



BACKGROUND PAPER

CLIMATE CHANGE: ITS IMPACT AND POLICY IMPLICATIONS

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Climate Change: Impact and Policy Implications
(Background Paper)

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EXECUTIVE SUMMARY

Unprecedented global warming has been observed in recent decades. Around the world, mean air and water temperatures have increased, amounts of snow and ice have diminished, and sea levels have risen. Canada is no exception: our mean temperature has increased by more than twice the global average temperature.

A warming climate will likely have short- and long-term effects on people's lives. Many aspects of our society are governed to some extent by climate. Here in Canada, climate change is likely to have an impact on human health, human rights, migration, food security, the economy, employment, national security and transportation.

Political, social and economic institutions will have no choice but to adapt to the societal disruption brought about by climate change, but they can also find ways to take advantage of new opportunities. That means taking climate change into account in public policy planning.

CLIMATE CHANGE: ITS IMPACT AND POLICY IMPLICATIONS*

1 INTRODUCTION

Scientists have observed unprecedented global warming in recent decades. Around the world, mean air and water temperatures have increased, amounts of snow and ice have diminished, and sea levels have risen.¹

In Canada, the effects of climate change have been particularly acute, with our average temperature rising by more than twice the global average increase and, in the country's Arctic region, by an even more dramatic amount.² The data show that, in recent decades, there have been more extreme hot days and fewer extreme cold days than there were 70 years ago.³ Rainfall amounts may be rising.⁴ Scientists have observed an increase in mean water temperature and wave height in Canada's oceans, as well as warming permafrost and shrinking ice caps in the Canadian Arctic.⁵

In 2016, countries agreed to take steps to limit global average temperature increases to between 1.5°C and 2°C above pre-industrial levels. The goal of this target is to reduce the risks and impacts associated with climate change. Consistent with this commitment, Canada implemented the Pan-Canadian Framework on Clean Growth and Climate Change, which includes measures to reduce greenhouse gas emissions and the impact of climate change in this country.⁶

Despite these efforts, it is clear that climate change will have short- and long-term effects on people's lives.⁷ Climate influences many aspects of our society, including agricultural production, the prevalence of certain diseases, and building and infrastructure design. Over time, climate change may also disrupt health, social and economic conditions.⁸

In the face of these disruptions, our political, social and economic institutions must demonstrate resilience and adaptability. To do so, they must recognize and eliminate barriers to adaptation: the laws, regulations and public policies that may prevent us from implementing strategic approaches to adaptation in the future.⁹ Integrating climate change into public policy planning now will ensure that our institutions – and our people – are prepared to face the challenges climate change will present in the future¹⁰ and even to take advantage of new opportunities that arise as a result of climate change.¹¹

This paper deals with the impact of climate change on eight aspects of our society: health, human rights, migration, food security, the economy, employment, national security and transportation. The impact of climate change on human beings and public policy is addressed in each case. The purpose of the paper is to help Canadian parliamentarians take the impact of climate change into account in their deliberations.

2 HEALTH

Climate change is characterized by an increasing global temperature, rising sea levels and altered precipitation patterns, with more frequent extreme weather-related events, including heat waves, floods, fires and droughts.¹² Each of these outcomes can affect human health, either directly or indirectly, and will have implications in all regions of the world, including Canada. Climate change is expected to affect the health of poor and vulnerable people predominantly, particularly in low- to moderate-income countries,¹³ and, in some cases, to affect the health of men and women differently.¹⁴ In Canada, northern communities and Indigenous ways of life are expected to be disproportionately affected by climate change.¹⁵

2.1 VECTOR-BORNE AND WATER-BORNE INFECTIOUS DISEASES

Vector-borne infectious diseases are infectious diseases transmitted through another organism, often insects. Increased average temperatures expand the geographic areas in which insects usually live and can lengthen an insect's breeding season. As a result, any disease carried by the insect will start to appear in previously unaffected regions and over longer periods of time throughout the year. For example, the incidences of mosquito-borne malaria and dengue fever, as well as tick-borne encephalitis, can be expected to increase in certain regions of the world.¹⁶

In Canada, tick-borne Lyme disease and mosquito-borne West Nile virus have only recently appeared as the country's southern climate has warmed. Surveillance of West Nile virus cases in humans began in 2002. Preliminary data for 2018 indicate that there were 427 West Nile virus infections reported, which is the second-highest number since 2007.¹⁷ Surveillance of Lyme disease cases began in 2009, with 144 cases reported in that year; the number has steadily increased since then. Between 2016 and 2017, reported cases of Lyme disease more than doubled from 992 to 2,025,¹⁸ and the regions in which infections are occurring have expanded.¹⁹

Water-borne infectious diseases are diseases caused by infectious agents carried in water; examples include cholera and dysentery. Extreme weather events can cause storm surges, flooding and damage to infrastructure, which can result in contaminated water supplies, and drought can lead people to use unsafe water sources.²⁰

In Canada's northern communities, the thawing permafrost may release previously unknown water-borne pathogens, which could affect the water and food supplies.²¹

2.2 HEAT STRESS, AND CARDIOVASCULAR AND RESPIRATORY DISEASES

It is expected that heat stress, heat stroke, and cardiovascular and respiratory diseases will increase due to increased greenhouse gas (GHG) emissions, as well as increased air pollutants and ozone levels from rising and extreme temperatures that produce heat

waves, drought and wild fires.²² Between 2010 and 2016, ambient air pollution increased in 70% of the world's cities.²³ The World Health Organization estimates that air pollution causes nearly 4.2 million premature deaths per year worldwide from cardiovascular and respiratory disorders.²⁴ The elevated number of deaths observed during heat waves indicates a direct link between heat exposure and negative health effects.²⁵

Climate change is expected to lead to increased heat stress for people in southern areas of Canada because of rising temperatures and an increasing number of heat waves,²⁶ and to worsened cardiovascular and respiratory conditions as a result of poor air quality from wild fires.²⁷

2.3 MALNUTRITION AND UNDERNUTRITION

Rising temperatures and extreme weather events are resulting in lower crop yields, which leads to both food insecurity and reduced food quality. Harvests of rice and maize could fall by as much as 40% by the end of the century due to rising temperatures.²⁸ As well, permanent flooding or salination of the soil is projected to cause populations to move inland and agricultural land to be lost from low-lying coastal regions, which are vulnerable to rising sea levels.²⁹

Although low- and middle-income countries are most vulnerable to these issues, Canada's coastal and northern communities are also at risk. In Atlantic Canada, risks from rising sea levels are increased because of land subsidence.³⁰ On Canada's Pacific coast, warming temperatures are expected to have a negative impact on the fishing sector, and particularly on salmon stocks.³¹ Temperatures are rising faster in northern Canada than in the rest of the country, which has resulted in thawing of permafrost, changes in animal migration, and poor hunting and fishing for traditional foods.³²

2.4 MENTAL ILLNESS

The consequences of climate change can bring about short- and long-term mental illness. The health issues discussed earlier, as well as displacement due to food insecurity, reduced or lost livelihood due to drought or floods and property loss from extreme weather events are likely to be accompanied by such mental health conditions as trauma, anxiety, depression and stress.³³

The Indigenous population in Canada may be at particular risk of mental illness as a result of climate change-related impacts to culture and social well-being. Although Indigenous peoples are accustomed to adapting to changes in the environment, climate change has increased the unpredictability of the environment and made traditional Indigenous knowledge less reliable.³⁴

3 HUMAN RIGHTS

In 1972, the international community met in Stockholm for the first global environmental conference.³⁵ The resulting declaration recognized that humanity has the power to transform our environment, and that doing so “wrongly or heedlessly” would jeopardize our basic human rights, including the right to life.³⁶

Almost 50 years later, the human rights implications of climate change are better understood. The Office of the United Nations (UN) High Commissioner for Human Rights (OHCHR) noted in 2015 that some of the rights most significantly affected by climate change moving forward will be rights to life, self-determination, development, food, water and sanitation, health, housing, education, and meaningful and informed participation. OHCHR also highlighted that climate change will disproportionately affect the particular rights of certain groups, such as Indigenous peoples, women, rural workers, persons with disabilities, children and future generations.³⁷

It is estimated that climate change already causes 400,000 premature deaths per year, largely due to increased hunger and higher rates of infection from communicable diseases in developing countries.³⁸ In Canada, climate change has a significant impact on many Indigenous and other communities through more wildfires, reduced surface water in lakes and rivers, and other depletions in resources and animal populations necessary to sustain traditional activities, such as hunting, fishing and the gathering of food and medicinal plants.³⁹ Canada is expected to face more significant challenges over time, including with respect to air, food and water quality.⁴⁰

While there is consensus that climate change has the potential to disrupt the full realization of a wide range of human rights, it is less clear what governments are required to do about it. The 2015 *Paris Agreement* calls on all countries to “respect, promote and consider” human rights obligations when addressing climate change.⁴¹ Perhaps more significantly, in a 2019 joint statement, five United Nations human rights treaty bodies warned that failure to prevent the foreseeable human rights impacts of climate change could constitute a violation of existing international legal obligations.⁴² In Canada, such obligations can be used by courts to interpret Canadian legislation.⁴³

Unlike in many countries, in Canada the constitution does not explicitly include the right to a healthy or safe environment.⁴⁴ Nevertheless, a wide variety of firmly established rights in Canada that draw on international human rights obligations are expected to be affected by climate change. This chapter will focus on three such groups of rights: the rights to life and security of the person; non-discrimination and the rights of children; and Aboriginal and treaty rights.⁴⁵

3.1 THE RIGHTS TO LIFE AND SECURITY OF THE PERSON

The rights to life and security of the person are recognized by foundational international human rights treaties,⁴⁶ as well as by section 7 of the *Canadian Charter of Rights and Freedoms*.⁴⁷ Climate change poses a threat to the realization of these rights, including through increased extreme weather events, periods of intense heat and cold, food scarcity and air quality degradation.

Internationally, rights to life and security of the person have formed part of the basis for climate change claims against governments. The first successful example of this occurred in the Netherlands in 2015, when the Dutch government was ordered by the Hague District Court to reduce GHG emissions by 25% by 2020 compared to 1990 levels.⁴⁸ In 2019, it was confirmed by the Dutch Supreme Court that this was the minimum action required based on international scientific consensus, fundamental human rights, including the right to life, and specific Dutch constitutional and civil law principles.

In Canada, it remains unclear whether the rights to life and security of the person could require the government to pursue particular climate change targets or policies. So far, section 7 of the Charter has essentially been interpreted as protecting people from government actions, rather than creating an obligation for governments to act.

However, some legal scholars have argued that this interpretation could change if, for example, a government set a standard that allowed for harmful levels of emissions to the point that increased risks of death, adverse health impacts or serious psychological stress could be clearly demonstrated.⁴⁹ Although this would be a significant shift in Charter interpretation, the Federal Court of Appeal recently reiterated that section 7 is not frozen in time, and specifically mentioned that the right to life and security of the person could someday evolve to include climate rights (among other possibilities) if special circumstances justified it.⁵⁰

In short, any Canadian efforts to mitigate and adapt to climate change need to respect constitutionally entrenched human rights to life and security of the person. Canada also has international legal obligations to promote universal respect for human rights, including rights to life and security of the person abroad.⁵¹

3.2 NON-DISCRIMINATION AND CHILDREN'S RIGHTS

Similarly, the right to substantive legal equality without discrimination is recognized by foundational international human rights treaties,⁵² as well as by the *Canadian Human Rights Act* and section 15 of the Charter. These rights are relevant because climate change is generally expected to impose the most significant burdens on vulnerable populations who have contributed the least to the problem.⁵³ In particular, several international legal cases have argued that policies that delay mitigation and adaptation to climate change implicitly impose costs on children and future generations, and that such policies are therefore discriminatory.⁵⁴

Although future generations are not generally recognized in Canadian law,⁵⁵ children benefit from equality rights and a range of additional protections, including the legal principle that laws and decisions concerning them must have their best interests as a primary consideration.⁵⁶

However, as with section 7 rights, it is unclear whether rights to equality and non-discrimination could require the government to pursue particular climate change targets or policies. The courts have said that, to constitute discrimination, the law must create a distinction between different groups in a way that results in a disadvantage to one group compared to the other. In this context, discriminatory law is not limited to written legislation. Rather, the Supreme Court of Canada has emphasized that a “broad understanding” of how “law” is defined in section 15 of the Charter is necessary.⁵⁷ For example, legislation that is simply underinclusive – as when human rights legislation does not provide protections based on sexual orientation – can be discriminatory.⁵⁸

Some legal scholars see scope for an expanded interpretation of section 15, arguing that equality rights extend broadly to any government inaction, meaning that the government is legally responsible not only for gaps in legislation that have discriminatory effects, but also for the absence of legislation or programs if the effect is discriminatory.⁵⁹

3.3 ABORIGINAL AND TREATY RIGHTS

Aboriginal and treaty rights are recognized by section 35 of the *Constitution Act, 1982*. Overlapping and potentially broader rights are also recognized by the *UN Declaration on the Rights of Indigenous Peoples*, which Canada has signed and endorsed but has not fully implemented in law. The precise nature and scope of Aboriginal and treaty rights also vary between First Nations, as well as between Inuit and Métis peoples, based, for example, on differing historical practices, customs, traditions, the terms of an applicable treaty, or the absence of a treaty where one was never signed.

While recognizing these differences, broadly speaking, climate change affects the realization of Aboriginal and treaty rights, perhaps most clearly with respect to rights that are grounded in traditional land use practices. Courts have long recognized that such rights often require government protection from environmental degradation. For example, in the context of Aboriginal fishing rights and the constitutionality of a government licensing scheme, the Supreme Court of Canada has observed that “the exercise of the right itself is dependent on the continued existence of the resource.”⁶⁰ Therefore, to the extent that resources are threatened by climate change, the exercise of Aboriginal and treaty rights may be threatened as well.

The impact of climate change on the exercise of Aboriginal and treaty rights has several implications for Canada. For example, the Crown has a procedural duty to consult the relevant Indigenous groups and accommodate their interests on lands where they have title. As noted by the Supreme Court of Canada, “the level of

consultation and accommodation required is proportionate ... to the seriousness of the adverse impact the contemplated governmental action would have.”⁶¹ Government actions that have an impact on climate may therefore require greater consultation and accommodation as those effects become more significant over time.

In addition, impacts on Aboriginal and treaty rights may be a factor in jurisdictional disputes between the federal and provincial governments. In Canada, the Crown has certain fiduciary obligations toward Indigenous peoples, regardless of whether the Crown is represented by the federal government or a provincial government. The Supreme Court of Canada has said that “any federal-provincial divisions that the Crown has imposed on itself are internal to itself,” suggesting that these divisions of power cannot be used to justify a failure to fulfill the Crown’s obligations.⁶² This view was raised in the context of climate change by the Athabasca Chipewyan First Nation and other intervenors before the courts of appeal in Saskatchewan and Ontario in support of the federal government’s *Greenhouse Gas Pollution Pricing Act*. While these arguments were acknowledged by both courts, they were neither relied upon nor dismissed, and thus could arise again in future cases.⁶³

3.4 FURTHER IMPLICATIONS

Climate change affects the realization of a wide range of international human rights, many of which have binding legal force in Canada. As with any government action, government efforts toward climate change mitigation or adaptation must comply with human rights standards, particularly with those that have constitutional status. These include the rights discussed in this section as well as many others, such as freedom of expression and peaceful assembly, freedom of the press, mobility rights, equality rights for persons with disabilities, and the right to an appropriate remedy when rights are infringed.

There is a growing international movement to challenge, based on human rights, government action or inaction with respect to climate change; this could have significant consequences for governments around the world.⁶⁴ As discussed above, in 2015 the Hague District Court ordered the Dutch government to reduce GHG emissions based on the right to life.⁶⁵ Similar cases against the United States, France, Germany and several other countries are at various stages.⁶⁶ In July 2019, a proposed climate change class action was denied authorization by the Superior Court of Quebec based on a failure to define members of the class in a non-arbitrary way.⁶⁷ At the same time, the Court rejected the argument that the issues raised were too political to be dealt with by a court.

In October 2019, 15 youth activists from across Canada filed a claim against the federal government based on sections 7 and 15 of the Charter, with the goal of mandating an enforceable climate plan that is consistent with global fairness and compatible with a stable climate.⁶⁸ The case could have significant implications for future climate change-related litigation in Canada.

Although they are beyond the scope of this section, it is worth mentioning Canada's other obligations to respect and promote human rights abroad,⁶⁹ including by taking appropriate steps to prevent, investigate, punish and redress human rights abuses by individuals and corporations.⁷⁰ Like governments, corporations are facing an array of novel lawsuits, including cases arguing that they are liable for their contribution to harms caused by climate change, as well as cases seeking orders for emissions reductions in their operations.⁷¹ Regardless of the outcomes of these particular cases, it is clear that climate change has a range of impacts on human rights which can be expected to grow in significance.

4 ENVIRONMENT-RELATED MIGRATION

Sixty-eight years after its creation, the office of the United Nations High Commissioner for Refugees (UNHCR) recorded the highest number of individuals ever displaced because of persecution, conflict or generalized violence. In 2018, approximately 70.8 million people around the world were forcibly displaced either within their own country, as internally displaced persons (41.3 million), or across international borders, as asylum seekers (3.5 million) and refugees (25.9 million).⁷² However, these figures give only a partial overview of the current migration situation. As stated by the head of the UNHCR, Filippo Grandi, in October 2019, “the increasingly complex, overlapping factors driving displacement, from conflicts fueled by ethnic and religious differences to collapsing eco-systems and weather-related disasters” lead to mixed flows of people on the move.⁷³

For more than three decades,⁷⁴ numerous efforts have been made to study and document if, how and why people migrate due to climate change and environment-related disasters.⁷⁵ While people migrate, in part, for environment-related reasons, there is no clear picture of the magnitude of the phenomenon.

Estimates of the number of people who will be compelled to move by 2050 because of climate change range from 25 million to 1 billion.^[76] The most widely cited figure appears to be 200 million climate migrants by 2050.^[77] It has also been estimated that between 500 million and 600 million people (approximately 10% of the world's population) are at extreme risk due to climate change.^[78] The numbers are difficult to predict because of the numerous and interrelated assumptions on which they are based, including assumptions about future global population and economic growth, the timing and impact of climate change events, and climate change-related motivations for people to move.⁷⁹

This lack of understanding of environment-related migration can lead to different challenges, nationally and internationally. One of those challenges is “a general lack of preparedness” for disasters, which can lead “to *ad hoc* responses,” especially in the case of mass displacements.⁸⁰ According to the state-led consultative process entitled

the Nansen Initiative, these challenges are caused by gaps in knowledge and data, gaps in the legal frameworks and gaps in the institutional, operational and funding capacities of different jurisdictions.⁸¹

This section aims to provide an overview of environment-related migration by discussing the different realities experienced by people who are on the move within their own country or who are crossing an international border. This type of migration will create certain challenges and opportunities for countries, including Canada, which will be explored further in this section.

4.1 PEOPLE ON THE MOVE DUE TO ENVIRONMENT-RELATED EVENTS

While many elements of people's lives can be indirectly influenced by "climate-related stressors on [their] livelihoods, health and safety," isolating the environment or climate as a reason for displacement is difficult.⁸² Some population displacement is a direct result of extreme weather events or rising sea levels and soil salinization that leave some regions uninhabitable.⁸³ In cases like these, where a natural disaster strikes their home, people are often forced, temporarily or permanently, to move within their country or to cross into a new one. In other cases, people's reasons for moving are not so easily linked to environment-related events. For example, it is hard to say how many of those who migrate voluntarily or preventatively⁸⁴ – the vast majority of whom move for such reasons as work opportunities and family reunification⁸⁵ – do so with environment-related events in mind.

People from the least developed states in Africa, Asia and Latin America, as well as from small, low-lying island nations, are the most likely to be on the move due to environment-related events.⁸⁶ In many of the countries in these regions, where supplies of basic necessities, such as food, water and shelter, are strained, climate-related stressors can cause instability by exacerbating problems and impeding effective governance.⁸⁷ For example, Yemen's protracted water crisis, in addition to the ongoing conflict, led to one of the largest humanitarian crises in the early part of the 21st century.⁸⁸

4.1.1 Displacement Within a Country

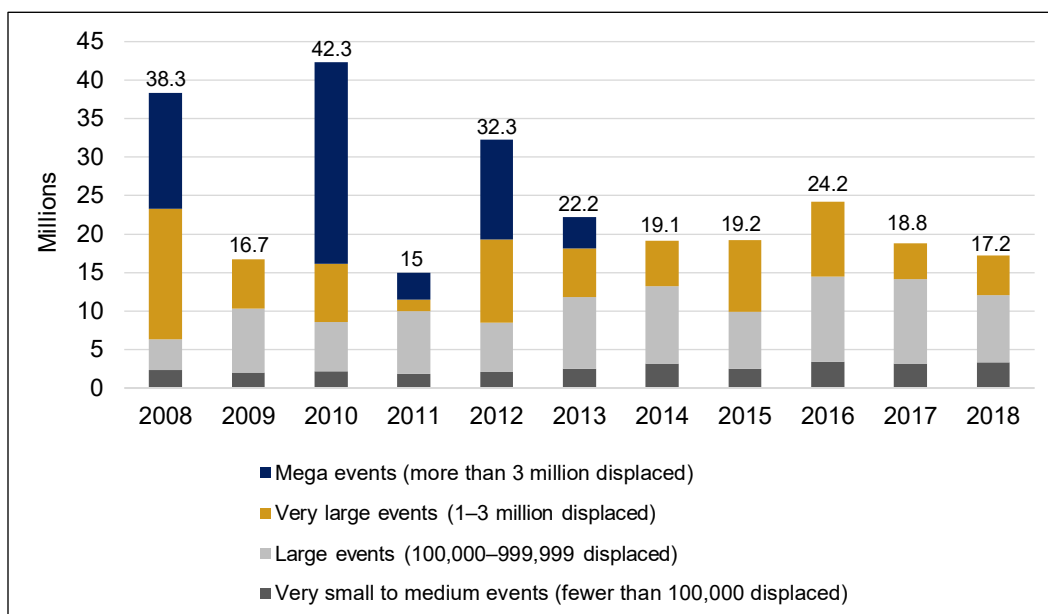
The Norwegian Refugee Council's Internal Displacement Monitoring Centre (IDMC) reported that in 2018, 1,600 disaster events, mostly weather-related, triggered 17.2 million new displacements within more than 140 countries. The Philippines, China and India accounted for about 60% of all these new displacements in 2018.⁸⁹

In many countries, people live in high-risk disaster-prone areas. This “unmitigated exposure of people and assets” creates vulnerability, which plays “a key role in preventing people from returning and recovering from the impacts of disasters.”⁹⁰ People in vulnerable situations, such as children, women and the elderly,

are generally less able to cope with and respond to hazards or shocks because of their disadvantaged position: socially because of marginalized status; economically because they are poorer; and politically because of lack of independence, decision-making power, and underrepresentation.⁹¹

The devastating power of disaster events can differ from year to year. As shown in Figure 1, the scale of disaster events during 10 years of IDMC recording included very small to very large events that displaced millions annually. On average, there were 26.5 million new displacements per year.⁹²

Figure 1 – Disaster-Related New Displacements by Scale of Event, Worldwide, 2008–2018



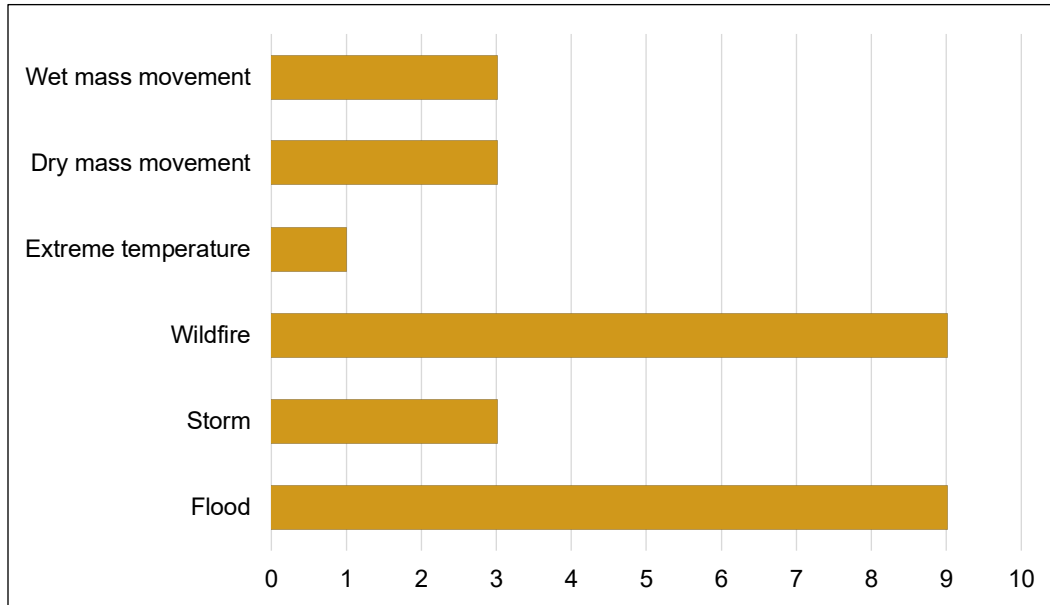
Source: Figure prepared by the authors using data obtained from Internal Displacement Monitoring Centre, [Global Internal Displacement Database](#), 2018 Dataset.

4.1.2 Displacement Within Canada

Of the 17.2 million new displacements in 2018, only about 19,000 were Canadians,⁹³ temporarily displaced within their country due to weather-related disasters, such as floods,⁹⁴ wildfires⁹⁵ or extreme temperatures, or geophysical disasters, such as earthquakes.⁹⁶ According to data received from Indigenous Services Canada, Indigenous people living on First Nations reserves are disproportionately affected. While the data received is not exactly comparable to the 2018 time period, it does

indicate that there were approximately 14,800 First Nations evacuees from April 2017 to March 2018 and about 10,500 from April 2018 to March 2019.⁹⁷ Figure 2 provides an overview of the types of natural disasters that displaced Canadians in 2018.

Figure 2 – Number of Natural Disasters Leading to New Displacements in Canada, by Hazard Type, 2018



Note: Mass movement describes a quantity of debris such as land, snow or ice that moves under the force of gravity. Wet mass movement refer to landslides caused by heavy rain, avalanches and permafrost degradation, whereas dry mass movement refers to soil erosion and rockfalls.

Source: Figure prepared by the authors using data obtained from Internal Displacement Monitoring Centre, “2018 internal displacement figures by country” and “Disaster-related new displacements by event in 2018,” [Global Internal Displacement Database](#), 2018 Dataset.

The federal, provincial and territorial governments, as well as local and Indigenous communities,⁹⁸ are responsible for emergency management to ensure the health and safety of Canadians and the full recovery of their communities after a disaster.⁹⁹ For example, under the Emergency Management Framework for Canada,¹⁰⁰ the federal government coordinates emergency management activities throughout Canada and provides support when requested by provincial and territorial governments who are responsible for emergency management within their jurisdictions.¹⁰¹

Many Indigenous communities in Canada are particularly vulnerable because of significant challenges when managing and recovering from disasters. This vulnerability is due, in part, to poorer socio-economic conditions compared to those in large urban communities, distant geographic location, and the frequency with which these events occur.¹⁰² The most common emergencies in these communities are floods, fires and the failure of community infrastructure as a result of disaster.¹⁰³ In some instances, disasters occur frequently. For example, in several years during the past decade, the Kashechewan First Nation in northern Ontario has experienced severe spring flooding,

causing multiple evacuations of the community. These recurring disasters have taken a serious and costly toll on the community, which led its leaders to sign an agreement with the provincial and federal governments to relocate the community.¹⁰⁴

Displacement of citizens and permanent residents within Canada is guided by the principles of mobility rights found in section 6 of the *Canadian Charter of Rights and Freedoms*. As explained in the previous section, of relevance in the context of migration may be other rights, including the right to life and security of the person, found in section 7 of the Charter, and Aboriginal and treaty rights as recognized by section 35 of the *Constitution Act, 1982*.

4.2 DISPLACEMENT ACROSS INTERNATIONAL BORDERS

People who cross an international border to claim refugee protection due to disaster- or climate change-related events are not generally considered refugees under the current international refugee protection regime.¹⁰⁵ Like international human rights law, modern refugee law has its origins in the aftermath of World War II, as well as the refugee crises of the interwar years that preceded it. The overarching goal of international refugee law is to provide protection to individuals forced to flee their homes and who are unable or unwilling to return to their country of origin “owing to a well founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group, or political opinion.”¹⁰⁶ In the case of environment-related cross-border displacement, it is very difficult to identify “a pristine ‘well founded fear of persecution’ as required by the Convention.”¹⁰⁷ Expanding the refugee definition under the 1951 *Convention relating to the Status of Refugees* (Refugee Convention) and its 1967 *Optional Protocol relating to the Status of Refugees* (Optional Protocol) is not a recommended solution,¹⁰⁸ as it could lead to the “watering down of the existing protections.”¹⁰⁹ Considering there is no legal status for those who cross an international border due to environment-related events, there is no overall data on their number.¹¹⁰ Such migrants are often categorized as migrants under economic streams.¹¹¹

New Zealand is one of the few countries that, to date, has adjudicated refugee protection claims related to environmental events. In the last 20 years, there have been eight instances in New Zealand in which individuals, who were from low-lying island states affected by climate change, claimed refugee protection based on environmental factors such as rising sea levels, inundation, coastal erosion and salination of the water table. In all cases, the New Zealand courts ruled that there were no grounds for refugee protection under the Refugee Convention and its Optional Protocol.¹¹² In the most recent decision, a dismissed application to appeal at the Supreme Court of New Zealand, issued in July 2015, the Court agreed with the lower courts that the appellant did not face “serious harm” if returned to Kiribati, saying that “there is no evidence that the Government of Kiribati is failing to take steps to protect its citizens from the effects of environmental degradation to the extent that it can.”¹¹³

However, the Supreme Court of New Zealand did note that its decision “did not mean that environmental degradation resulting from climate change or other natural disasters could never create a pathway into the Refugee Convention or protected person jurisdiction.”¹¹⁴ The Court also stated that its decision in this particular case should not rule out the possibility of granting refugee protection in an appropriate climate change refugee case.¹¹⁵

Following New Zealand’s decision and his deportation, Mr. Teitiota filed a complaint to the UN Human Rights Committee responsible for monitoring States parties’ adherence to the *International Covenant on Civil and Political Rights* (ICCPR). He argued “that by deporting him, New Zealand had violated his right to life” since Kiribati was no longer inhabitable due to climate change and rising sea levels.¹¹⁶ While the Committee upheld New Zealand’s decision because it determined Kiribati implemented sufficient protection measures for its citizens, the Committee did set “new standards that could facilitate the success of future climate change-related asylum claims.”¹¹⁷ In its non-binding decision, the Committee stated that, by returning people to countries where their lives might be threatened by climate change, there is a potential for infringement on people’s rights under the ICCPR. Further, people seeking asylum are not required to prove that they would face immediate harm due to climate-related events if deported back to their home countries. The Committee argued that climate-related events can occur both suddenly or over time through slow-onset processes, such as sea level rise, and either situation could spur people to seek safety elsewhere. The Committee also underlined that the international community must assist countries adversely affected by climate change.¹¹⁸

4.2.1 Canada as a Host Country

While no state has given refugee protection to individuals affected by disaster- or climate change-related events in their country of origin, some countries have welcomed such individuals within their borders or, at least, have not returned them. Canada is one of those countries: at the time of the 2010 Haitian earthquake and the 2015 Nepal earthquake, it welcomed affected people and temporarily allowed citizens from those countries who were already in Canada to remain.¹¹⁹

In 2010, the Government of Canada expedited immigration applications from Haitians with family in Canada,¹²⁰ and Haitians already in Canada were temporarily allowed to extend their stay.¹²¹ Within one year, Canada had welcomed 3,600 Haitians as permanent residents and granted temporary permission for more than 3,000 other Haitians to enter the country. It reunited over 2,500 families and facilitated the union of 203 Haitian children with their adoptive families in Canada.¹²² Of note, decision-makers at the Immigration and Refugee Board of Canada reviewing refugee protection claims from Haiti at the time also took into consideration the impact of the earthquake.¹²³ In 2015, the Government of Canada prioritized “the processing of

immigration applications already in progress on request from those who are significantly and personally affected by the earthquake in Nepal.”¹²⁴ The federal government also considered extension requests from Nepalese citizens temporarily in Canada.

The *Immigration and Refugee Protection Act* – Canada’s principal refugee legislation – does not provide for the admission of people displaced for reasons directly related to disaster or climate change events. According to a June 2019 statement from the office of the Immigration, Refugees and Citizenship minister, the Government of Canada makes resettlement decisions with respect to individuals potentially affected by climate change “on a case by case basis.”¹²⁵ In order for Canada to welcome environmentally displaced individuals, the federal government would need to decide if it extends refugee-type protection to such migrants. Legislative changes would not necessarily be required, as public policy direction or regulatory changes could suffice.¹²⁶

4.3 FURTHER IMPLICATIONS

When addressing climate change, the 2015 *Paris Agreement* asks states that are parties to the convention to

respect, promote and consider their respective obligations on human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities and people in vulnerable situations and the right to development, as well as gender equality, empowerment of women and intergenerational equity.¹²⁷

This comprehensive approach to rights is also found in other international efforts that aim to reduce inequalities and vulnerabilities, including the UN Development Programme Sustainable Development Goals. Goal 13 calls on all UN member states to “take urgent action to combat climate change and its impacts.”¹²⁸ In migration-specific international documents, such as the *Global Compact for Safe, Orderly and Regular Migration* and the *Global Compact on Refugees*, there are also a number of objectives¹²⁹ that call on states to, for example, “minimize the adverse drivers and structural factors that compel people to leave their country of origin.”¹³⁰

Given global urbanization, the IDMC predicts that “people’s exposure and vulnerability to disasters and the displacement they trigger is likely to continue to rise.”¹³¹ For that reason, the impact of disasters and climate change on national and international displacement flows is a growing concern. This is especially true for the UNHCR, because the majority of people under its protection mandate

are concentrated in the most vulnerable areas around the world. Climate change will force people into increasing poverty and displacement, exacerbating the factors that lead to conflict, rendering both the humanitarian needs and responses in such situations even more complex.¹³²

This can lead to massive protection challenges connected with displacement, migration and relocation. The absence of an international legal framework that reflects the current environment-related displacement realities does not preclude the possibility of developing specific local, national and international policies to protect those who are forced to move because of climate change.¹³³

5 FOOD SECURITY

Along with armed conflict, climate change is one of the leading causes of food insecurity worldwide.¹³⁴ The Food and Agriculture Organization of the United Nations (FAO) defines food security as “a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.”¹³⁵

In 2018, one of the principal indicators of food insecurity, undernourishment, affected some 821 million people around the world, or 10.8% of the global population. A decline in the prevalence of undernourishment from 14.5% in 2005 to 10.6% in 2015 was followed by a gradual increase in the number of undernourished people over the following three years.¹³⁶ As the FAO explained:

Climate variability and extremes are a key driver behind the recent rises in global hunger and one of the leading causes of severe food crises. The changing nature of climate variability and extremes is negatively affecting all dimensions of food security (food availability, access, utilization and stability).¹³⁷

Rising temperatures, changing precipitation patterns and increasingly frequent extreme climate events are already affecting global food security.¹³⁸ Various models of future climate change effects point to declines in crop, livestock, aquaculture and fisheries productivity.¹³⁹

5.1 AGRICULTURE AND LIVESTOCK PRODUCTION

Our warming climate is already affecting some crop types because insect pests are appearing earlier than before. For example, in the United States, the potato leafhopper now appears 10 days earlier on average than in the 1950s, causing losses in the millions of dollars every year.¹⁴⁰ Climate change is also likely to generate more disease-related losses¹⁴¹ and to disrupt the synchronicity of the plant (and fruit tree)/pollinator relationship.¹⁴² The enhanced distribution and competitiveness of invasive weeds due to rising atmospheric carbon dioxide concentrations is another major issue.¹⁴³ Lastly, rising sea levels cause flood risks and increase the salinity of farmland at or near sea level.¹⁴⁴

Climate change may also affect livestock production. Droughts could reduce the production of forage for cattle and grain for poultry.¹⁴⁵ Intense heat can cause heat stress in livestock and reduce reproductive capacity.¹⁴⁶ With respect to the dairy industry, researchers have found that heat can result in a milk loss of 5.5 kilograms per day per cow.¹⁴⁷ Animal mortality resulting from extreme heat is also well documented. For example, in Quebec, “the loss of at least 500,000 poultry in July 2002, despite the use of modern ventilation systems, shows the gravity of heat waves.”¹⁴⁸ More frequent and intense heat waves may increase animal mortality in the future.¹⁴⁹

5.2 AQUACULTURE AND FISHERIES

The effects of climate change on fisheries and aquaculture are increasingly well documented. Ocean deoxygenation and acidification caused by surface water warming is likely to disturb many species of fish and marine organisms. A reduction in available oxygen levels is particularly harmful to species intolerant to hypoxia (a lack of oxygen supply to body tissues), such as tuna.¹⁵⁰ Rising ocean acidity has a significant impact on the ability of certain mollusks and corals to form their shells.¹⁵¹

In lakes and rivers, freshwater fish and salmonids are particularly sensitive to water levels and flows. Lower water levels in rivers may affect the reproductive capacity of certain species of fish by shrinking spawning areas and interfering with the natural transportation of eggs to floodplains.¹⁵²

With respect to aquaculture, climate change increases the risk of disease and the proliferation of algae and parasites at production sites. In times of drought, aquaculture will compete with other industries, including agriculture, for access to fresh water.¹⁵³

5.3 FOOD INSECURITY: GEOGRAPHIC AND SOCIAL DISPARITIES

Generally speaking, developed nations do not feel the effects of climate change as acutely as developing nations, and they have the financial resources to adapt. According to the FAO, “climate change could exacerbate existing inequalities and further widen the gap between developed and developing countries.”¹⁵⁴

For example, it is likely that equatorial regions, where most developing countries are located, will see reduced yields for some of the most widespread crops (wheat, rice and corn),¹⁵⁵ as well as reduced fish stocks. At higher latitudes, higher temperatures may in fact extend growing seasons and create new agricultural zones. It is probable that many species of fish will migrate to these regions because of ocean warming.¹⁵⁶

In Canada, climate change is likely to exacerbate existing food insecurity among Indigenous peoples and in northern communities. Climate change could impede activities such as hunting, fishing and gathering and compromise the consumption of traditional foods, which make a vital contribution to these communities’ nutrition,

culture and way of life.¹⁵⁷ While Indigenous and northern communities are likely to benefit from warmer temperatures that create new agricultural opportunities, this may not be enough to compensate for the impact of climate change on their food system.¹⁵⁸

It is important to note that food insecurity affects women more than men. Currently, severe food insecurity – going for at least a day without eating in a given year – is slightly higher among women than among men around the world. In Latin America, where the gap is widest, 10% of women experience severe food insecurity compared to 8.3% of men.¹⁵⁹ In developing countries, especially in rural regions that depend on subsistence agriculture, women are particularly vulnerable to climate change. They control less land than men, and the land they control is often of poorer quality. They also have less access to credit and the modern inputs they need to adapt to a changing climate (fertilizer, improved seeds, mechanical tools).¹⁶⁰

5.4 POLICY IMPLICATIONS

Any disruption to agricultural production is certain to have significant economic consequences for both producers (reduced revenue and investment) and consumers, particularly low-income consumers (food price increases and volatility). Climate change is likely to have an impact on global trade and the world economy.¹⁶¹

Reducing food insecurity worldwide – one of the United Nations’ sustainable development goals – depends in large part on how well countries adapt to climate change in the short, medium and long terms. The FAO recommends an integrated approach to fighting hunger based on strengthening partnerships, cooperating in the context of trade, developing sustainable agriculture and fighting climate change.¹⁶²

6 THE ECONOMY

According to the Bank of Canada, climate change is one of the main risks facing the Canadian economy.¹⁶³ The economic risks of climate change can be characterized as *physical* risks from disruptive weather events and *transitional* risks related to the shift to a less carbon-intensive global economy.¹⁶⁴

6.1 PHYSICAL RISKS

More frequent and severe disasters linked to climate change can pose physical risks to the economy directly, and they are both costly and unpredictable. In 2018, extreme weather caused \$2 billion in damage in Canada.¹⁶⁵ Furthermore, with the increasing frequency of these events, the associated costs have grown by approximately \$400 million per year when compared to the previous two decades.¹⁶⁶ Such costs are expected to rise to as much as \$43 billion by 2050.¹⁶⁷

Insured losses from weather-related catastrophic events are also increasing. Between 1985 and 2018, the share of insured losses that were due to weather-related catastrophes, rather than those related to earthquakes or man-made disasters, almost doubled globally.¹⁶⁸

With the rising costs of damage attributed to extreme weather, individuals, companies and governments are unable to purchase insurance to cover these costs. For example, in many parts of Canada vulnerable to floods, overland flooding insurance is unavailable.¹⁶⁹ Across the country, 35% of properties were covered by overland flood insurance in 2018.¹⁷⁰ In some cases, governments have stepped in to assist homeowners to pay for losses that are not insured by the private sector.¹⁷¹

Although weather-related damage has a proportionally larger impact on individuals and organizations with property and investments that are affected directly, the general trend of increasing incidents and costs may lead to the devaluation of other properties and assets, as well as a general reduction in economic activity. If such a trend were to lead to a decline in house prices, for example, consumer spending in the Canadian economy might drop significantly as households' net worth decreased. For example, the 2016 wildfires in Alberta led to a 1% decrease in Canada's gross domestic product (GDP) and set back economic recovery, according to the Bank of Canada.¹⁷²

In addition to the impact of climate change through extreme weather events, its impact on the natural environment could affect particular industries. For example, unusually high temperatures could harm agricultural crops or fishing stocks.

Warmer-than-usual winters in Canada have already affected many industries. For example, rising temperatures have led to the closure of many of the ice roads that mining companies and northern communities depend on for transportation of supplies in the winter months.¹⁷³ The forestry sector has also been affected: for example, warmer winters also led to an epidemic infestation of mountain pine beetles – which are usually killed off in the winter months – that destroyed millions of hectares of pine forest in British Columbia between 1999 and 2015.¹⁷⁴

6.2 TRANSITIONAL RISKS

Transitional risks for the economy are those related to a shift towards a low-carbon economy, according to the Bank of Canada.¹⁷⁵ This shift will impose costs on carbon-intensive sectors of the economy, such as the oil and gas industry. For example, fossil fuel reserves may be left untouched if the costs of extraction become too high, decreasing their value for the provinces and territories that own these non-renewable natural resources, as well as for investors. Or an unanticipated policy measure targeting a carbon-intensive industry could trigger a sudden decrease in the value of the companies operating in that industry. In turn, this could affect these companies' investors and lenders. Conversely, other sectors, such as green technologies, may benefit from the transition.

A producer of fossil fuels, Canada – and its economy – is particularly susceptible to transitional risks. As the global economy shifts to less carbon-intensive activities, changes will occur in the type of energy that is used, what manufacturers produce and how they produce it.

Some of Canada’s biggest manufacturers, such as those in the automotive and aerospace industries, are closely linked to the energy sector. Sudden policy, technological or consumption-related changes may be especially disruptive for these industries because moving labour and capital towards less carbon-intensive sectors is both costly and time-consuming.

6.3 QUANTIFYING THE RISKS

Internationally, work is underway to create a universal taxonomy for defining which activities or financial instruments could be considered environmentally sustainable and to better measure how much physical and transitional risk the financial system faces. For example, central banks and financial supervisors have established a Network for Greening the Financial System, which deals with climate risk management for the financial sector; Canada is a member.

The Task Force on Climate-related Financial Disclosures established by the Financial Stability Board – an international body that monitors the global financial system – developed, in 2016, a set of voluntary disclosure recommendations for companies to assess and inform investors, lenders and insurance underwriters of their exposures to climate-related risks. In June 2019, the task force reported that, while climate-related financial information has increased since it released its recommendations, much more work is required before the risks to the financial system are sufficiently understood.¹⁷⁶

In the 2019 federal budget, the government stated its support for the task force’s standards and “aims to raise firms’ awareness of the importance of tracking, managing and disclosing material climate-related risks and opportunities in a consistent and comparable way.”¹⁷⁷ The federal government also announced the launch of an Expert Panel on Sustainable Finance, which released its final report in June 2019.¹⁷⁸ The 15 recommendations in the report “seek to leverage Canada’s financial acumen to facilitate and accelerate market activities, behaviours and structures that – at scale – could put Canada and its key industries at the forefront of the transition to a climate-smart economy.”¹⁷⁹

7 EMPLOYMENT

The impact of climate change on labour markets is complex and will vary by economic sector, social demographics and geographic location. In addition, the magnitude of the impact on labour depends on the severity of the increase in global temperatures and its effect on the natural environment.

Policy measures to mitigate and adapt to climate change will also have direct and indirect effects on the labour market. Many stakeholders predict labour market transitions within and between different economic sectors. The pace of technological change and adoption is likely to play an important role in these transitions. Overall, climate change will have both positive and negative effects on the labour market.

7.1 NEGATIVE IMPACTS

Extreme temperatures and the increasing occurrence of natural disasters caused by climate change are having a negative impact on employment that depends on ecosystem services. The International Labour Organization (ILO) reported that, in 2014, 40% of total global employment relied directly on ecosystem services.¹⁸⁰ Affected sectors included agriculture, fishing, forestry, food production, biofuels and renewable energy sources. For example, workers could lose their jobs when infrastructure or crops are destroyed as a result of a natural disaster. Others may have to migrate in the short or long term when their environment is destroyed. Also, working conditions may be more difficult for some workers who must deal with increasingly hot temperatures. Climate change therefore affects employment at different levels.¹⁸¹

Carbon-intensive industries, such as oil and gas extraction and refining, and coal-fired power generation, are more likely to see reduced investment and increased operating costs due to any policy measures to reduce carbon emissions that have a negative impact on employment in these sectors.¹⁸²

According to the ILO and the Organisation for Economic Co-operation and Development (OECD), labour market adaptation measures can greatly reduce anticipated job losses due to climate change.¹⁸³ These adaptation measures include:

- the protection and restoration of natural infrastructure – for example, the restoration of certain adaptation-relevant ecosystem services;
- the implementation of skills development programs to help workers move into sectors where there is employment growth, thus protecting them against some of the adverse effects of climate change, including income loss; and
- the implementation of social protection mechanisms – for example, those that offer financial support to communities or individuals affected by natural disasters.¹⁸⁴

The OECD adds that labour market adaptation will be facilitated if those markets function well and that governments must develop policies to adapt the labour market to the new realities created by climate change.¹⁸⁵

7.2 OPPORTUNITIES

Climate change and the transition from carbon-based energy and production systems will create new employment opportunities in the clean technology sector. This sector includes a wide range of companies that operate in almost all sectors of the economy, and it is currently experiencing rapid growth at home and abroad.¹⁸⁶

The main areas of clean technology growth are in the energy sector, including through carbon sequestration; technologies to improve energy efficiency, energy distribution, the production of renewable electricity, and heat production; and the use of biofuels. The transportation sector and the built economy (buildings) have the potential to continuously improve energy efficiency and make a significant transition from fossil fuel consumption.¹⁸⁷

According to the OECD and the ILO, if governments prepare their labour markets for this transition – for example, by identifying the key skills that will be needed for the workforce – transformation and job creation in new sectors will offset job losses in polluting sectors. Adequate preparation will maximize employment benefits in the transition to greener practices.¹⁸⁸

8 CLIMATE CHANGE IMPACTS ON NATIONAL DEFENCE AND SECURITY

Involving elements of human, national, regional and international security, climate change is a non-traditional security threat that transcends borders. Across Canada, the impacts of climate change include the increasing intensity and frequency of extreme weather events, such as floods, droughts, tornadoes, wildfires, heat waves and storms, as well as melting permafrost, coastal erosion and damage to seasonal ice roads in Northern communities. In addition, climate change poses significant risks to the security and well-being of individuals and communities. From a defence and security perspective, climate change is often referred to as a “threat multiplier”: a stressor capable of compounding pre-existing security risks.¹⁸⁹

Principally affecting the most vulnerable populations, climate change makes an impact on security by contributing to the loss of livelihoods, reinforcing environmental pressures and disaster risks, causing displacement, and exacerbating the threat of societal and political unrest.¹⁹⁰ As a result, climate change weakens “the resilience and capabilities of states to respond appropriately.”¹⁹¹ It can also physically threaten essential defence and security infrastructure.

The destabilizing consequences of climate change have been increasingly recognized. According to the U.S. Department of Defense (DoD), the threat multiplier effects of climate change may increase volatility and create “conditions that can enable terrorist activity and other forms of violence.”¹⁹² The 2019 *Worldwide Threat Assessment of*

the US Intelligence Community stated that “[g]lobal environmental and ecological degradation, as well as climate change, are likely to fuel competition for resources, economic distress, and social discontent through 2019 and beyond.”¹⁹³ In January 2019, the United Nations Security Council held a debate entitled “Addressing the impacts of climate-related disasters on international peace and security” that highlighted the multidimensional relationship between climate-related risks and conflict.¹⁹⁴

Canada is not immune to the non-traditional threats posed by climate change. The factors that determine the safety and security of Canadians are interconnected, and weaknesses in policy areas – such as those discussed elsewhere in this publication – are intensified under climate stress, and can create direct and indirect challenges for the defence and security of Canada.

8.1 CLIMATE CHANGE, AND DEFENCE AND SECURITY IMPLICATIONS FOR THE ARCTIC

Encompassing more than 75% of Canada’s coastline and 40% of its landmass, Canada’s Arctic domain is undergoing significant change.¹⁹⁵ Some observers have referred to the Arctic as the “front line” of climate change because Arctic temperatures are rising at a rate that is between two and three times the global annual average.¹⁹⁶ Climate change is affecting the Arctic’s ecosystems, diminishing its sea ice and altering the region’s maritime geography. These effects are resulting in a complex array of challenges and opportunities for Canada and other Arctic nations.

The Arctic has traditionally been treated as a zone of international peace and cooperation. Yet, as climate change eases access to the region, including to natural resources and shipping routes, Arctic activity and competition are projected to rise in the future, and both Arctic and non-Arctic states have demonstrated heightened commercial and strategic interest in the region. Military experts contend that increased access to Arctic shipping routes, which reduce the sailing distance between Asian ports and Northern Europe by 40%, may contribute to disputes about “natural resource exploration and recovery, fishing, and ... future shipping lanes.”¹⁹⁷

North Atlantic Treaty Organization (NATO) Allies have expressed concern about Russia’s increased military presence in the Arctic, which includes efforts to rebuild its Cold War bases, increase its submarine activity, enhance its ballistic and cruise missile capabilities, and expand its icebreaking fleet.¹⁹⁸ Since acquiring observer status on the Arctic Council in 2013, China also has demonstrated greater interest in the region, expanding its scientific engagement, reportedly building its icebreaker capability, and increasing Arctic transit by civilian and military vessels.¹⁹⁹ In 2018, China’s Arctic Policy declared the “Polar Silk Road” as an extension of its Belt and Road Initiative.²⁰⁰

The ramifications of a warming Arctic on military and public safety operations are numerous. Increasing Arctic maritime traffic has potential implications for Canada's ability to exercise control over its sovereignty, carry out effective search and rescue operations, and respond to emergencies. According to Canada's 2019 Arctic and Northern Strategy, as human, commercial and military activities increase in the Arctic, so too do the risks of organized crime, irregular migration, human smuggling and damage to the Arctic's ecosystems.²⁰¹ Given the North's harsh operating environment, Arctic surveillance across the air, land, sea and space domains remains a challenge.

Recognizing both the growing geostrategic importance of the Arctic and the difficulties associated with maintaining security across an immense – yet sparsely populated – region, in 2017, *Strong, Secure, Engaged: Canada's Defence Policy* (SSE) committed the Government of Canada to “[enhancing] its ability to operate in the North and work closely with allies and partners.”²⁰²

SSE identified a number of initiatives designed to adapt Canada's defence policy to a changing Arctic, including those aimed at:

- improving mobility to reach the country's northernmost communities;
- augmenting Canada's long-term presence in the region;
- strengthening situational awareness by replacing older satellite systems;
- developing Arctic-focused capabilities, such as Joint Intelligence, Surveillance and Reconnaissance,²⁰³ tailored to the operating environment;
- conducting joint exercises with Canada's allies and partners; and
- expanding training for the Canadian Rangers, who – through the Canadian Armed Forces Reserve Force – support national security and public safety operations in remote, isolated and coastal regions of Canada.²⁰⁴

Moreover, SSE highlighted whole-of-society emergency management capabilities in the Arctic and Northern communities as a priority.²⁰⁵

Climate change is projected to lead to rapid alterations to the strategic landscape in the Arctic. The intersection of political, social, economic and demographic factors plays a crucial role in examining the relationship between climate change and security in the Arctic. The impacts on societies “depend not only on the magnitude and speed of climate change, but also on the unequally distributed vulnerabilities and adaptive capacity within and between societies.”²⁰⁶ Reducing vulnerabilities and improving resilience to climate threats will require close collaboration among stakeholders, including all levels of government, Indigenous peoples and organizations, Canada's international allies and partners, and the private sector.²⁰⁷

8.2 CLIMATE CHANGE AND THE CANADIAN ARMED FORCES

Between 2008 and 2018, the Canadian Disaster Database recorded more than 195 major disasters in Canada that resulted in billions of dollars in damages, as well as the displacement of hundreds of thousands of Canadians.²⁰⁸ The extent of extreme weather and natural disasters in Canada is expected to worsen with climate change. In November 2019, a report examining the effects of climate change on human health warned that, “[i]n a mid-range GHG emissions scenario, wildfires in Canada are projected to rise 75% by the end of the 21st century.”²⁰⁹

Through Operation LENTUS, which is the response of the Canadian Armed Forces (CAF) to natural disasters in Canada, CAF personnel have been increasingly called upon to respond to climate-related events across the country. Between April and September 2019, the CAF supported provincial authorities following Hurricane Dorian in Nova Scotia, assisted the Province of Ontario with forest fire evacuations, and provided flood relief in New Brunswick, Quebec and Ontario.²¹⁰

Military advisors in the United States have underscored the potential impacts of climate change on military readiness. In explaining that the National Guard, reserve forces and the Army Corps of Engineers are “being called on more frequently to battle wildfires, respond to flooding and major snow events, and move water to drought-stricken areas, at home and abroad,” an advisory board comprising former U.S. military leaders has warned that extreme weather events “will stress these organizations’ capacities and increase the degree to which active forces will be called on in [Domestic Support of Civil Authorities] missions.”²¹¹ They have also advised that the increased demand on these organizations should “be factored into future war plans” and that “[p]lanners should not assume that all forces will be able to deploy on short notice.”²¹²

Canadian Chief of the Defence Staff General Jonathan Vance has noted that climate change has required a shift in how the CAF organizes and allocates resources. For example, he has indicated that

[the CAF maintains] a part of the armed forces at readiness, and in some cases quite high readiness, to be able to respond to Canadians in need. [We now have] a process whereby we anticipate fire season, flood season and increases in the requirement for search and rescue response, depending on when people will be out on the water and land. . . . It has, though, become not a case of the odd occurrence. It’s now almost routine. . . . We take that into consideration in terms of the force structure of the reserves. I’ve given direction to look at developing ways to make the reserves far more capable and ready, in terms of initial response, because they are present [in communities].²¹³

The link between climate change and security can also have implications for the deployment of CAF personnel overseas. Climate change “has the potential to create sustained natural and humanitarian disasters on a scale far beyond those we see today. The consequences will likely foster political instability where societal demands exceed the capacity of governments to cope.”²¹⁴ As a result, the CAF may be increasingly called on to deploy in support of international humanitarian and disaster relief operations. In the aftermath of Hurricane Dorian, the CAF deployed a CC-130J Hercules aircraft to the Bahamas on 6 September 2019 to deliver humanitarian relief to the Caribbean region, two days before the CAF also deployed personnel to Nova Scotia to assist with relief efforts.²¹⁵

The effects of climate change may place at risk not only the pace of CAF operations and CAF’s state of readiness, but also military installations. While to date, the CAF has not publicly released a similar report, in January 2018, the U.S. DoD released a study entitled *Climate-Related Risk to DoD Infrastructure: Initial Vulnerability Assessment Survey (SLVAS) Report*, which found that roughly 50% of military sites reported damage from six categories of risk:

- flooding due to storm surge;
- flooding due to non-storm surge events (rain, snow, sleet, ice, river overflow);
- extreme temperatures (hot and cold);
- wind;
- drought; and
- wildfire.²¹⁶

In the report, U.S. defence officials noted that

[c]hanges in climate can potentially shape the environment in which we operate and the missions we are required to do. ... If extreme weather makes our critical facilities unusable or necessitate costly or manpower-intensive work-arounds, that is an unacceptable impact.²¹⁷

Projected climate impacts in Canada may also be detrimental to physical military infrastructure assets.

Concerning Canada’s military and GHGs, the Department of National Defence (DND) “represents more than half of the Government of Canada’s greenhouse gas emissions.”²¹⁸ In SSE, the Government outlined several “Green Defence” initiatives aimed at reducing DND’s and the CAF’s emissions, such as investing in infrastructure projects to reduce the military’s carbon footprint, transitioning to 20% of non-military vehicle fleets to hybrid and electric by 2020, and installing electric charging stations.

8.3 CLIMATE CHANGE AND NATIONAL SECURITY CONSIDERATIONS

In 2004, two of the three core national security priorities identified in the Government of Canada's National Security Policy were protecting the safety and security of Canadians at home and abroad and contributing to international security. Projected climate change may undermine these objectives. The policy stated that national security threats, including natural disasters and critical infrastructure vulnerability, "generally require a national response, as they are beyond the capacity of individuals, communities or provinces [and territories] to address alone."²¹⁹ As more intense and frequent climate events occur across Canada, the ability of civilian authorities to respond to domestic emergencies effectively and efficiently will increasingly determine the extent to which the safety of Canadians can be assured.

Since 2007, collaboration between multiple levels of government, such other partners as Indigenous communities, the private sector (e.g., critical infrastructure owners and operators) and non-governmental organizations on matters relating to emergency response has been guided by the Emergency Management Framework for Canada.²²⁰ The framework encourages a risk-based "all hazards" approach to planning for major disasters, including climate-related effects. While Canadian efforts relating to emergency management have traditionally focused on preparedness and response, various levels of government are increasingly concerned about "proactive prevention/mitigation efforts and forward-looking recovery measures" to build resiliency among affected Canadian communities.²²¹

Emergency management planning in Canada is highly dependent on critical infrastructure, which comprises:

- energy and utilities;
- information and communication technology;
- finance;
- health;
- food;
- water;
- transportation;
- safety;
- government; and
- manufacturing sectors.²²²

According to the Department of Public Safety and Emergency Preparedness, "[d]isruptions of critical infrastructure could result in catastrophic loss of life, adverse economic effects and significant harm to public confidence."²²³ The Department's *National Cross Sector Forum 2018–2020: Action Plan for Critical Infrastructure*

identified the effects of climate change as a hazard that directly affects critical infrastructure and that is potentially capable of causing “cascading consequences throughout the supply chain.”²²⁴ The action plan underscored that “[t]he development of adaptation strategies for infrastructure in regions exposed to more frequent and severe weather events will be crucial to reducing the negative social and economic impacts of climate change.”²²⁵

9 TRANSPORTATION INFRASTRUCTURE

Canada has an extensive national transportation network to move goods and people across the country. In its report entitled *Transportation in Canada 2018: Overview Report*, Transport Canada identified climate change as one of Canada’s key transportation challenges.²²⁶ According to the department, gradual climate change impacts, such as permafrost thaw and the increasing frequency and intensity of extreme weather events, pose risks to domestic supply chains and the mobility of Canadians. On the other hand, melting ice could lead to increased marine traffic in the North – an opportunity that comes with its share of challenges.

9.1 MARITIME TRANSPORTATION

In its most recent report on the ocean and cryosphere, the Intergovernmental Panel on Climate Change (IPCC) said that melting glaciers and ice caps in the polar regions contribute to warming oceans and rising sea levels.²²⁷ The report’s findings raise concerns that extreme sea-level events that occurred once a century in many regions could occur annually by 2050.

In *Canada’s Changing Climate Report*, the Government of Canada argues that relative sea level will rise along most of Canada’s Atlantic and Pacific coasts and the Beaufort coast in the Arctic.²²⁸ Moreover, a rise in sea level, combined with more frequent storm surges, could lead to increased flooding, damage to coastal infrastructure and shoreline erosion.²²⁹

From an economic perspective, reduced access to ports for tourism and marine trade due to flooding or navigational hazards, such as a storm or sea ice, could have significant impacts. Increased disruption of ferry services could also affect the ability of many Canadians living in coastal areas to travel and obtain supplies. Finally, since ports are often part of an important intermodal transportation infrastructure, disruption of a network element, such as a section of railway with dock access, could force a terminal to reduce or cease operations.²³⁰

9.2 LAND TRANSPORTATION

The observed increases in temperatures in Canada and extreme temperature changes have impacts on land transportation infrastructure. According to a Government of Canada report on climate risks and adaptation practices for the Canadian transportation sector, increased freeze–thaw cycles can cause road deterioration, while high temperatures can cause pavement softening or permanent deformation.²³¹

Precipitation is projected to increase across Canada over the 21st century, although summer precipitation is projected to decrease over southern Canada.²³² Flooding, coastal erosion and landslides caused by more frequent precipitation, storm surges and rising sea levels can affect traffic when they result in road or railway closures. Such closures have a negative impact on Canadians' ability to travel in emergencies or to obtain supplies, which is a real issue for some rural and remote communities.

Extreme cold is a constant concern for railways, as very cold temperatures make steel tracks and wheels more brittle and air brakes more prone to leaks and freezing.²³³ Obviously, milder temperatures in winter could reduce the frequency of these problems. As for high temperatures, the 2014 IPCC report on climate change notes that thermal expansion can cause rail tracks to buckle.²³⁴ Finally, as with roads, rail tracks can be obstructed by heavy rainfall resulting in landslides or mudslides.²³⁵

9.3 AIR TRANSPORTATION

According to the 2014 IPCC climate change report, an increase in the frequency and intensity of storms near airports, particularly in coastal areas, could increase the number of weather-related delays and cancellations. Delays and cancellations can have significant economic consequences, in addition to making it more difficult to supply some rural and remote regions. Moreover, many of the climatic factors affecting land transportation, such as precipitation and freeze-thaw cycles, also have negative consequences for runway use and maintenance.²³⁶

9.4 NORTHERN CANADA

Although not as developed as the system in southern Canada, the northern transportation system plays a crucial role in the socio-economic development of the region's communities, which represent less than 1% of the Canadian population and include a high proportion of Indigenous peoples.²³⁷ The transportation system in the North strengthens regional links while facilitating the movement of people and goods and creating economic opportunities across this vast territory.²³⁸

The northern regions have specific transportation infrastructure characteristics. The road network is almost non-existent in some areas, particularly in Nunavut, where communities are more dependent on air and marine transportation for supplies and travel. Yukon has a more extensive and year-round road network. The Northwest Territories is accessible by air, rail, road and sea.²³⁹

About half of Canada's land area is permafrost,²⁴⁰ a layer of ground that supports ecosystems, communities and transportation infrastructure.²⁴¹ This layer is vulnerable to climate change, and the resulting impacts are numerous.²⁴² Given that the climate in Canada's North is warming faster than anywhere else in the world,²⁴³ the impacts of global warming are more pronounced in northern regions than elsewhere. For example, melting permafrost threatens soil stability, which affects existing infrastructure, including roads and runways.²⁴⁴ In addition, with the decrease in ice cover due to global warming, it is becoming increasingly difficult to use winter roads, restricting the land-based connection between remote communities and the rest of the country.

9.4.1 Opportunities and Challenges

Notwithstanding the above, climate change can offer opportunities for transportation infrastructure in Canada's North under certain conditions. For example, melting ice and an extended summer season facilitate marine transportation in the Canadian Arctic and could contribute to the growth of several economic sectors, including commercial fishing and shipping, tourism and natural resource development.²⁴⁵

To support this growth, in Budget 2017 the Government of Canada announced investments in trade and transportation projects, creating the National Trade Corridors Fund as part of the Trade and Transportation Corridors Initiative. This initiative aims, among other things, to develop more efficient transport corridors to international markets.²⁴⁶ More specifically, the initiative aims to improve the safety of Canada's northern transportation system and help it withstand the impacts of climate change.²⁴⁷

However, the opening of the Northwest Passage to navigation brings with it a number of national security challenges. First, the likely increase in maritime traffic for economic and scientific activities will require Canada to increase its surveillance and policing activities in the region. According to a recently released document by the federal government, the *Arctic and Northern Policy Framework*, there are currently gaps in infrastructure and monitoring in Canada's Arctic and North.²⁴⁸ To address these gaps, the framework sets out Canada's objective to strengthen its surveillance and control capabilities by enhancing its military presence in the region.²⁴⁹

9.5 INFRASTRUCTURE

The design and construction of new infrastructure will have to take climate change into account. It is estimated that an important proportion of Canada's public infrastructure is nearing the end of its serviceable lifespan,²⁵⁰ which means that significant investments will be required for its replacement, restoration and maintenance in the near future. To ensure its sustainability, the effects of climate change will have to be taken into account throughout the infrastructure life cycle.

The Government of Canada has adopted various measures to address the impacts of climate change, including the following:

- the Northern Transportation Adaptation Initiative;
- the Transportation Assets Risk Assessment Program;
- the Disaster Mitigation and Adaptation Fund; and
- the Municipalities for Climate Innovation Program.

NOTES

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