

FOSTERING RESILIENCE AND ADAPTING TO CLIMATE CHANGE IN THE CANADIAN NORTH — IMPLICATIONS FOR INFRASTRUCTURE IN THE PROPOSED CANADIAN NORTHERN CORRIDOR

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SUMMARY

The Canadian Northern Corridor (CNC) has been proposed to overcome gaps in the northern transportation system that limit social and economic development in the Canadian North (Fellows et al. 2020). Intended to be a multimodal transportation right-of-way through Canada's North, the CNC seeks to capitalize on shifting global markets and increased access to northern resources (Pearce et al. 2020; Fellows et al. 2020). However, transportation infrastructure has remained constrained across northern Canada. Significant challenges exist for northern infrastructure due to isolation, restricted access and extraordinary environmental conditions — all of which climate change is projected to radically intensify (Palko and Lemmen 2017; Pearce et al. 2020).

Climate change drastically reduces the feasibility of expanding northern infrastructure. Significant increases in environmental risk threaten existing infrastructure and magnify maintenance costs. Adaptation in remote northern locations can be exceedingly difficult and costly (Palko and Lemmen 2017). Additional Arctic warming is guaranteed to have systemic effects and pose significant challenges for northern infrastructure: temperature and precipitation will continue to increase; permafrost thaw will be amplified through changes in seasonal snow cover and land ice; ice loss of mountain and polar glaciers is virtually certain; coastal impacts such as erosion and storm surges will be magnified by increasing sea level and extreme volatility; and Arctic sea ice extent will decline to the point of likely being practically ice free in September before 2050 (IPCC 2021). Determining how to facilitate long-term, effective climate change adaptation is critical to overcome these challenges.

Adaptation planning seeks to anticipate and mitigate the risks that result from climate change. This is done through two methods: hard and soft adaptation. Hard adaptations provide a physical barrier to the source of risk, such as a sea wall. In contrast, soft adaptations reduce risk by adjusting human behaviour through a variety of methods, including regulating development out of high-risk areas through land use bylaws or development permits, and fostering environmental stewardship to bolster ecosystem services, such as wetland preservation to reduce flooding (Bonnett and Birchall 2020). However, common misunderstandings about which adaptation initiatives are effective often disable adaptation planning (Kehler and Birchall 2021). This often results in maladaptation — when adaptation measures result in unintended negative consequences that further increase risks. Hard infrastructure adaptations intended to reduce physical risk, despite typically being used as the foundation of adaptation planning, magnify the risk of maladaptation when used alone (Bonnett and Birchall 2020). Due to the capital-intensive nature of hard measures, both upfront and in long-term maintenance, and their predisposition to environmental degradation, the need to go beyond hard measures to address vulnerability is well understood (Bonnett and Birchall 2020; Kehler and Birchall 2021; Naylor et al. 2020).

Adapting infrastructure to climate change in the Canadian North presents a formidable challenge. Limits and constraints to effective adaptation, such as lagging implementation, isolation, low population and limited tax base to fund local-level adaptation and infrastructure maintenance, result in significant challenges and limited capacity to overcome them (Bonnett and Birchall 2020; Birchall and Bonnett 2020; Birchall et al. 2021; Ford et al. 2015).

While climate change is perceived to have the potential to increase access to the North — allowing trade, tourism and transport of much-needed goods and services to northern communities — in reality, existing and new construction will be progressively vulnerable to unprecedented climatic effects and the resulting infrastructure maintenance will grow increasingly costly. This increase in vulnerability and costs is likely to restrict the anticipated socioeconomic boons of expanded connectivity and resource development, potentially straining already vulnerable communities and Indigenous Peoples. Considerable uncertainty requires a planning approach to infrastructure adaptation that focuses on mitigating risks of climate change while also bolstering community resilience. Infrastructure expansion such as the CNC necessitates adaptation planning that includes fostering economic diversity and infrastructure resilience. Increased disaster risk due to climate change could push communities already overwhelmed by maintenance and adaptation to being unable to cope, resulting in vulnerabilities across northern Canada.

Balancing hard adaptations with other forms of policy, such as soft adaptations intended to increase adaptive capacity and adaptation readiness, is critical to avoid maladaptation of infrastructure. Regardless of cost or feasibility, for infrastructure adaptation to be effective it must coincide with a reduction of socioeconomic stressors,

and all decision making must be done through a localized, participatory and equitable process (IPCC 2014). Addressing adaptation and resilience for northern infrastructure requires exploring what is necessary to foster resilience, examining what avenues for adaptation are most effective and then maximizing the benefits of limited funding allocated toward these strategies.

Effective adaptation strategies focus on the reduction of vulnerability through place- and context-specific approaches, using low-risk, high-benefit policy measures that are supported through significant intergovernmental co-operation, public engagement and integration of non-Western knowledge systems. By further understanding the pathways to achieve resilience, and through a holistic approach to adaptation, it is possible to balance the increased environmental risks of climate change with socioeconomic impacts, and to do so in a way that is economically sustainable long into the future.