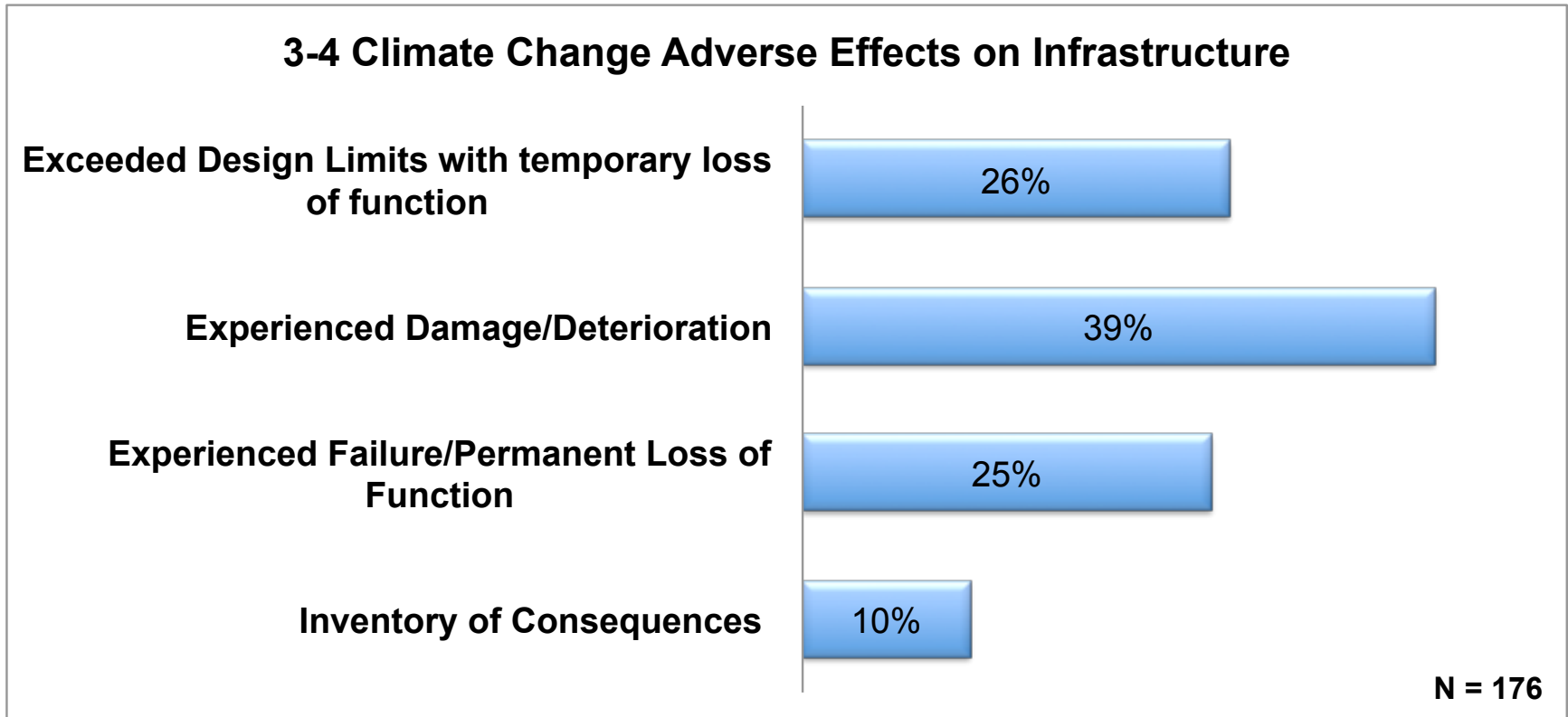
3. Infrastructure Vulnerability

In terms of the municipality infrastructure portfolio, what climate change risks were experienced?



3. Infrastructure Vulnerability

In terms of the municipality infrastructure portfolio, what climate change consequences were experienced?

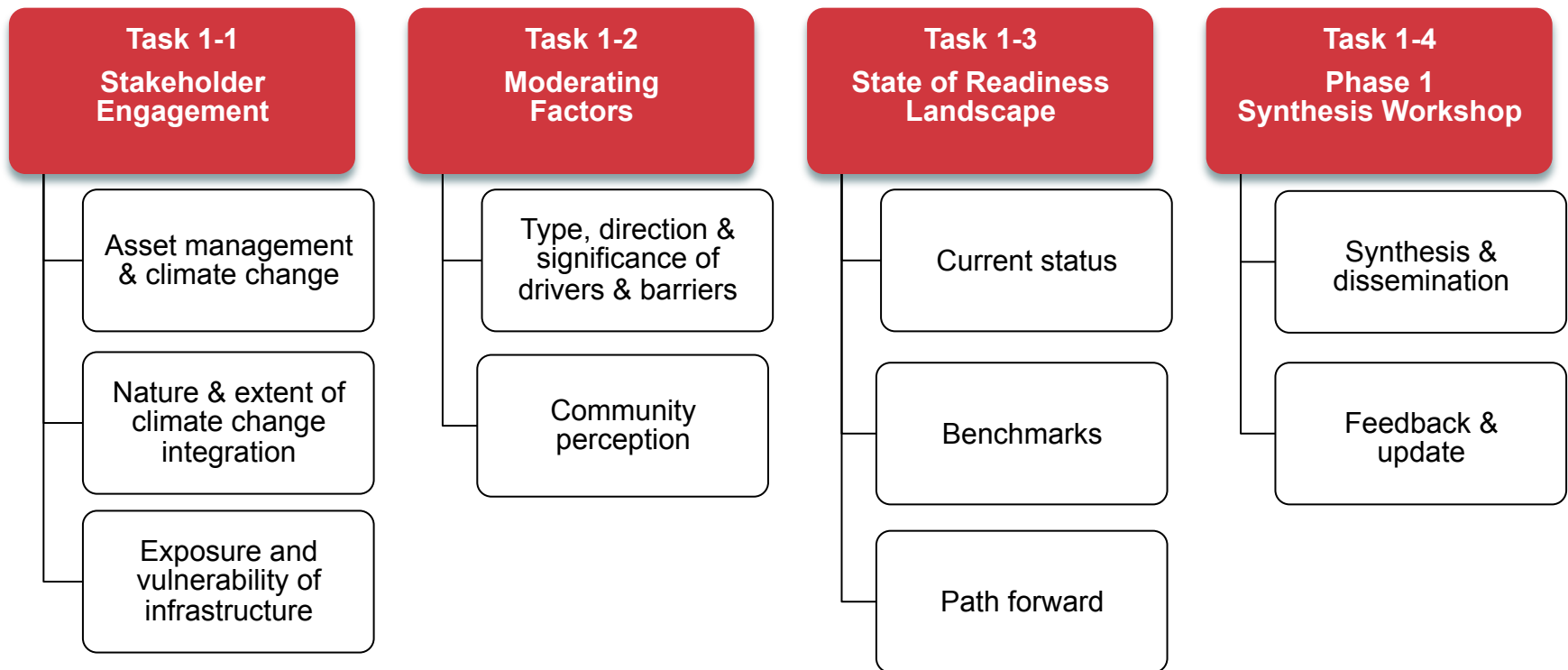


Future Project Direction



Continue to Disseminate Phase 1 Outcomes

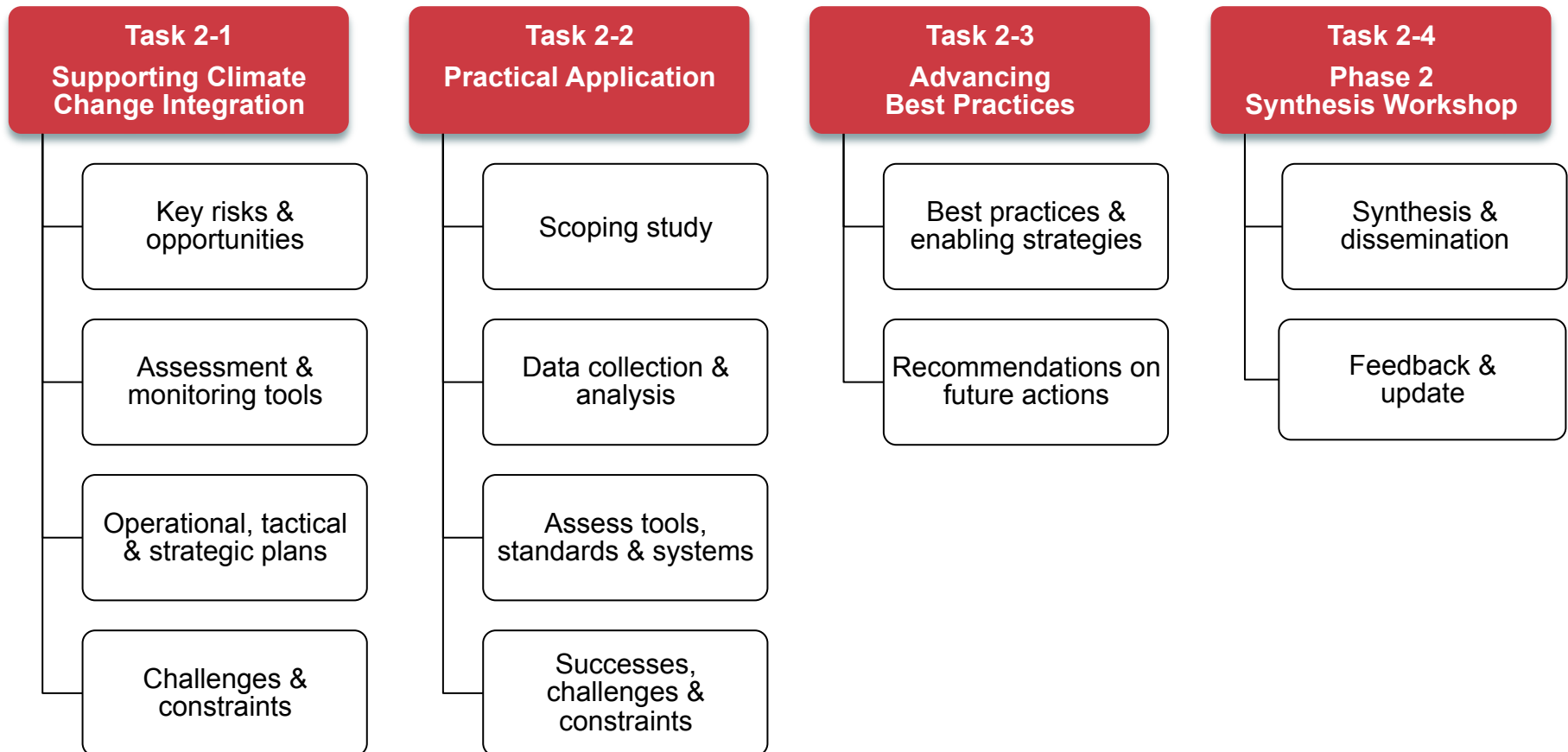
OMAFRA Priority Area #1: What is the current state of readiness of Ontario's rural municipalities in how they assess, measure and plan for climate change impacts in their municipal infrastructure?



Initiate Phase 2 Activities

OMAFRA Priority Area #2:

What types of assessment tools, standards, monitoring systems and other resources should be developed or modified to assist municipalities in managing infrastructure in the context of a changing climate?



Knowledge Translation & Transfer

Website

<https://carleton.ca/geirg/climate-change-effects-and-asset-management-for-rural-infrastructure/>

Conference & Journal Publications

[Shawn Kenny – <https://carleton.ca/geirg/publications/>]

[Kate Dupré – <https://carleton.ca/psychology/people/kate-dupre/>]

- Kenny, S., Dupré, K. and McEvoy, A. (2018). “Climate Change Considerations within the Asset Management of Core Infrastructure for Rural Ontario Municipalities – An Initial Assessment.” Proc., CSCE-GC126:10p.
- McEvoy, A, Dupré, K, & Kenny, S. (2018). Rural Community Perceptions of Climate Change. Paper Accepted at American Psychology Association’s Annual Convention, San Francisco, CA.

Social Media



Future Publications, Webinars & Workshops

Content, scope & dates to be determined

Thank You! Any Questions?



For more information please contact:

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