

Coastal Citizen Science as Climate Infrastructure: Lessons from Atlantic Canada

Policy Brief

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Purpose of this note

This briefing note highlights the contribution of citizen science initiatives in Atlantic Canada to climate adaptation, risk governance, and coastal management. Using the experience of the Eastern Shore Citizen Science Coastal Monitoring Network (ESCOM), it argues that the key challenge facing citizen science is no longer whether communities can generate useful knowledge, but how citizen-generated information can be recognized, validated, and incorporated into climate adaptation and mitigation decision-making. The note also aims to inform the Council of Canadian Academies' State of Citizen Science in Canada assessment by drawing attention to the opportunities and challenges associated with integrating coastal citizen science into governance systems.

About Transforming Climate Action

The Transforming Climate Action (TCA) programme is conducting integrated, interdisciplinary and multi-institutional research to reduce critical uncertainty in the climate system, advance marine carbon dioxide removal science, and support just and equitable climate adaptation.

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Key Observations

- ◆ Atlantic Canada's coastal communities are experiencing increasing climate-related risks, yet many rural and remote areas lack sufficient environmental monitoring infrastructure.
- ◆ Citizen science can complement governmental monitoring by providing continuous, hyperlocal information on coastal change, climate impacts, and environmental conditions.
- ◆ Citizen science can strengthen climate risk knowledge, support emergency preparedness, identify local vulnerabilities, and improve understanding of environmental change at scales often beyond the reach of public monitoring programs.
- ◆ The fundamental policy question is no longer whether citizen science can produce valuable information, but how that information should be incorporated into formal climate adaptation, risk mitigation, and coastal management processes.
- ◆ The Eastern Shore Citizen Science Coastal Monitoring Network (ESCOM) demonstrates that community members can generate, interpret, and apply climate-relevant information to support local resilience and preparedness.
- ◆ Effective integration of citizen science requires recognition, long-term support, data governance frameworks, and mechanisms that connect community-generated information with government decision-making.

Introduction

Climate change is already affecting Atlantic Canada's coastal communities and industries. The Canadian Climate Institute estimates that Atlantic Canada could incur approximately \$330 million annually in coastal damages from climate-related disasters¹ underscoring the urgency of improving climate risk assessment and adaptation planning.

At the same time, significant information gaps remain. Few public studies assess climate risks for specific coastal industries in Atlantic Canada² and many rural and coastal communities lack sufficient climate observing and forecasting infrastructure. Citizen science can help address these gaps by generating place-based information that complements governmental monitoring and academic research.³

The Eastern Shore Citizen Science Coastal Monitoring Network (ESCOM) illustrates this potential. Built on the principle that local residents possess valuable knowledge about the environments in which they live, ESCOM enables community members to participate directly in coastal and climate monitoring while contributing information relevant to adaptation and resilience planning.

This briefing note argues that the Council of Canadian Academies' upcoming assessment of citizen science should not only examine the growth and diversity of citizen science initiatives but also consider how citizen-generated knowledge can inform decision-making, particularly for climate mitigation and adaptation. It also directs the attention on the short and long-term societal impacts of integrating citizen science into provincial, regional, and federal policies, and some of the key considerations and benefits of citizen science for coastal and rural communities in Atlantic Canada.

Background of the citizen science concept and its benefits

Citizen science is the practice of public participation in scientific research with the aim of increasing scientific knowledge with their active contribution on data collection, analysis, and dissemination.⁴ Citizen science should be understood as a strategic complement to governmental monitoring and academic research, not as a low-cost substitute for either, or merely as a data collection process.

Citizen scientists may participate in a wide range of activities, including developing research questions, collecting and analyzing data, interpreting findings, disseminating results, and contributing to science policy discussions. Beyond scientific outcomes, citizen science also supports public engagement, environmental stewardship, scientific literacy, and democratic participation in scientific enquiry.⁵ **Indeed, citizen science is an expression of the right to**

¹ Canadian Climate Institute 2020 [16 April 2004](#)

² Atlantic Economic Council 2025 [Adaptation Report - EN - Final V3.pdf](#)

³ Eiken et al., 2021

⁴ IUCN [Citizen science - resource | IUCN](#)

⁵ Hecker et al., 2019

participate in the cultural life of the community and to share in scientific advancement and its benefits, as recognized in international human rights instruments.⁶

In Atlantic Canada, many coastal and rural communities lack publicly funded climate observing and forecasting infrastructure sufficient to monitor coastal ecosystems, ocean conditions, and climate-sensitive communities at the temporal and geographic scales required for informed decision-making. The practical reality is that government agencies cannot monitor every beach, estuary, marsh, and climate-sensitive community with sufficient temporal and geographic resolution.

Citizen science has emerged as an important approach for addressing these information gaps and support climate adaptation and risk governance. First, citizen science can **expand observing capacity by generating continuous data** on coastal morphology, ecosystems, oceanographic conditions, and local environmental change. Linking top-down environmental observing systems with bottom-up community monitoring can improve the relevance, efficiency, sustainability, and decision-making value of environmental information.⁷ For coastal policy, this can strengthen baseline datasets, support environmental assessments, and improve decisions related to conservation, climate adaptation, and blue economy development.

Second, citizen science can make an important **contribution to climate monitoring**. Climate change is experienced locally through storm impacts, precipitation patterns, wind events, drought conditions, coastal flooding, and other hyperlocal phenomena that may not be adequately represented in regional datasets. Personal weather stations and community-based monitoring networks can expand observational coverage, particularly in rural and remote areas where governmental infrastructure is limited. When supported by appropriate training, maintenance, and data management protocols, citizen-generated climate information can improve preparedness, support emergency response, and strengthen risk governance.⁸

Third, citizen science contributes to the **transition from risk management to risk governance**. Community members help generate distributed knowledge about hazards, local vulnerabilities, and areas of exposure while supporting preparedness before, during, and after emergencies. Citizen science therefore strengthens both the evidence base for decision-making and the capacity of communities to respond to climate risks.

Fourth, citizen science creates opportunities to **incorporate local and traditional knowledge** into decision-making. Different forms of knowledge are often used alongside scientific information in practice, particularly by practitioners and local decision-makers. Citizen science can help create pathways through which these knowledge systems contribute to research, planning, and governance.

⁶ *Universal Declaration of Human Rights*, article 27; *International Covenant on Economic, Social and Cultural Rights*, article 15; United Nations Committee on Economic, Social and Cultural Rights, *General comment No. 25 (2020) on science and economic, social and cultural rights (article 15 (1) (b), (2), (3) and (4) of the International Covenant on Economic, Social and Cultural Rights)*.

⁷ Eiken et al., 2021

⁸ Lucrezi, 2021

Finally, citizen science contributes benefits that extend beyond environmental monitoring. It promotes public engagement with science, supports critical thinking, and advances the ability of people to participate in scientific inquiry and the use of scientific knowledge in democratic decision-making.

Despite these benefits, citizen-generated information remains largely underutilized within formal decision-making processes. Environmental and climate governance frameworks often lack mechanisms for effectively incorporating community-generated evidence into policy, planning, and risk assessment activities.

As citizen science continues to mature, the central policy question becomes:

How can citizen-generated information be recognized, validated, and incorporated into climate adaptation and mitigation decision-making?

Lessons from The Eastern Shore Citizen Science Coastal Monitoring Network (ESCOM)

ESCOM provides an example of how citizen science can support both scientific and community objectives. ESCOM operates on Nova Scotia's Eastern Shore, where participants collect and interpret coastal and meteorological information to improve their understanding of environmental change and strengthen community preparedness. ESCOM covers a coastline of over 2 000 km, comprising almost 100 small coastal communities across three municipalities. The network is organised into community-based coastal climate teams of between four and ten citizen scientists. Each team has a coordinator who promotes monitoring activities and represents the needs of its members in a steering committee that meets monthly. This collaborative, bottom-up approach ensures that decision-making is inclusive.

ESCOM combines weather stations, geomorphological observations, and ecosystem indicators. By September 2026, this citizen science initiative had incorporated 22 personal weather stations and 14 manual rain gauges from Seaforth (Halifax Regional Municipality) to Port Shoreham (Municipality of the District of Guysborough), purchased, owned, and maintained by the citizen scientists. The coastal climate teams have collected over 200 beach profile, granulometry, and beach vegetation surveys at 19 coastal sites over a period of more than two years, five of which are located within provincial parks. Each citizen scientist uploads this data to an online centralised database, where it is automatically visualised for the general public. Citizen scientists also have the option of downloading their own data and conducting different analyses with the support of an artificial intelligence-based tool.

ESCOM members receive training in data collection and analysis using online materials designed specifically for the coastal and climate parameters they are collecting. This training is supplemented by monthly webinars featuring guest speakers from academic, governmental and community-based institutions in Canada and abroad. In addition, several academic and non-

profit institutions support also support ESCOM by providing data and web hosting, funding applications and community engagement. This approach enables ESCOM to generate information that contributes to our understanding of coastal change, while building community capacity to respond to climate-related risks.

Implications for the CCA Report

The State of Citizen Science in Canada assessment should consider:

- How citizen science information is currently incorporated into climate adaptation and mitigation decision-making across Canada.
- Barriers that prevent citizen-generated information from informing planning, policy development, and environmental governance.
- Mechanisms for connecting community-based monitoring initiatives with municipal, provincial, and federal decision-making frameworks.
- Approaches for validating and integrating citizen science information alongside scientific and governmental datasets.
- Governance models that support scientific integrity, community participation, and responsible data stewardship.
- The role of citizen science in strengthening climate resilience in rural, remote, and coastal communities.
- The role of citizen scientists in the design, development and analysis of results that are used to prepare governmental reports.

Further Recommendations

For Governments and Public Agencies

- Recognize citizen science as a complement to governmental monitoring and climate-risk assessment systems, such as the Hazard Risk Vulnerability Assessments or Provincial Parks Plans.
- Develop mechanisms that enable citizen science information to be incorporated into environmental monitoring, climate adaptation planning, and risk-management frameworks, such as the Coastal Protection Action Plan of Nova Scotia.
- Empower citizen scientists to preserve coastal ecosystems and inform provincial and municipal governments on environmental degradation.
- Provide long-term support for citizen science networks, including funding, training, data management, and community leadership, including specific measures to ensure the effective participation of marginalized and vulnerable sectors of the population.
- Support data governance approaches that include and recognize community participation and stewardship of locally generated information.

For Researchers and Climate Adaptation Programs

- Strengthen methods for collecting, validating, and analyzing citizen-generated information, with interoperability frameworks and robust datasets.

- Support regional organizations that provide funding, training, coordination, and capacity-building for citizen science initiatives in the long-term.
- Encourage local autonomy of citizen science initiatives with complementary support from academic institutions. As in ESCOM, which Dalhousie University is supporting in several ways (Coastal management researchers, computer science developers, life science students), but the citizen science network is autonomous in its decision making and data collection.
- Foster collaboration among researchers, community organizations, governments, and practitioners to increase the practical application of citizen science information.

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