



Water rushes down Front Street in Nome, Alaska, during Typhoon Merbok on Saturday, Sept. 17, 2022. Credit: AP Photo/Peggy Fagerstrom

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# Climate Change Adaptation Issues for Arctic and Sub-Arctic Cities

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Arctic and sub-Arctic cities are already experiencing the impacts of rapid climate change in the region, which pose severe risks to urban infrastructure and the health and livelihoods of urban residents. Environmental changes and extreme weather events compound existing social, economic, and political stressors faced by northern cities. Given these challenges, local authorities are increasingly hard-pressed to provide and maintain safe living and environmental conditions for residents. By learning from these experiences and challenges, decision-makers at various levels of government can implement further actions to enhance cities' resilience locally and globally in the face of the adverse effects of climate change.

# The State of Urban Climate Change Adaptation in the Arctic

The Arctic has been changing at an unprecedented rate over the past several decades, driven by climate change, with the pace of warming in the region four times faster than the rest of the world. Alaska has warmed twice as fast as the global average since the middle of the 20th century.<sup>1</sup> With a changing climate comes greater demand for adaptation actions in Arctic and sub-Arctic cities, where two-thirds of the region's four million population reside. Cities are particularly vulnerable to climate change impacts due to the immobility of their infrastructure, their residents' historical and cultural connectedness to their homes, and their high reliance on technologies (e.g., information and communication systems). Despite the urgent need for adaptation measures, there is a lack of reported information on climate adaptation actions that have been undertaken in urban areas across the Arctic and sub-Arctic.<sup>2</sup> Various factors, including those discussed below, limit the initiation and implementation of local adaptation measures in northern urban areas.

## Barriers to Urban Climate Change Adaptation

Although the impacts of climate change vary from city to city, one can distinguish common adaptation issues.

**Protecting urban infrastructure against climate change.** The impacts of climate change are already and will further undermine the physical integrity of urban infrastructure, especially in cities built on permafrost – the layer of perennially frozen ground. Around 70% of infrastructure located on permafrost is in areas with high risks of being affected by permafrost thaw.<sup>3</sup> In addition, the forecasted increase in the severity of precipitation creates potential dangers for flooding, exposing the urban built environment, transport, and communication systems to infrastructure maintenance and construction risks. A 36% increase in infrastructure lifecycle replacement affected by climate change is estimated for Alaska by 2059.<sup>4</sup> In a changing climate, aging municipal infrastructure adds further vulnerabilities and challenges for cities to maintain services for residents.

**High financial cost of adaptation policies.** Cities across the Arctic and sub-Arctic face financial challenges in launching and implementing adaptation actions, including local budgetary

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1 Carl J. Markon et al. 2018. "Alaska. Impacts, Risks, and Adaptation in the United States," in *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment*, ed. D.R. Reidmiller et al., vol. II (Washington DC: US Global Change Research Program), 1185–1241, <https://doi.org/10.7930/NCA4.2018.CH26>.

2 I. V. Canosa et al. 2020. "Progress in the Climate Change Adaptation in the Arctic," *Environmental Research Letters* 15: 093009, <https://doi.org/10.1088/1748-9326/aae53e>.

3 Jan Hjort et al. 2018. "Degrading Permafrost Puts Arctic Infrastructure at Risk by Mid-Century," *Nature Communications* 9: 5147, <https://doi.org/10.1038/s41467-018-07557-4>.

4 Luis Suter, Dmitry Streletskiy, and Nikolay Shiklomanov. 2019. "Assessment of the Cost of Climate Change Impacts on Critical Infrastructure in the Circumpolar Arctic," *Polar Geography* 42, no. 4: 267–86, <https://doi.org/10.1080/1088937X.2019.1686082>.

constraints and difficulty attracting private investment to carry out these policy actions.<sup>5</sup> For instance, the potential cost for Alaska to address damage to public infrastructure caused by climate change is estimated at \$142 to \$181 million annually.<sup>6</sup> The lack of sufficient financial resources is coupled with the problem of understaffed municipal environmental departments that do not always possess the capacity to take on climate change adaptation responsibilities.

**Lack of relevant regulations and legislation.** Without the necessary legal framework and guidelines, cities are less likely to embark on measures that address climate change and environmental challenges. In Anchorage, for instance, one of the obstacles to diverting and reducing municipal solid waste is the absence of state and local government requirements for mandatory recycling. Increasing recycling is crucial as the only municipal solid waste landfill in Anchorage has 35 years of capacity left. Additionally, access to and availability of technology and scientific information are essential determinants of municipal capacities to develop and implement climate adaptation policies.

## The Way Forward

To ensure that local authorities effectively develop and implement climate adaptation actions, it is crucial to foster cooperation between different levels of government. This cooperation should include active participation from Indigenous and non-Indigenous Arctic communities, scientists, and business representatives. Engaging all relevant stakeholders facilitates the inclusion of local needs and interests in broader discussions on climate security and resilient cities, contributing to more diverse policies and strategies for addressing the specific needs of Arctic cities and their residents.

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5 Nadezhda Filimonova and Stacy D. VanDeveer. 2021. "Multi-Level Governance, Climate Change, and Municipal Solid Waste Management: Insights from Murmansk, Russia," *Urban Studies and Practices* 5, no. 1: 80–101.

6 April M. Melvin et al. 2017. "Climate Change Damages to Alaska Public Infrastructure and the Economics of Proactive Adaptation," *Proceedings of the National Academy of Sciences of the United States of America* 114, no. 2: E122–31, <https://doi.org/10.1073/pnas.1611056113>.



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