Climate Change Adaptation and Housing in Canada:

A Policy Integration Analysis at Multiple Levels

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A Thesis

In the Department of Geography, Planning, and Environment

Presented in Partial Fulfillment of the Requirements for the Degree of Master of Science (Geography, Urban, and Environmental Studies) at Concordia University

Montreal, Quebec, Canada

November 2022

CONCORDIA UNIVERSITY
School of Graduate Studies

This is to certify that the thesis prepared

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Entitled: Climate Change Adaptation and Housing in Canada: A Policy Integration Analysis at Multiple Levels

and submitted in partial fulfillment of the requirements for the degree of

Master of Science (Geography, Urban, and Environmental Studies)

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Abstract

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Alice Yue

Adaptation is an essential component of action to deal with the growing severity of climate change. It is widely recognized in the literature that adaptation is a cross-cutting issue that requires deliberate and coordinated engagement from all sectors and levels of governance to achieve successful implementation. The housing sector is particularly impacted by climate change. Frequent exposure to climate events such as flooding, wildfires, and extreme heat are leaving households unable to cope with worsening conditions. In addition to physical risks, lack of access to safe and secure housing is a major driver of social vulnerability, which increases the disproportionate burden of climate change experienced by disadvantaged and marginalized groups. In Canada, housing makes up one of the biggest industries and therefore has become a crucial consideration in national adaptation efforts. To date, Canada has favoured a decentralized governance approach to climate change adaptation that disperses responsibility across federal, territorial, provincial, and municipal jurisdictions. Consequently, strategic initiatives are emerging to address adaptation from each level of government, which raises the question of how well integrated adaptation action is across sectors and levels of government. Does Canadian adaptation policy recognize the role that housing policies play in shaping climate change-related risks and vulnerabilities? To what extent is housing and adaptation policy vertically (by level of government) and horizontally (by sector) integrated? In answering these questions, this paper builds on a growing body of policy integration research by conducting a content analysis of policy goals and instruments in Canadian housing and climate change adaptation strategies. Using a policy comparison framework adapted from Candel and Biesbroek (2016), I identify 62 strategic documents related to adaptation and housing policy published since 2015 from 27 units of government. I identify 2,088 policy instruments from these documents and examine the extent to which there is integration across policy frames, goals, instruments, and policy subsystems within these policy domains. Though there are climate policy integration studies in other sectors such as forestry, energy, and agriculture, this paper will demonstrate the first policy integration study involving adaptation and the housing sector. It aims to shed important insight on challenges in Canada's policy design in these sectors to inform more coordinated climate resilience policymaking in the future.

Acknowledgements

The creation of this thesis began under unconventional circumstances, and it's surreal to see this chapter of life circling towards its conclusion. It's been a long, and far from individual effort.

Alex, learning from you has been an immense privilege. Our conversations week after week keep me renewed and inspired. Thank you for your patience and gentle counsel while I found confidence in my ideas.

To my labmates, classmates, and co-workers turned to friends—what a blessing it is to have crossed paths in this funny life! I'm so proud of you all, and can't wait to see what is in store for us down the road.

Robyn, Sarah—this thesis would not have been possible without your support. I see reflections of my past and future in you both, which has provided me both consolation and compassion during my lowest moments. Thank you for your enduring companionship even across the inordinate amount of land borders that separate us.

Finally, profound thanks to my family, who keep me in check, push me to do better, and empower the best version of myself.

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1. General Introduction

Climate change is a critical global challenge as we face the accelerating effects of anthropogenic greenhouse gas emissions. Canada is not exempt from this challenge and faces an array of climate risks across its geographically diverse territory. The consequences of these risks are being felt across sectors and regions, where higher temperatures and more frequent and intense weather events are threatening infrastructure and human security across the country (Warren & Lemmen 2014). Nationally, Canada is experiencing double the rate of average global temperature change (Bush & Lemmen, 2019). Canada's Atlantic coast is experiencing both subsidence and increased risks of coastal flooding due to sea level rise (Lemmen et. al, 2016). Warming in western Canada is contributing to more frequent wildfire and drought occurrences (Warren & Lemmen 2014). Northern Canada is warming three times faster than the global mean (increasing 2.3 degrees Celsius in the past 70 years), heavily impacting snow and ice cover in the region (Bush & Lemmen, 2019). Major flooding ravaged Quebec in 2017 and 2019, displacing almost 15,000 people and incurring over $500 billion (CAD) dollars in insurance claims and disaster relief (Perreaux 2018; Saint-Arnaud 2019). Catastrophic flooding in British Columbia during 2021 resulted in over $450 million (CAD) in damages—an underestimated amount that doesn't take into account damages suffered by homeowners without flood insurance (Charlebois 2019). In the same year, the Pacific Northwest experienced record-breaking temperatures linked to the "heat dome" effect, bringing about unprecedented conditions that pose significant risk to human health and well-being (Philip et al., 2021). The ramifications of these worsening climate realities are being felt across sectors and regions, where higher temperatures and more frequent and intense weather events are threatening infrastructure, biodiversity, food security, and human security (Warren & Lemmen 2014). These impacts are particularly acute for vulnerable groups like low-income households, immigrants, the elderly, women, and Indigenous peoples, who often experience the worst of flooding, extreme heat, and other hazards while having the least amount of resources to cope (Bednar et al., 2019; Furgal & Seguin, 2006; Perreault et al., 2020; Thistlethwaite & Henstra, 2017).

Mitigation of current and future emissions coupled with intentional adaptation is required to reduce vulnerability and increase capacity to cope with worsening climate hazards (Schipper, 2006; Smit & Wandel, 2006). Adaptation is now recognized as an essential component of

Canada's response to climate change in all sectors, and particularly in housing where it has committed to investing in more resilient and energy efficient infrastructure and stringent building codes in an effort to adapt to climate change impacts (Government of Canada, 2016). The Canadian housing sector contributes 9.43% to Canada's gross domestic product and is a major and growing source of household debt in Canada (Statistics Canada, 2021). It is already experiencing increasing impacts from extreme weather events like flooding and wildfires (Smoyer-Tomic et al., 2003; Thistlethwaite & Henstra, 2017; Valois et al., 2020). In addition to physical risks, lack of access to safe and secure housing is a major driver of social vulnerability, which increases the disproportionate burden of climate change experienced by disadvantaged and marginalized groups (Ajibade & McBean, 2014; Owusu & Nursey-Bray, 2019; Perreault et al., 2020). Poorer households, for example, often lack the funds to move away from risks and can become trapped in hazardous zones, contrasting with the outmigration of wealthier households to safer areas (De Koning & Filatova, 2020; Keenan et al., 2018). Shelter, as a basic human need, is also a crucial determinant to physical and mental well-being, access to resources, and access to social support networks, all of which help to improve human capacity to adapt and cope with climate impact (Kohen et al., 2015; Pepin et al., 2018).

Successful adaptation requires deliberate and coordinated efforts from all sectors and levels of governance in order to maximize synergies and avoid unintended negative consequences that exacerbate social vulnerability (Anguelovski et al., 2018; Candel & Biesbroek, 2016). Multi-level governance has emerged as a common form of governance, resulting in a dispersal of authority across a vast number of jurisdictions (Bulkeley & Betsill, 2005, 2013; Candel & Biesbroek, 2016; Hooghe & Marks, 2010). In Canada, for example, adaptation policymaking is usually the culmination of numerous levels of government, non-government, and private actors (Bednar & Henstra, 2018; Henstra, 2017). This dispersal of authority across jurisdictions, especially when tackling cross-cutting issues, can generate challenges with coordination and integration between subsystems. Each actor or system may operate differently and embody different characteristics, and a lack of a holistic approach can exacerbate social vulnerability or have other serious consequences on society (Cejudo & Michel, 2017; Tosun & Lang, 2017).

The past five years have seen a number of housing- and climate change-related strategies adopted in Canada by a range of actors. The objective of these plans is to provide an overarching

framework to guide decision-making, identify new priorities, and demonstrate a new and continued commitment to advancing housing and climate change policy action in the coming years. At the federal level, this includes the adoption of the National Housing Strategy in 2017 and the Pan-Canadian Framework Convention on Climate Change in 2016. At the provincial and territorial levels, corresponding regional housing and climate change strategies were established from 2017 onwards in accordance with the federal frameworks. To date, all 13 units of provincial and territorial governments and most major municipalities have adopted these strategies.

Despite the significance of the housing sector for adaptation implementation in Canada, it is unclear to what extent housing and adaptation are being integrated in climate change planning across regions and levels of government. Existing policies such as the Pan-Canadian Framework on Climate Change and the National Housing Strategy are still nascent, and a comprehensive assessment is needed to determine the extent to which the relationship between housing and adaptation is reflected in these key strategic frameworks and their associated implementing mechanisms. In this thesis, I conduct a comprehensive assessment of both vertical integration (between levels of government) and horizontal integration (across sectors) in Canadian adaptation and housing policy and governance in answering the following questions:

1. Do housing and climate change strategies at the Canadian federal, provincial, and territorial levels recognize the role that housing plays in reducing climate change-related risks and vulnerabilities?

2. To what extent are policy goals and instruments in Canadian federal, provincial, and territorial housing and adaptation policies vertically and horizontally integrated?

Climate Policy Integration (CPI) has emerged as a key analytical approach for examining current efforts around vertical and horizontal policy integration and understanding how to maximize the effectiveness of adaptation policies whilst minimizing trade-offs and potential unintended negative outcomes (Di Gregorio et al., 2017). Here, I will apply the CPI approach to the housing and climate change adaptation policy sectors.

To operationalize the CPI approach, this thesis analyzes emerging policy mixes that capture the extent to which adaptation and housing policies are being linked within key strategic planning policies for adaptation and housing at the federal and regional levels. Policy mixes are defined as the accumulation of policy goals and instruments over time and across sectors to address particular policy issues. Effective policy mixes minimize negative and contradictory interactions while maximizing synergy and cooperation within the policy landscape (Cejudo & Michel, 2017; Howlett & Rayner, 2007; Lesnikowski et al., 2019). More specifically, I will analyze key climate change and housing strategies and their implementation mechanisms that are being established at the federal, provincial, and territorial (FPT) levels to identify whether climate change risk reduction policies and housing policies are being considered in relation to one another, and whether existing policy goals and instruments are interacting in synergistic or conflicting ways. This research aims to uncover whether adaptation planning is taking into account key housing issues, and whether housing priorities are responding to key climate change risks and vulnerabilities.

This thesis follows a manuscript-based thesis structure. The following section summarizes key literature on adaptation governance and policy, policy integration, and interactions between the adaptation and housing policy domains. The third section includes the manuscript, composed of an introduction to key concepts, methodology, results, and discussion. The final section concludes with reflections on policy and suggestions for further research.

2. Literature Review

This literature review is organized into four sections that provide contextual information into adaptation governance in Canada, as well as key concepts that constitute the foundation of this study. The first section discusses how housing vulnerability is related to climate change, followed by an overview of the current context of adaptation governance in Canada. The final two sections outline scholarship on policy mixes and policy integration, and how they are operationalized for the purposes of this study.

2.1 Housing and climate change vulnerability

Vulnerability is a central concept in adaptation studies, and adaptation policies are often framed as a response to climate change-related vulnerability (Dupuis & Knoepfel, 2013). A commonly cited definition from the IPCC defines vulnerability as "the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change […]" (McCarthy et al, 2001). O'Brien et al. (2007) expands on this definition by making a distinction between "outcome" and "contextual" vulnerability. Outcome approaches tend to prioritize biophysical aspects of vulnerability, considering it as the 'end-point' or result of climatic impacts on a certain group. This framing of vulnerability is more scientific and quantifiable. The IPCC definition cited above also conforms with the outcome perspective to vulnerability. Contextual vulnerability provides a more nuanced and expansive interpretation of vulnerability, recognizing that climate change doesn't exist in a vacuum, but rather against the backdrop of human socio-political structures. In this view, human society and the environment are inseparable through dynamic and continuous interactions that affect vulnerability.

Vulnerability scholarship has grown steadily year-by-year since the concept was first introduced to the environmental field in 1990, especially attracting considerable attention from 2006 onwards (McDowell et al., 2016; Wang et al., 2014). The 'outcome' framing of vulnerability largely dominated early discourse and research up until the 2000s, when 'contextual' vulnerability framings started to become more widely used (Ford et al., 2018; McDowell et al., 2016). However, McDowell et al. (2016) finds that some studies claiming to adopt a contextual vulnerability framework actually concentrate on biophysical risks and do not critically engage with social vulnerability.

This thesis adopts a contextual view on vulnerability. Housing systems are an example of a socio-political structure that has a multi-faceted relationship with climate change and vulnerability. The housing system through its institutions, actors, and policies can create and re-produce social vulnerability by privileging certain interests and providing differential access to housing rights and tenure (Aarland & Reid, 2019; Agyekum et al., 2020; Ajibade & McBean, 2014; Cunsolo Willox et al., 2012; Lee & Zandt, 2019; Owusu & Nursey-Bray, 2019). On the other hand, it can also reduce social vulnerability through the provision of affordable housing and other social services (Canham et al., 2019; Dreier & Hulchanski, 1993; Vale et al., 2014). Investing in energy-efficient housing is an example of a direct action that can reduce utility costs and ease energy poverty (Tsenkova et al., 2011). Strategic actions like mitigating language barriers by providing interpreters and other language resources, increasing accessibility of meeting spaces, and subsidizing transportation costs can facilitate more involvement from vulnerable groups in decision-making processes to affect more inclusive housing policy (Edge et al., 2020).

It is well-established in the literature that climate change impacts are particularly devastating for marginalized groups, who are more likely to be displaced and affected by climate events but less likely to have the resources to be able to cope with them (Anguelovski et al., 2016; Cunsolo Willox et al., 2012; Furgal & Seguin, 2006; Sovacool et al., 2015). Housing vulnerability literature demonstrate that having access to housing and housing rights is crucial to decreasing vulnerability (Aarland & Reid, 2019; Ajibade & McBean, 2014; Freitas et al., 2019; Owusu & Nursey-Bray, 2019; Pandey et al., 2018). The concept of marginalization originates from the Global South, explaining how structural factors constrain vulnerable groups from participating in environmental stewardship while also increasing their risk to climate hazards. A lack of proper access to quality housing has been found to push vulnerable groups to participate in sometimes dangerous coping methods and strategies that can lead to the gradual degradation of environmental and human health, or erode natural resilience against disasters (Ajibade & McBean, 2014; Pandey et al., 2018; Porio, 2011). A study on informal settlements in Lagos, Nigeria shows that residents participate in hazardous practices like ‘waste-filling’ for housing construction and flood control which pollutes the environment while accelerating the spread of disease and land subsidence. An absence of housing tenure and “constant threats of eviction and

demolition" also encourages the construction of temporary and weak housing structures that are unable to withstand or protect residents from flooding hazards. Not to mention, the impermanence of housing causes increased instances of psychological stress, decreases environmental stewardship, and constrains adaptation efforts. In this case, residents are essentially putting themselves at higher risk to climate hazards for temporary shelter (Ajibade & McBean, 2014). Oulahen (2021) explores the concept of facilitation in relation to marginalization the face of increasing flood risk in Canadian coastal communities. While marginalization theorizes how vulnerable groups are constrained by socio-structural factors and exposed to further risk, facilitation articulates how the same socio-structural forces "enable other groups of people to pursue environmental benefits" without having to take on the full extent of risk (Oulahen, 2021). Oulahen (2021) finds that not only are affluent groups choosing to live in flood-prone areas to reap the environmental benefits of living close to water, they are simultaneously marginalizing long-term residents who do not have the same resources to mitigate risk and enjoy environmental rewards.

Some studies in the Global North that illustrate the tensions between marginalization and facilitation from France, Canada, the US, and the UK show that those most at risk of death during extreme heat events are those predisposed to health issues, and those living in older buildings without insulation (Chen et al., 2020; Mavrogianni et al., 2015; Price et al., 2013; Smoyer-Tomic et al., 2003; Vandentorren et al., 2006). Flood management research in the US shows that flood-prone areas tend to be poorer, less-educated, lower income, and more racially diverse (Collins et al., 2019; Mach et al., 2019; Siders et al., 2019). Siders (2019) also finds that buyout programs, a popular strategy for flood management in the US, are characterized by vague and subjective governance that could exacerbate social inequity and vulnerability by enabling 'white flight' and more segregation. More broadly, vulnerability or adaptive capacity is shaped by access to resources, social protection, and decision-making capacity in housing choices (Ajibade & McBean, 2014; Pandey et al., 2018).

In the United States, there is a rich scholarship on environmental and housing justice that examines contextual drivers of climate change vulnerability (Collins et al., 2019; Curran & Hamilton, 2012; Hoffman et al., 2020; Keenan et al., 2018; Siders et al., 2019). In the Canadian context, this relationship is most evident in the scholarship focused on the Canadian North and

Indigenous communities, where a lack of adequate access to housing has serious physical and psychological health consequences that decreases adaptive capacity (Fayazi et al., 2020; Kohen et al., 2015; Pepin et al., 2018; Perreault et al., 2020). Northern Canada is already experiencing unique geographical changes due to climate change, from thawing permafrost to coastal erosion that threatens existing infrastructure and livelihoods (Ford et al., 2018; Ford & Smit, 2004). Although northern Canadian communities have demonstrated strong adaptive capabilities to the changing climate, researchers predict that accelerating climate impacts will surpass coping capacity and require deliberate and transformative adaptation intervention (Ford et al., 2006; Ford, Champalle, et al., 2015; Kates et al., 2012). In non-Indigenous communities in Southern Canada, however, housing vulnerability has generally been researched as an outcome of biophysical climate risk and less is known about socio-structural factors (Picketts et al., 2014; Thistlethwaite & Henstra, 2017). This is reflected in Canada's policy approach and priorities, which focuses on reducing property damage by building physical resilience to hazards (i.e. construction of dams, dikes, pumps) and restricting development in high risk areas (Thistlethwaite & Henstra, 2017). This absence of research on environmental and housing justice in the Canadian context punctuates the need for more justice and equity research in Canada.

Current adaptation approaches to managing the housing-climate change nexus in Canada tend to focus on reducing exposure in the built environment to biophysical risks and targeting property owners. Canada is moving towards a shared responsibility framework in tackling many climate risks, transferring responsibility to other stakeholders and homeowners themselves to invest in protection and recovery from climate hazards (Henstra et al., 2019). This is particularly the case for flooding, where property owners are expected to implement property-level flood protection (PLFP) measures and purchase insurance to protect themselves from flooding. There are a few concerns in this approach, however. First, Henstra et al. (2019) find, in a study across 10 provinces, that there is weak incentive among property owners to implement mitigatory or recovery measures, likely due to low awareness of flood exposure risks. Second, Canada's adaptation priorities demonstrate a bias towards homeowners (e.g. disaster assistance programs targeted towards homeowners), excluding renters and non-property owners from the conversation about adaptation and housing (Edge et al., 2020). This reflects a pervasive renter bias in Canadian housing policy, where studies show that the Canadian housing system

privileges homeownership despite growing unaffordability and inaccessibility of home-owning, particularly for young, low-income, and migrant households (Aarland & Reid, 2019; Agyekum et al., 2020; Hulchanski, 2006; Novac et al., 2002; Thistlethwaite & Henstra, 2017; Walks, 2014). Despite a significant and growing rental sector, housing tenure appears to be under-researched in relation to climate change adaptation (Instone et al., 2015).

2.2 Adaptation governance in Canada

Adaptation is a key pillar of global climate change governance and is rapidly emerging as a formal policy area across every level of government and around the world (Magnan, 2016; Lesnikowski et al., 2016). Schipper (2006) outlines the history of adaptation, how its conceptual framework has changed overtime, and how it shapes climate change policy today. Until the end of the 20th century, adaptation was largely considered as a secondary priority to, or even a distraction from, mitigation of greenhouse gas emissions (Pielke et al., 2007). Focusing climate change policy efforts on adaptation was generally unpopular and controversial, since it was perceived to represent a "defeatist" perspective on addressing the root causes of anthropogenic climate change (Schipper, 2006; Smit & Wandel, 2006). This perspective began to shift in the mid-2000s, however. Adaptation was formally recognized to be of equal importance to mitigation in the 2010 UNFCCC Cancun Agreement, where low and middle-income countries pushed for the prioritization of adaptation to protect vulnerable groups against the inevitable and already occurring impacts of climate change. As the consequences of climate change are becoming increasingly apparent around the world, adaptation has now emerged as a key pillar of climate change governance, and as a strategy to be developed further in the face of intensifying impacts of climate change.

Canada's first major national climate action framework was adopted in 2016 to identify pathways for both emissions reduction and resilience-building efforts. The Pan-Canadian Framework on Clean Growth and Climate Change (2016) identified infrastructure investments, addressing climate-related health risks, providing more support to vulnerable areas, reducing climate hazard risks, and incorporating both Traditional and scientific knowledge into resilience-building as priorities for adaptation policies in the coming years. Scholarship on adaptation governance in Canada has also advanced in many different directions in the past decade (Clar &

Steurer, 2019; Henstra, 2017; Picketts et al., 2013; Vogel et al., 2020). Some studies have focussed on looking at different methods to build adaptive capacity in northern Canada through co-management, Traditional Knowledge, and other community-based methods (Armitage et al., 2011; Ford et al., 2016; Pearce et al., 2015). Outside of the North, there are individual-level studies from other regions looking at building resilience to flooding, heat, and wildfires (Austin et al., 2015; Thistlethwaite & Henstra, 2017). However, adaptation governance pertaining to policy integration has not been studied in Canadian literature.

Climate change impacts affect nearly every aspect of society; consequently, adaptation requires engagement from all levels of government and multiple sectors. In other words, effective adaptation necessitates some form of multi-level governance (Amundsen, 2010; Biesbroek & Lesnikowski, 2018; Juhola et al., 2011; Keskitalo et al., 2016; Urwin & Jordan, 2008). Multilevel governance describes how authority and power are shared among state and non-state actors in a policy system. Hooghe and Marks (2001) distinguish between two types of multi-level governance. Type 1 captures how power is shared across vertical levels of government that tackle a diverse range of issues within their geographic jurisdictions. In Canada, vertical governance manifests through its federal, provincial/territorial, and municipal governments. Type 2 captures how authority has dispersed horizontally between policy sectors and public or private actors. These actors are generally more specialized and focused on a specific issue. Both types of governance are present and important in Canada.

Climate change risks are dynamic and characterized by many uncertainties, requiring a high level of flexibility from governance structures. Single-level forms of governance are likely to be insufficient to address adaptation on their own, as they are less able to engage with the contextually diverse and changing aspects of adaptation to climate change (Biesbroek & Lesnikowski, 2018). The role of national governments is often to provide leadership, direction, and information to facilitate the adaptation process. Local governments, with knowledge of unique contextual factors, implement appropriate policies according to local needs and priorities (Biesbroek & Lesnikowski, 2018). The emphasis on multi-level governance approaches to adaptation is a shift from early framings of adaptation as a fundamental local issue. Critiques of the localist agenda point to the fundamental limits that local governments and actors face in assuming responsibility for adaptation when they are not equipped with the authority, staff skills,

and financial resources to undertake large-scale adaptation (Nalau et al., 2015). In a policy instrument study including 125 local governments across the Global North, Lesnikowski et al. (2020) finds that countries with more engagement at the national level are more likely to have substantive local adaptation policy adoption. This finding compliments research from Amundsen (2010) and Keskitalo et al. (2016), which finds that an important reason for lackluster adaptation at local levels is a lack of leadership and support for local-level implementation from the national level. Oulahen (2018) identifies similar challenges in Canada, where inadequate collaboration, lack of senior-level political leadership, and inconsistency of policies between levels of government are major barriers to climate change adaptation.

Canada follows a network governance approach to adaptation implementation which involves a mix of government, public, and private sector actors that contribute to a shared goal beyond self-interest (Bednar & Henstra, 2018). What differentiates network or collaborative governance from other governance modes is that it is characterized by trust and collaboration between stakeholder groups, where authority is 'flattened' and shared relatively equally across the network. Historically, this was seen through the creation of Regional Adaptation Collaboratives (RACs) from 2009 to 2012 established by Natural Resources Canada to facilitate and coordinate adaptation planning across governments and sectors (Bauer & Steurer, 2013; Wellstead et al., 2016). The implementation of climate change risk assessments and adaptation planning into tangible policies and programs remains weak in Canada, however. The Auditor General's 2017 and 2018 reports on adaptation implementation in federal and regional policy found that Canadian governments rarely develop detailed adaptation plans that outline budgets, timelines, and precise outcomes. Rather, they find that adaptation planning is not systematic and that regions were not supplied with the leadership or resources to achieve adaptation outcomes (Auditor General of Canada, 2017-2018). Bednar et al. argue that Canada's reliance on network governance approaches to managing adaptation has created an implementation deficit, where there is a disconnect from the early stages of adaptation planning such as risk identification and goal-setting, to following through with concrete actions (Bednar et al., 2019). The voluntary involvement and shared authority that typifies network governance, although beneficial for adaptation planning, also results in circular discussions and lack of enforcement mechanisms to

ensure timely decision-making and implementation. As such, it could be concluded that national leadership on adaptation so far has been weak.

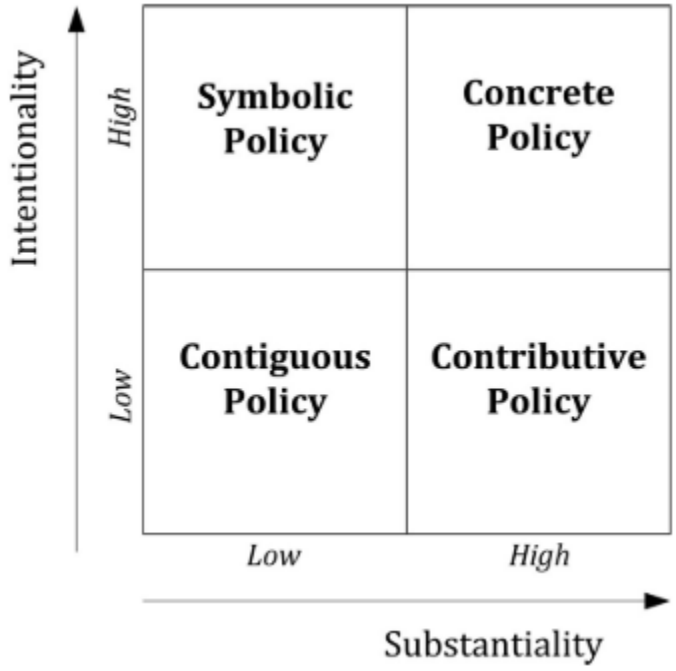
2.3 Tracking adaptation policies

Given the complex and multi-scalar nature of climate change impacts, adaptation is emerging in a complex policy environment that spans sectors and geographic regions, and where there are a wide range of goals, approaches, and tools coming from different actors at different times (Lesnikowski et al., 2019). This has generated two main challenges for comparing adaptation across contexts. First, in the conceptualization of adaptation, where the multitude of definitions that exist makes it difficult to establish conceptual clarity and consistency. Within adaptation policy research, this is referred to as the 'dependent variable problem': "the indistinctness of the phenomenon that is being measured and the fuzziness of its scope and boundaries, which leads to contradictory results and difficult comparisons between studies" (Dupuis & Biesbroek, 2013, pg. 1476). Second, that there is no single approach to "measuring" adaptation, making it difficult to understand how adaptation is progressing over time (Berrang-Ford et al., 2019; Ford et al., 2013). While mitigation policy progress and outcomes can be tracked and assessed based on changes in greenhouse gas emissions, adaptation has no such obvious outcome metric, and its definition and measurement are contested (Dilling et al., 2019; Ford et al., 2015). It is hard to know what "successful" adaptation looks like, given that future climate conditions are unknown. Ford et al. (2013) identify four main approaches to adaptation tracking: outcome-based, readiness-based, process-based, and policy-based tracking. This study assesses adaptation using the policy-based tracking approach. In lieu of direct outcome measurements that are difficult to achieve in adaptation research, policy instruments are used as a proxy measurement as they are often a clear reflection of changing levels of engagement and action on adaptation (Lesnikowski et al., 2019). Policy instruments are the mechanism by which governments translate goals into concrete action. They reflect the tangible goals and actions that governments are taking in response to socio-climatic vulnerability (Berrang-Ford et al., 2019). The policy-based tracking method as a metric for adaptation is particularly effective for monitoring progress over time, conducting comparative analysis, and identifying general trends in adaptation planning, and has therefore been a popular approach in many comparative climate change policy studies (Henstra,

2016; Lesnikowski et al., 2019; Macintosh et al., 2015; Mees et al., 2014; Schaffrin et al., 2015; Vogel et al., 2020).

Here I follow with the definition of adaptation provided by Dupuis and Biesbroek, who describe adaptation as: "The process leading to the production of outputs in forms of activities and decisions taken by purposeful public and private actors at different administrative levels and in different sectors, which deals intentionally with climate change impacts, and whose outcomes attempt to substantially impact actor groups, sectors, or geographical areas that are vulnerable to climate change" (Dupuis & Biesbroek, 2013, pg. 1480). Dupuis and Biesbroek (2013) explore the concepts of intentionality and substantiality in their definition, and further cross these two concepts in a matrix to distinguish between the four types of policies that are often labeled as "adaptation': symbolic, concrete, contiguous, and contributive policies (see Figure 1). Contiguous policies are not intended for climate change, nor do they have a substantial impact on reducing climate change vulnerability. While contributive policies (e.g. disaster risk reduction) can have a substantial influence on reaching adaptation objectives, they do not consider climate change impacts in the long term. Symbolic policy describes policies that are purposefully created for adaptation, but have a weak or indirect impact. Concrete policies describe perhaps what is the ideal type of policy for adaptation, one that is both intentional and has a substantial impact on reducing vulnerability. In their definition, Dupuis and Biesbroek advance a stricter outlook on what should be defined as adaptation policy—that they should be purposeful and sufficiently substantial, to avoid "comparing apples to oranges" in adaptation studies.

Figure 1. Typology of policies labeled as "adaptation"



Note. Reprinted from "Comparing apples and oranges: The dependent variable problem in comparing and evaluating climate change adaptation policies", by Dupuis, J. and Biesbroek, R., (2013).

A public policy is an action undertaken by the government in response to an issue, consisting of "goals, targets, instruments, and agents" (Henstra, 2016; Lesnikowski et al., 2019). Policy instruments (e.g. laws and regulations, funding, educational campaigns) are created by government actors and target different sectors and/or actors affected by climate change risks. These instruments are the key mechanisms by which governments implement their policy goals (Biesbroek & Delaney, 2020; Schaffrin et al., 2015). Policy instruments can be either "substantive" or "procedural". Substantive instruments take direct action on a policy issue by enacting "hard" policies (e.g. educational programs, subsidies, laws and regulations) that direct affect behaviour, while procedural instruments are "soft" instruments (e.g. public outreach, creation of advisory groups, research funding) that aim to shift behaviour through voluntary means (Macintosh et al., 2015). These different instruments are technically substitutable, meaning that there is no one correct instrument to address any problem (Henstra, 2016; Macintosh et al., 2015). As such, policy instrument choice is a political decision, and the deliberate selection of one kind of instrument over another can serve the interests of different

groups. Even if policy instrument choice is subjective, its impacts can produce maladaptive outcomes.

Policy mixes are combinations of policy goals and instruments that are designed to address a certain policy problem. Singular policy goals and instruments tend to accumulate over time to create dynamic and complex policy mixes (Howlett et al., 2017; Howlett & Rayner, 2007; Lesnikowski et al., 2019). Howlett et al. (2017) distinguish different types of policy mix complexity, which range from a spectrum of 'simple' to 'complex'. The simplest policy mixes are comprised of single goals, instruments, and levels, while most complex policy mixes comprise of multiple goals at multiple levels using multiple instruments. The gradual addition of individual policy instruments into increasingly complex policy mixes creates a higher likelihood for tensions, incoherencies, and inconsistencies to emerge when compared to comprehensive replacement of old policy mixes with new mixes that are better suited to changing needs. Howlett and Rayner (2007) explain that that these inconsistencies can be introduced through processes of layering (overlap of goals and instruments), drift (changing goals without changing instruments), and conversion (changing instruments in one sector to try to influence another). These mechanisms also demonstrate an additional concern, where new policy initiatives are, to an extent, predetermined and constrained by historical policies (Lesnikowski et al., 2019). In other words, path dependency constrains reflexive policy (re-)creation or updating processes that are necessary to enhance policy mix synergies and prevent maladaptive outcomes.

Numerous typologies have been developed and tested to classify policy instruments, and are an important analytical tool in observing policy mixes. A policy mixes approach allows for flexibility and consistency of research design when considering the variability of actors and sectors involved in adaptation policymaking. The Nodality (information), Authority (regulation), Treasure (finance), and Organization (administration) (NATO) typology first developed by Christopher Hood (1983) is a popular and enduring typology for identifying and comparing policy instruments due to its parsimoniousness in distinguishing very specific instrument types. NATO has been applied to various adaptation contexts, including in Canada by Henstra (2017), in a large sample study including 125 local governments by Lesnikowski et al. (2019), and in Europe through a review of 184 articles in Europe (Biesbroek & Delaney, 2020). This study uses

the NATO typology to classify different governing resources, and further subdivides them by purpose into substantive and procedural instruments in each category.

2.4 Policy integration

The emergence of complex adaptation policy mixes increases the potential for incoherent policy instruments that work at cross-purposes, and creates challenges for achieving consistent and synergistic risk reduction. A large literature on climate policy integration argues that robust policy integration is necessary for effective climate action (Candel & Biesbroek, 2016; Cejudo & Michel, 2017; Di Gregorio et al., 2017; Freeman, 1985; Howlett et al., 2017), and that a lack of integration can increases the risk of policy failure, and even maladaptive policy outcomes (Anguelovski et al., 2016; Eriksen et al., 2011; Juhola et al., 2016). Considering policy integration in the governance of cross-cutting policy issues has potential to create synergistic effects, improve resource-efficiency, and encourage innovative solutions (Runhaar et al., 2018). However, ensuring integration in policymaking becomes challenging when taking into consideration the multiplicity of cross-sectoral actors involved that may have conflicting interests or managerial styles. Modern governance is becoming increasingly de-centralized, favouring "devolution, disaggregation, and specialization" when tackling policy issues. This means that there is a diffusion of authority across a growing number of single purpose, specialized, or localized efforts towards effective governance. Although policy integration may not always succeed, any efforts for integration can help avoid compounding climate threats or negative ripple effects across other critical sectors. Especially considering the dispersion of responsibility across decision-making bodies, coordination and coherence are necessary objective to prioritize. This section on policy integration will examine definitions of policy integration as well as different methodological approaches that have been used to measure integration in adaptation studies.

Policy integration is commonly articulated along two dimensions, vertical integration and horizontal integration, which capture how authority is distributed between levels of government and among policy actors. Vertical integration therefore considers integration between levels of government. Horizontal integration considers integration across sectors. This study will examine

both dimensions of integration, which are consistent with Hooghe and Marks (2001) description of multi-level governance.

Policy integration studies are methodologically diverse, especially when adapted to suit the characteristics of different sectors. There are numerous existing climate policy integration (CPI) studies in the land-use, forestry, agriculture, energy, water, and food sectors (Candel & Biesbroek, 2018; Di Gregorio et al., 2017; Hogl et al., 2016). Various interpretations of coordination, coherence, and integration exist under the umbrella of CPI, though the three terms are oftentimes used interchangeably. Cejudo (2017) argues that although the three are related, they are substantively distinct from one another, and all three are required to achieve policy goals. Loosely, the three terms are defined as follows: (1) Policy coordination refers to the process through which subsystems share knowledge, and all actors have clearly defined responsibilities to be able to make decisions collaboratively; (2) Policy coherence refers to the consistency of policy outputs, outcomes, objectives, and their associated implementation tools; (3) Policy integration refers to the integration of administrative and organizational decision-making (Cejudo & Michel, 2017; Nilsson et al., 2012). Di Gregorio et al. adopt a similar perspective, where they define climate policy integration as the "integration of multiple policy objectives, governance arrangements and policy processes related to climate change mitigation, adaptation and other policy domains". They identify three key components to CPI: (1) integrating objectives between climate change mitigation and adaptation, (2) internal and external climate policy coherence, and (3) vertical and horizontal policy integration (Di Gregorio et al., 2017). Hogl et al. (2016) discusses the evolution of policy integration studies through a review of the literature, using forest policy as a starting point. They identify three main analytical viewpoints for integration studies: (1) institutional, which questions the effectiveness of "organizational, procedural, or communicative instruments for achieving more integrated processes and results across sectors (horizontal EPI) and tiers of government (vertical EPI), (2) political, which explores the interests of actors and power dynamics to understanding the effectiveness of integration efforts and (3), policy-learning, which study frames of reference, ideas, or policy paradigms that influence actor behaviour and preferences. Candel and Biesbroek's (2016) policy integration framework includes elements of the above definitions, but also departs slightly from classic interpretations of policy integration. They consider policy

integration to be processual rather than an end goal, where integration is "a process of reflexivity and learning from past experiences resulting in continuous adjustments by reconsidering the need to increase or decrease the degree of policy integration depending on how the issue evolves (Biesbroek, 2021)." Policy integration therefore, is not a static end goal nor does it have a linear trajectory. Rather, it is a process that can and should flow in both directions of integration and dis-integration depending on the needs of the institutions in question. I adopt this perspective in my study, where policy integration is an on-going, dynamic, non-linear process, with multiple inter-connected dimensions (Candel & Biesbroek, 2016).

This thesis will adapt Candel and Biesbroek's (2016) conceptual framework on policy integration to evaluate horizontal and vertical integration in the context of climate change and housing. The framework consists of four dimensions: policy frame, subsystem involvement, policy goals, and policy instruments. Policy frame refers to how an issue is perceived in its governance system (Dewulf, 2013). In the context of integration, it asks whether cross-cutting issues are recognized and addressed as such, and whether they will be tackled using an integrated approach. A lack of awareness of or inconsistency in policy frame can have serious ramifications on social vulnerability. Subsystem involvement refers to the range of actors and systems involved in the policy process. As governance continues to favour dispersal of authority vertically down to localized governments and horizontally across sectors and specialized units, the number of subsystems involved increases the more an issue is prioritized. Policy goals set explicit objectives within strategies to address an issue. Their coherence is crucial to consider given the broad range of policy goals coming out of multiple jurisdictions. Policy instruments, their deployment and characteristics, must also be integrated. At the most detailed level of observation, the policy instrument dimension differentiates between substantive and procedural instruments to examine the range of policies that address sectoral concerns, the presence of coordinating mechanisms, and the consistency of the policy instrument mixes.

3. Manuscript

3.1 Introduction

Climate change is a critical global challenge, and Canada faces an array of climate risks across its geographically diverse territory. The consequences of these risks are being felt across sectors and regions, where higher temperatures and more frequent and intense weather events are threatening infrastructure and human security across the country (Warren & Lemmen 2014). Major flooding ravaged Quebec in 2017 and 2019, displacing almost 15,000 people and incurring over $500 billion (CAD) dollars in insurance claims and disaster relief (Perreaux 2018; Saint-Arnaud 2019). Catastrophic flooding in British Columbia during 2021 resulted in over $450 million (CAD) in damages—an underestimated amount that doesn't take into account damages suffered by homeowners without flood insurance (Charlebois 2019). Heat waves, drought, and wildfire conditions are growing more intense year by year, aggravated by anthropogenic climate change. In 2021, the Pacific Northwest experienced record-breaking temperatures linked to the "heat dome" effect, bringing about unprecedented conditions that pose significant risks to human health and well-being (Philip et al., 2021). These impacts are particularly acute for vulnerable groups like low-income households, immigrants, the elderly, women, and Indigenous peoples, who often experience the worst of flooding, extreme heat, and other hazards while having the lowest capacity to adapt (Bednar & Henstra, 2018; Furgal & Seguin, 2006; Perreault et al., 2020; Seguin et al., 2008; Thistlethwaite & Henstra, 2017).

Adaptation is an essential component of Canada's response to climate change, and housing is a key sector for climate action. The Government of Canada has committed to investing in more resilient and energy efficient homes and increasing the stringency of building codes to adapt to climate change impacts (Government of Canada, 2016). Climate change poses significant economic risks to the Canadian housing sector, which contributes over 9% to Canada's gross domestic product (Statistics Canada, 2021). The housing sector itself isn't without issue--Canada's "housing bubble" continues to drive unaffordability, leaving over 1.7 million people without access to secure housing. As a result, housing affordability and supply have become a priority in federal policy. The federal government released the first national housing strategy in 2017 to address the ongoing affordability crisis in the Canadian housing sector. The National Housing Strategy identifies affordable housing concerns as a major federal policy priority. At the

provincial and territorial levels, corresponding regional housing strategies were created from 2017 onwards in accordance with the federal framework. To date, all 13 provincial and territorial governments, as well as most large municipalities, have published a housing strategy. These strategies identify policy directions and goals that address core housing need in Canada, specifically housing affordability, availability, homelessness, and renewal of existing affordable housing stock. With the designation of $72 billion (CAD) in a new National Housing Strategy to support the construction and renewal of new homes and affordable housing, cities across Canada are likely to see sharp growth in both market and social housing over the next decade (National Housing Strategy, 2017; Government of Canada, 2022). The scale of this future investment makes it even more critical for the housing sector to consider climate change adaptation to prevent growing vulnerability to climate hazards.

Over the past five years, a number of housing- and climate change-related strategies were adopted at all levels of government in Canada. The purpose of these plans is to provide an overarching framework to guide decision-making, identify new priorities, and demonstrate a new and continued commitment to advancing housing and climate change policy. This study aims to identify whether climate change risk reduction policies and housing policies account for linkages between these sectors, and whether existing policy goals and instruments are interacting in synergistic or conflicting ways. Furthermore, it aims to uncover whether adaptation planning is considering key housing policy priorities, and whether housing priorities are responding to key climate change risks and vulnerabilities. To do so, I conduct a comprehensive assessment of both vertical and horizontal integration in Canadian adaptation and housing policy and governance. It examines the following questions: do housing and climate change strategies at the Canadian federal, provincial, and territorial levels recognize the role that housing plays in reducing climate change-related risks and vulnerabilities? To what extent are policy goals and instruments in Canadian federal, provincial, and territorial housing and adaptation policies vertically and horizontally integrated?

3.1.1 Adaptation governance in Canada

In Canada, environment is a shared jurisdiction and adaptation policy is made at all levels of government where each level plays a different role. The federal government leads agenda-setting

and delegates implementation responsibility to lower levels of government. Provincial and territorial policy adopt strategies to tackle regional climate hazards, also having authority over building codes and development decisions. Municipal policy implements adaptation in the specific sectors within their jurisdiction like land-use decisions and infrastructure maintenance, following provincial/territorial guidance. Reflective of this decentralization, Canada has developed a multilevel approach to adaptation governance that disperses authority across multiple jurisdictions, and to non-governmental actors (Bednar & Henstra, 2018; Henstra, 2017). There is some national programming for adaptation, coupled with diffusion of management responsibility to regional and local levels.

The election of a federal Liberal majority government in 2015 marked a pivot in national policy priorities for climate change in Canada. The new government released the first national strategy for climate change in 2016, the Pan-Canadian Framework on Clean Growth and Climate Change (PCF). The PCF identifies several adaptation objectives, including investing in infrastructure, addressing climate-related health risks, providing more support to vulnerable areas, reducing climate hazard risks, and incorporating both Traditional and scientific knowledge into resilience-building. It also required that provinces and territories adopt their own strategies if they hadn't already done so. Before the publication of the PCF, only Nunavut (2011) and Quebec (2012) had published dedicated adaptation strategies. Other climate change strategies published before the PCF in British Columbia, Manitoba, Ontario, and Nova Scotia are focussed on emission reduction, and engagement with adaptation is superficial and lacking implementation detail. Subsequently, climate change strategies were created at the provincial and territorial levels in accordance with the federal framework. To date, all 13 units of provincial and territorial governments, as well as most major municipalities, have published a climate change strategy. These strategies identify policy directions and goals, collaborators, funding, and specific policy actions to undertake over a given time period. Adaptation priorities in these strategies address resilience goals in areas like infrastructure, natural systems, communities, energy, and the economy. These climate change and housing strategies provide the basis for this research.

3.1.2 Policy integration for adaptation

There is a strong emphasis in the adaptation governance literature on mainstreaming adaptation policies into at-risk policy sectors. A large literature has argued that robust integration is necessary for effective adaptation to take place (Candel & Biesbroek, 2016; Cejudo & Michel, 2017; Di Gregorio et al., 2017; Freeman, 1985; Howlett et al., 2017), and that a lack of integration can have negative consequences for already marginalized groups and exacerbate social vulnerability (Anguelovski et al., 2016; Eriksen et al., 2011; Juhola et al., 2016; IPCC, 2021). Climate Policy Integration (CPI) has emerged as a key analytical approach for examining vertical and horizontal policy integration around mitigation and adaptation issues, including how to maximize the effectiveness of adaptation policies whilst minimizing trade-offs and potential unintended negative outcomes (Di Gregorio et al., 2017). Ensuring integration in policymaking becomes challenging when taking into consideration the multiplicity of cross-sectoral actors involved. Modern governance is becoming increasingly de-centralized, favouring "devolution, disaggregation, and specialization" when tackling policy issues. This means that there is a diffusion of authority across a growing number of single purpose, specialized, or localized efforts towards effective governance (Cejudo & Michel, 2017; Hooghe & Marks, 2010). This pattern can be seen in Canada, where environmental governance is a shared jurisdiction between all levels of government. The dispersion of responsibility across decision-making bodies makes coordination and coherence a necessary objective to prioritize.

Despite the significance of the housing sector for adaptation implementation in Canada, it is unclear to what extent housing and adaptation are being integrated in climate change planning across regions and levels of government. Existing policies such as the Pan-Canadian Framework on Climate Change and the National Housing Strategy are still nascent, and a comprehensive assessment is needed to determine the extent to which the relationship between housing and adaptation is reflected in these key strategic frameworks and their associated implementing mechanisms. To operationalize the CPI approach, this study analyzes the extent to which adaptation and housing policies are linked within key strategic planning policies for adaptation and housing at the federal, regional, and local levels. It applies Candel and Biesbroek's (2016) integration framework to evaluate policy integration in the context of climate change and housing. The model consists of four dimensions: policy frame, subsystem involvement, policy goals, and policy instruments.

Policy frames refer to the overall aim of a strategy and how the problem is defined, prompting the question of whether an issue is being perceived or interpreted in the same way across scales. Subsystem involvement refers to the expanse of actors and jurisdictions involved, and whether there is vertical and horizontal integration between them. Policy goals refer to precise policy objectives and risks addressed. Policy instruments refer to the specific tools being employed to tackle the policy issue. For this study, the policy goals and policy instrument dimensions have sub-components that capture the multiple aspects of integration that can exist within each policy realm. Within the policy goals dimension, the two sub-components describe the range of policies that address the policy problem and policy coherence. The former seeks to address whether inter-sectoral concerns are addressed in each sector's policy goals. The latter identifies whether each document makes references to other sector or jurisdictional strategies. The policy instruments dimension has three sub-components. The first looks at how many policy instruments in housing policies look at adaptation, and vice versa. The second looks at procedural instruments to assess levels of information sharing and collaboration, which usually signal developing integrative practices. The third looks to see whether there are reviewing or updating mechanisms in strategies, which is important in illuminating the coherence of policy instrument mixes in a subsystem. Each of these policy aspects are evaluated qualitatively according to the characteristics described in the model.

3.2 Methodology

3.2.1 Collection of Policy Documents

Canada is structured as a federal system of government, which consists of 10 provinces and 3 territories. Each province and territory face climate change risks to its housing sector. All provinces and territories have adopted at least one strategy in both the climate change and housing sectors between 2015 and 2021. The only exception is Nunavut, which has not published an updated climate change strategy after its 2010 Climate Change Impacts and Adaptation strategy. Another Pan-Territorial Adaptation Strategy was published in 2011, detailing priorities in adaptation planning across all three territories is included in the study.

Policy and strategic planning documents published after 2015 were collected from federal, provincial/territorial, and municipal governments for a total of 27 units of government in

Canada. The municipality with the largest population from each province or territory was chosen for the sample, which together represent almost a quarter of Canada's population. This timeframe reflects Canada's transition from a Conservative majority government to a Liberal majority government, and the publication of two major federal strategies on housing and climate change, the National Housing Strategy in 2017 and the Pan-Canadian Framework on Clean Growth and Climate Change in 2016.

A snowball sampling approach is applied for the collection of policy documents at the federal and provincial/territorial levels. An initial sample of documents was acquired through a web search of government websites and archives to locate the main framework strategies in each unit. These documents were coded to identify the implementing policies for each strategic plans, which were then also coded. A total of 62 documents were identified during the search. Implementing policies were considered relevant if they address major policy concerns in the housing and adaptation sectors and identify specific actions to be taken that address them. In the housing sector, those topics include affordability, homelessness, housing development, and housing renewal. In the climate change sector, adaptation-specific strategies and integrated climate change strategies that include adaptation are included in the study. The main reason for using framework strategies as the starting point for snowball sampling is because they summarize key priorities, goals, and actions of leading actors on housing and adaptation. This sampling approach captures the most important adjacent policies and identifies key instruments relevant to implementation of housing and adaptation strategies.

3.2.2 Data coding and extraction

In the next stage of analysis, documents were coded according to a unique coding protocol (see Appendix A for full coding protocol). A total of 17 indicators operationalizes four categories: climate hazard and vulnerability indicators, policy instrument types, policy targets, and equity considerations. Here, I define equity considerations relatively narrowly as policy tools that consider the needs of groups with high social vulnerability in the context of climate change. Climate hazard indicators are derived from the IPCC's 5th assessment report. Policy instruments are recognized as the main mechanism by which governments employ their resources to take action against policy issues. In identifying adaptation policy instruments, this study aligns with

Dupuis and Biesbroek's (2013) definition which makes an important distinction between policies with and without intentionality towards adaptation. Although some policies not explicitly for adaptation may have a substantial impact on adaptation (i.e. disaster risk reduction), they are lacking consideration for climate change impacts in the long term. Dupuis and Biesbroek define an adaptation policy strictly, where it should be purposeful and sufficiently substantial, to avoid "comparing apples to oranges" in adaptation studies. Therefore, policy instruments are included in the dataset only if they demonstrate intentionality towards either housing or climate change adaptation as defined by Dupuis and Biesbroek (2013). This study adopts the Nodality (information), Authority (regulation), Treasure (finance), and Organization (administration) (NATO) typology for policy instrument analysis, first developed by Hood (1986). Policy instruments are further distinguished between substantive ("hard" policies) and procedural ("soft" policies). This distinction captures two approaches that governments can take to implement policies: the direct provision of goods and services (substantive), or the indirect effort to change the beliefs and behaviours of actors (procedural) (Howlett et al., 2006). This typology is applied to the study of adaptation by Lesnikowski et al. (2019) and adapted here (Lesnikowski et al., 2019). The coding protocol was implemented via Google Forms and Microsoft Excel.

3.2.3 Data Analysis

Descriptive statistics were conducted for each indicator using R version 4.1.2. Results are reported by jurisdiction and summarize distributions for each indicator and correlations between indicators of interest. Frequency distributions help to visualize and compare what policy priorities are in each sector. Correlations between instrument type, climate and housing risks, and equity considerations are conducted to further examine potential relationships in policy choices and climate or housing characteristics.

The integration analysis consists of two parts: a cross-sectoral (horizontal) analysis and a cross-jurisdictional (vertical) analysis, adapted from Candel and Biesbroek's (2016) multi-dimensional model for conceptualizing integration. The four-part framework includes policy frames, subsystem involvement, policy goals, and policy instruments. Specific indicators were developed for each dimension of the framework to measure integration (see Table 1). Documents were assessed on their level of horizontal and vertical integration using a 4-point Likert scale.

The policy frame dimension is interpreted as the definition of the problem, ranging from a narrow definition (the issue is only considered within the boundaries of one sector) to a holistic definition (recognizes adaptation in housing as a challenge for all sectors and levels of government). Subsystem involvement looks at how actors in each sector participated in strategic planning and their role in implementation. The policy goals dimension contains two components. The first addresses whether housing and adaptation sectors have adopted adaptation into their policy goals, and the second measure looks at whether strategies refer to strategic planning and policy priorities for the other sector. The policy instruments sub-dimensions consist of three elements. The first looks at the proportion of instruments in adaptation strategies that address housing issues, and the proportion of instruments in housing strategies that address adaptation issues. The second looks at whether there are procedural instruments in places to facilitate information sharing and collaboration between the housing and adaptation sectors. Finally, the third is a binary indicator that captures whether there are review mechanisms in places to analyze interactions between policies in each sector.

Table 1: Policy Integration Framework and Measurement (adapted from Candel and Biesbroek 2016)

		1 (Low)	2	3	4 (High)
Policy Frame		The problem is defined in narrow terms within the governance system; the cross-cutting nature of the problem is not recognized and the problem is considered to fall within the boundaries of a specific subsystem. Efforts of other subsystems are not understood to be part of the governance of the problem. There is no push for integration	There is awareness that the policy outputs of different subsystems shape policy outcomes as well as an emerging notion of externalities and do-no-harm. The problem is still predominantly perceived of as falling within the boundaries of a particular subsystem. There is no strong push for integration	As a result of increasing awareness of the cross-cutting nature of the problem, an understanding that the governance of the problem should not be restricted to a single domain has emerged as well as associated notions of coordination and coherence	General recognition that the problem is and should not solely be governed by subsystems, but by the governance system as a whole. Subsystems are desired to work according to a shared, 'holistic' approach, which is particularly recognized within procedural instruments that span subsystems (see ''Policy instruments'')
	Horizontal	***Housing adaptation narrowly defined-- only in the context of protection from climate hazards***	***Some recognition that housing policies influence resilience outcomes***	***Awareness of the various ways that housing and climate change influence one another and the need to coordinate them***	***Achieving resilience is considered a challenge for housing system as well as adaptation work***
	Vertical	***Strategies are narrowly defined as falling into only one jurisdiction***	***Some recognition of the importance of coordination between jurisdictions***	***Awareness of the various ways that different levels of government influence one another and the need to coordinate between them***	***Achieving resilience is considered a challenge for all levels of government***
Subsystem Involvement		One dominant subsystem, which governs the issue independently (Metcalfe 1994). Formally, no other subsystems are involved, although they may be in terms of substantial, nonintentional policymaking	Subsystems recognize the failure of the dominant subsystem to manage the problem and externalities (Bryson et al. 2006; Feiock 2013), which results in the emergence of concerns about the problem in one or more additional subsystems	Awareness of the problem's crosscutting nature spreads across subsystems, as a result of which two or more subsystems have formal responsibility for dealing with the problem	All relevant subsystems have developed ideas about their role in the governance of the problem. The number of subsystems that are formally involved is equal to or higher than at previous manifestations, but complemented with a less engaged set of alternative subsystems

	Horizontal		***Adaptation actors are not present in housing policies, housing actors are not present in adaptation policies***	***Adaptation actors involved in housing system issues***	***Housing actors are involved in adaptation issues***	***Adaptation actors are embedded in housing strategies, housing actors are embedded in adaptation strategies***
	Vertical		***One dominant actor governs the issue independently***	***Role of subsystems recognized generally, but no specific tasks delegated***	***Recognition and active involvement of subsystems***	***All government actors and relevant subsystems have developed ideas about their role in the governance of the problem***
Policy Goals	Range of policies in which problem is embedded		Concerns only embedded within the goals of a dominant subsystem	Concerns adopted in policy goals of one or more additional subsystems (Keast et al. 2007; McNamara 2012)	Possible further diversification across policy goals of additional subsystems	Concerns embedded within all potentially relevant policy goals
		Horizontal	***Sector specific adaptation goals in one system (i.e. no adaptation in housing policies or vice versa)***	***Housing or adaptation goals are referenced in plans from either sector***	***Both housing and adaptation reference one another as concerns in their policy goals***	***Both housing and adaptation have adopted adaptation into their policy goals***
	Policy coherence		Very low or no coherence. Occurs when cross-cutting nature is not recognized, or when subsystems are highly autonomous in setting (sectoral) goals	Because of rising awareness of externalities and mutual concerns subsystems may address these to some extent in their goals	Coordinated sectoral goals, which are judged in the light of coherence (Geerlings and Stead 2003). Subsystems attempt to develop synergies (Metcalfe 1994)	Shared policy goals embedded within an overarching strategy (Geerlings and Stead 2003; Jochim and May 2010; Keast et al. 2007; McNamara 2012; Metcalfe 1994)
		Horizontal	***No reference to other sectoral strategies***	***Adaptation will reference housing strategies***	***Housing strategies will reference adaptation strategies.***	***Sectoral strategies reference each other and all other relevant strategies***
		Vertical	***No reference to strategies from other levels of government***	***Municipal strategies will reference either Prov./Terr. strategy or Federal strategy***	***Municipal strategies will reference both Prov./Terr. strategy and Federal strategy***	***Strategies from all levels of government reference each other.***
Policy Instruments	Range of subsystems' policies that contain		Problem only addressed by the substantive and/or procedural instruments of a dominant subsystem	As a result of increased awareness of externalities one or more additional subsystems (partially) adapt	Possible further diversification of instruments addressing the problem across subsystems	Instruments embedded within all potentially relevant subsystems and associated policies

	policy instruments			their instruments to mitigate negative effects		
		Horizontal	***No adaptation policies about housing, and no housing policies about adaptation***	***There is at least one adaptation policy about housing or housing policy about adaptation***	***Adaptation and housing policies have a significant place in each system (below 50%)***	***Both adaptation and housing strategies have a significant (more than 50%) proportion of instruments dedicated to each other***
	Procedural instruments at system-level		No relevant procedural instruments at system-level	Some procedural information sharing instruments at system-level (cf. Metcalfe 1994)	Increasing number of system-level procedural instruments that facilitate subsystems to jointly address the problem	Broad range of procedural instruments at system-level, including boundary spanning structures that coordinate, steer and monitor subsystems' efforts
		Horizontal	***No procedural instruments related to information sharing between housing and adaptation***	***Information sharing related to housing/adaptation***	***Some instruments aimed at influencing the other system***	***Coordinating mechanisms in place to ensure that there is collaboration between the systems***
		Vertical	***No procedural instruments related to information sharing between jurisdictions***	***Evidence of information sharing between jurisdictions***	***Some instruments aimed at influencing other jurisdictions***	***Coordinating mechanisms in place to ensure that there is collaboration between systems***
	Consistency (binary)		No consistency. Sets of instruments are purely sectoral and result from processes of policy layering (Rayner and Howlett 2009)	Subsystems consider externalities of sectoral instrument mixes in light of internal and inter-sectoral consistency	Subsystems seek to jointly address the problem by adjusting and attuning their instruments. Consistency becomes an explicit aim	Full reconsideration of subsystem instrument mixes, resulting in a comprehensive, cross-subsystem instrument mix that is designed to meet a set of coherent goals

3.3 Results

A total of 62 strategic documents published between 2015 and 2021 were identified from the housing (n = 34) and climate change adaptation (n = 28) sectors. This timeframe encompasses the publication of the major relevant federal strategies, the National Housing Strategy and the Pan-Canadian Framework on Clean Growth and Climate Change in 2017, and indicates the prioritization of these issues in Canadian politics. A total of 2,088 instruments were identified from 27 units of government at the federal, territorial/provincial, and municipal levels. Overall, 1,185 housing instruments and 889 climate change adaptation instruments are observed, with 14 falling into both categories. Among the provinces and territories, Saskatchewan describes the fewest instruments in its strategies (only 1% of all instruments) while the Northwest Territories describes the most (7% of all instruments). At the municipal level, no applicable instruments were found in Charlottetown while Vancouver identifies the most instruments (10%).

3.3.1 Descriptive results

Adaptation sector

I observe notable variation between levels of government in the types of policy instruments adopted to address adaptation issues (Table 2). At the federal level, there is a strong reliance on authority-based instruments (39%). Building regulations (11% of all substantive instruments) and knowledge networks (29% of all procedural instruments) are the most prevalent tools adopted in the authority category. The federal government also has a stronger reliance on information-(31%) and finance-based instruments (19%), and less on organization-based instruments (12%). Half of the instruments at the regional-level are information-based, followed by authority instruments (22%). Regional governments rely relatively little on both organization (14%) and financial tools (14%). Among municipal governments, there is a heavy reliance on authoritative and informational instruments (38% and 35%, respectively), particularly spatial planning and reports and assessments (11% and 14% of all substantive) and urban networks and public outreach (31% and 29% of all procedural) instruments. Local governments rely least on financial instruments (9%), but tend to use organization-based instruments (18%) like changes to municipal operations (14% of all substantive instruments) relatively more than other levels of government.

Table 2. Preferred instrument types in the housing and adaptation sectors, broken down by jurisdiction

Adaptation			
	Federal[a]	Prov./Terr.[b]	Municipal[c]
Information	31%	50%	35%
Regulation	39%	22%	38%
Finance	19%	14%	9%
Administration	12%	14%	18%
Housing			
	Federal[d]	Prov./Terr.[e]	Municipal[f]
Information	18%	23%	33%
Regulation	15%	19%	32%
Finance	48%	40%	18%
Administration	18%	17%	17%

Note. This table depicts the distribution of preferred instrument type according to the NATO typology in the adaptation and housing sectors. Results are reported separately by sector and by jurisdiction.
[a] Percentage of total instruments found in Federal climate change adaptation strategies.
[b] Percentage of total instruments found in Provincial and Territorial climate change adaptation strategies.
[c] Percentage of total instruments found in Municipal climate change adaptation strategies.
[d] Percentage of total instruments found in Federal housing strategies.
[e] Percentage of total instruments found in Provincial and Territorial housing strategies.
[f] Percentage of total instruments found in Municipal housing strategies.

Most policy instruments target government actors as implementing agents (79%), and some target civil society organizations (14%). Regional and local governments are the most active implementing actor in the adaptation sector, followed by actors in civil society. In federal strategies, federal actors make up 40% of all implementing actors followed by civil society (23%). In regional strategies, provincial and territorial actors make up two-thirds (66%) of all implementing actors also followed by municipal actors (11%). This pattern is repeated at the local level, where the majority of implementing actors come from the local government (82%), followed by actors in civil society (8%).

Most policy instruments do not specify a climate hazard but instead are aimed at managing general climate change risk. When a climate hazard is specified, there is substantial variation between levels of government (Table 3). At the federal level, there is a relatively narrower emphasis on certain risks, especially sea level rise/coastal flooding (5%), extreme precipitation and inland flooding (3%), followed by loss of Arctic sea ice (2%). I also observe adaptation

planning in equal measure for infectious disease risks, drought, erosion, permafrost melt, and wildfires (1% each). Other levels of government are responding to a wider range of risks but there is a pronounced emphasis on adapting to extreme heat (8%) at the local level. In both regional and local plans, instruments are more strongly focus on planning for extreme precipitation and flooding (6% each). Sea level rise and coastal flooding are also concerns among some regions and municipalities (4% and 6%, respectively). These concerns arise from coastal provinces and municipalities such as Vancouver, B.C., St. John's, N.L., and Halifax, N.S.

Table 3. Climate hazards addressed in the adaptation and housing sectors, broken down by level of government

Adaptation			
	Federal[a]	Prov./Terr.[b]	Municipal[c]
Changing Patterns of Infectious Diseases	1%	3%	0%
Drought	1%	1%	2%
Erosion and Landslides	1%	4%	2%
Extreme Cold Events	-	0%	2%
Extreme Heat Events	-	2%	8%
Extreme Precipitation and Inland Flooding	3%	6%	6%
Loss of Arctic Sea Ice	2%	1%	-
Permafrost Melt	1%	3%	-
Poor Air Quality	-	2%	3%
Sea Level Rise	5%	4%	6%
Storms	-	2%	3%
Wildfires	1%	4%	2%
Not Specified	84%	68%	65%

Note. This table shows the percentage of instruments in each jurisdiction that address each climate hazard. Results are reported for the adaptation sector only.
[a] Percentage of total instruments found in Federal climate change adaptation strategies.
[b] Percentage of total instruments found in Provincial and Territorial climate change adaptation strategies.
[c] Percentage of total instruments found in Municipal climate change adaptation strategies.

Across all levels of government, the vast majority of policy instruments in the adaptation sector do not address housing (79%). Of those that do, most are not tenure specific (12%) and address impacts on housing only very generally (Table 4). At the federal level, a total of 19% of instruments address housing, like investing in climate-resilient infrastructure for housing. Tenure-specific instruments focus on developing building codes and integrating risk assessments

for Indigenous housing (4%) and social housing (1%). Only 10% of policy instruments in provinces and territories address housing, 2% of which targeting owner-occupied housing, followed by social housing and affordable private rentals (1% each). These instruments are mostly informational (e.g. developing a PEI Coastal Property Guide to inform coastal property owners of flood hazards) and financial (e.g. providing financial support to install air purifiers as protection from wildfire smoke in Yukon). At the municipal level, there is more focus on market housing (8%) than on non-market housing (3%). The majority of instruments addressing market housing at the municipal level include updating by-laws to support resilience objectives and zoning changes, or informational instruments that provide information to homeowners and property developers. Instruments that are not tenure-specific consist primarily of regulatory changes in the built environment (68%), including changes in building and spatial planning regulation.

Table 4. Housing tenure categories addressed by adaptation and housing sector instruments, broken down by level of jurisdiction

Adaptation			
	Federal[a]	Prov./Terr.[b]	Municipal[c]
Tenure-specific	6%	4%	11%
Non-tenure specific	13%	6%	14%
Not housing relevant	81%	90%	75%
Housing			
	Federal[d]	Prov./Terr.[e]	Municipal[f]
Affordable Private Rental	8%	15%	19%
Housing Cooperative	1%	2%	1%
Indigenous Housing (General)	26%	0%	0%
Indigenous Off-Reserve Housing	5%	2%	1%
Indigenous On-Reserve Housing	8%	2%	1%
Owner-Occupied Housing	8%	13%	7%
Property Investor	5%	8%	6%
Private Rental	3%	10%	12%
Social Housing	16%	17%	13%
Temporary Housing	4%	4%	2%
Unhoused	2%	3%	7%
Not Specified	14%	23%	29%

Note. This table shows the percentage of policy instruments that address each type of housing tenure. Results are reported by sector and by jurisdiction.
[a] Percentage of total instruments found in Federal climate change adaptation strategies.
[b] Percentage of total instruments found in Provincial and Territorial climate change adaptation strategies.
[c] Percentage of total instruments found in Municipal climate change adaptation strategies.
[d] Percentage of total instruments found in Federal housing strategies.
[e] Percentage of total instruments found in Provincial and Territorial housing strategies.
[f] Percentage of total instruments found in Municipal housing strategies.

Housing sector

We observe significant differences between the adaptation and housing sectors in the types of policy instruments used to implement strategic policies (Table 2). This suggests that the sectors have distinct policy styles, which raises potential challenges for policy integration. At the federal level, housing strategies rely heavily on financial instruments (48%), like direct expenditures. The federal government relies far less on informational (18%), authoritative (15%), and organizational (18%) tools. A similar pattern is observed at the regional level. Provinces and territories also utilize substantially more financial instruments (40%) than information-based (23%), authoritative (19%), or organizational (17%) instruments. At the municipal level, however, governments rely much less on financial instruments (18%), and most on informational (33%) and authoritative (32%) instruments.

Local governments, regional governments, and civil society are the most active implementing actors in the housing sector, followed by federal actors. In federal strategies, federal actors make up 61% of all implementing actors followed by civil society (15%). In regional strategies, provincial and territorial governments make up 62% of all implementing actors also followed by community actors (14%). This pattern is again repeated at the local level, where the majority of implementing actors come from the local government (49%), followed by actors in civil society (16%). Across all levels of government, civil society (such as community groups and academia) is consistently involved around 15% of the time as an implementing actor. Federal actors prefer information- (36%) and finance-based instruments (29%), employing authoritative (18%) and organizational (17%) instruments a relatively even amount. Regional actors also tend to favour informational and financial instruments (31% and 29% respectively). Local actors on the contrary, use financial instruments a lot less (19%) than regional and federal actors, while using authoritative (33%) and informational (29%) instruments more.

Housing sector strategies rarely implement actions that address climate hazards. Indeed, not a single federal housing policy instrument addresses a specific climate change hazard. At the provincial and territorial level, only three hazards are commonly addressed: extreme heat (2), extreme precipitation and inland flooding (2), and sea level rise (1). At the municipal level, there is also a focus on flooding (2), but the other hazards addressed include extreme cold (1) and storms (1).

Unsurprisingly, housing sector instruments more heavily target public sector housing than adaptation sector instruments (Table 4). There are major differences across levels of government to this effect, however. At the federal level, 38% of policy instruments target Indigenous housing, including on-reserve housing (7%), off-reserve housing (5%), and general housing considerations for Indigenous Peoples (26%). Public and private sector housing are targeted relatively evenly (24% and 23% respectively). At the provincial and territorial level, 46% of instruments target the private sector, such as affordable private rental housing (15%), owner-occupied housing (13%), private rental housing (10%), and property investors (8%). Overall, 27% of instruments target housing in the public sector, most commonly social housing (17%). Local government instruments echo a similar pattern to regional instruments, where there is a heavier focus on private sector housing (45%) than public sector housing (24%).

BC Housing's Climate Adaptation Framework, published in 2017, is the first framework published by a principal housing actor to address climate change adaptation in Canada. BC Housing is the housing authority for the Province of British Columbia and is responsible for construction and management of provincial social housing. The framework includes 14 policy instruments that address extreme heat and flooding risks for social housing. Over half of these instruments are information-based, including facilitating education and research on climate change, conducting vulnerability assessments, and monitoring climate-related impacts. The other half are authoritative and organizational instruments such as updated building design codes, and emergency response guidelines for extreme heat. There are no financial instruments associated with this framework. The instruments outlined in the framework are implemented primarily in collaboration with community groups (14%). All 6 of 14 instruments that address equity specifically target low-income groups.

Equity and vulnerable groups

Finally, I also examined whether adaptation and housing policies are addressing issues around equity. Instruments are considered to address equity if the term "equity" is explicitly used, or if the policy addresses risks to groups with high social vulnerability to climate change. Overall about one-quarter of all policy instruments address equity in some form. Instruments in adaptation strategies overall address equity issues less often than instruments in housing strategies (11% and 36%, respectively). There are stark differences between levels of government, however. In adaptation strategies, almost a three-quarter (73%) instruments at the federal level include equity considerations. All of these instruments except one (that mentions gender dimensions) address adaptation for Indigenous Peoples. At the regional level, however, only 10% of instruments address equity (again primarily in the context of Indigenous Peoples), and at the municipal level only 6% of instruments address equity. Local adaptation strategies address a somewhat wider number of vulnerable groups, however, including Indigenous Peoples (2%), youth (1%), the elderly (1%), people experiencing homelessness (1%), people with disabilities (1%), and low-income groups (0.3%).

Housing strategies at each level of government reflect a similar pattern, where 73% of federal instruments consider equity but regional (36%) and local (32%) level instruments do so much less (Table 5). Overall, low-income groups are the most frequently considered group (9%), followed by Indigenous People (8%), people experiencing homelessness (8%), the elderly (6%), people with physical disabilities (5%), gender minorities (3%), youth (2%), people experiencing family violence (2%), and people with social disabilities (2%). Immigrants and migrants again, are the least considered group (0.1%) where visible minorities are not considered at all.

3.3.2 Policy Integration Analysis

Using Candel & Biesbroek's multi-dimensional policy integration framework (Candel & Biesbroek, 2016), I analyze 62 strategic adaptation and housing plans from the federal, regional, and municipal levels according to four components: policy framing, subsystem involvement, policy goals, and policy instruments. The policy frame analysis looks at how strategies identify the nature of the policy problem (climate change impacts and/or housing) in their mission

Table 5. Equity Considerations in adaptation and housing sector instruments, broken down by jurisdiction

	Federal	Prov./Terr.	Municipal
Adaptation			
Yes	73%	10%	6%
No	27%	90%	94%
Housing			
Yes	73%	36%	32%
No	27%	64%	68%

Note. This table shows the percentage of policy instruments that have equity considerations. Results are reported by sector and by jurisdiction.

statement. The analysis of subsystem involvement looks at implementing actors for each policy, and how they relate to one another. The policy goals analysis looks at the mutuality of adaptation and housing goals in the two sectors, and whether strategies from each sector reference each other in their planning. To assess the final component, policy instruments, the analysis evaluates all 2,088 policy actions to assess the level of interaction between sectors. Strategies are measured on a Likert scale from 1 to 4, where 1 corresponds to lowest integration and 4 refers to the highest (see Table 1). The numbers are aggregated by jurisdiction by taking the average score of all strategy documents in one jurisdiction (see Tables 7 and 8, results tables). The results below take a comparative approach to illuminating possible discrepancies between jurisdictions (i.e. a province and its biggest municipality) and between regions (i.e. Western, Eastern, Northern Canada).

Overall results demonstrate that integration of Canadian adaptation and housing policy is uneven. We observe that there tends to be higher levels of vertical integration between jurisdictions and lower levels of horizontal integration between sectors. This indicates that the need to coordinate between different levels of government is generally well-recognized in Canada, but that cross-sectoral connections between housing and adaptation are still nascent.

3.3.2.1 Horizontal policy integration

Policy framing

Policy framing around housing and climate change tends to be narrowly defined around sectoral priorities in Canadian strategic planning at all levels of government. While five housing

strategies aim to achieve broad sustainability outcomes (8%), the remaining strategies focus on addressing sector-specific issues like housing affordability and availability. Among adaptation strategies, eight of 28 adaptation strategies discuss the relationship between climate change impacts and housing-related issues like infrastructure and healthy communities, but lack explicit reference to housing (Alberta, Iqaluit, Moncton, Montreal, New Brunswick, Vancouver, Yukon Territories, Pan-Territorial Strategy). Federal climate change strategies tend to have narrower policy frames. While they do not acknowledge housing adaptation directly, they do allude to building 'more livable' communities. Canada's National Housing Strategy recognizes affordable housing as a 'cornerstone of sustainable, inclusive communities.' The Northwest Territories adopted the same policy framing as the National Housing Strategy. British Columbia's climate change strategy and Nunavut's housing strategy demonstrate horizontal integration between the housing and climate change mitigation sectors, but do not connect housing and adaptation in their policy frames. The policy frames cite the importance of clean energy and energy efficiency in housing, respectively. The remaining provinces and territories demonstrate narrow, sector-specific policy frames in their strategies.

St John's, Toronto, and Vancouver demonstrate higher horizontal integration among municipalities. The example below from St. John's adaptation strategy demonstrates issue linkage between housing and adaptation, where achieving resilience is considered a challenge for both housing and adaptation:

> *St. John's will have a future of continued economic prosperity and diversity, where citizens have a strong sense of identity and appreciation for their cultural, natural and built heritage and the arts. This city has active, healthy citizens, living in affordable, accessible, complete neighbourhoods. St. John's attracts and welcomes investment, residents and visitors from the region, the province, and around the world. (Resilient St. John's Community Climate Plan: Adapting to Climate Change, 2021)*

Subsystem Involvement

We observe overall low levels of horizontal coordination between actors in the housing and adaptation sectors, but higher involvement of housing actors in adaptation planning than vice versa. Overall, 10 out of 28 adaptation strategies included housing actors as implementing agents

but only 2 of 34 housing strategies included adaptation actors as implementing agents. Canada's federal strategies recognize that a cross-sectoral approach in reaching climate and housing goals is needed, but there is no explicit effort to coordinate planning or policy implementation between adaptation and housing entities. The strategies emphasize the importance of accountable partnerships and collaboration, but there are no clear mechanisms or processes in place to ensure this. Among the provinces and territories, Alberta, British Columbia, Yukon, and the Northwest Territories' adaptation strategies identify implementing actors in the housing sector. Six municipalities have a general recognition that cross-sectoral actors should be involved in implementing their adaptation strategies, but don't have specific tasks delegated to them. Seven of thirteen municipal adaptation strategies identify implementing actors in the housing sector (Calgary, Halifax, Iqaluit, Montreal, Saskatoon, Vancouver, and Winnipeg). Among all housing strategies analyzed here, only Nunavut and PEI's strategy includes involvement from adaptation sector actors.

Policy Goals

Overall, there is low horizontal integration in policy goals between adaptation and housing strategies. For 80% of strategies, including all federal strategies, policy goals are sector-specific and only reflect the priorities of that sector. Two provincial housing strategies from British Columbia and Alberta have adopted adaptation concerns into their policy goals. Alberta's Capital Planning Framework by its Seniors and Housing department cite reducing environmental impacts on social housing as a priority and also states its alignment with its Climate Leadership Plan published in the same year. BC Housing's Climate Adaptation Framework integrates adaptation considerations into its policy planning by preparing existing and new housing to withstand climate impacts and building community resilience. Another three housing strategies from Alberta, Ontario, and PEI refer to sustainable housing and communities generally in their policy goals, with no specification of adaptation metrics.

Seven adaptation strategies from British Columbia, Winnipeg, Toronto, St. John's, New Brunswick, Halifax, and Moncton address housing concerns in their policy goals. Toronto and British Columbia's climate strategies set out goals to improve energy efficiency in housing through retrofitting existing buildings and designing new buildings to be near-zero emissions,

while considering affordability impacts to residents. Winnipeg, St. John's, New Brunswick, Halifax, and Moncton's climate strategies identify resilient and energy efficient infrastructure as priorities in their policy goals, but lack an explicit reference to housing-specific considerations.

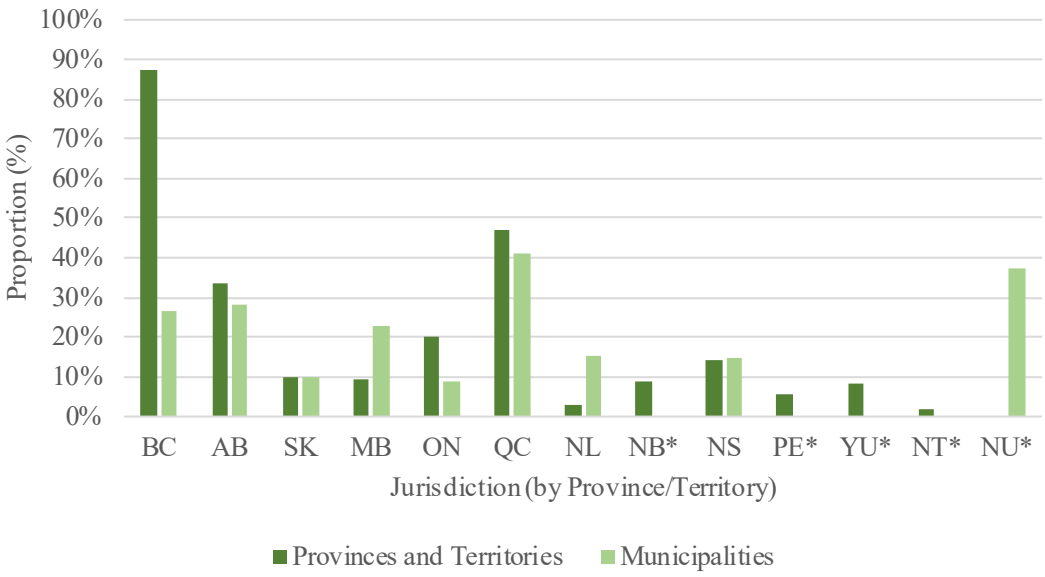
The second sub-dimension for measuring horizontal integration of policy goals looks at whether strategies refer to each other. Canada's "A Healthy Environment and a Healthy Economy" plan, published 3 years later in 2020, makes reference to the National Housing Strategy when discussing improving energy efficiency in buildings. Including that federal plan, only 11 of 60 strategies make explicit reference to strategic plans in the other sector. Four adaptation strategies from Vancouver, Toronto, Charlottetown, and Iqaluit refer to housing strategies. Six housing strategies from Vancouver, Toronto, Alberta, Ontario, and Nunavut (2) refer to climate change strategies. Vancouver and Toronto demonstrate the highest level of integration; both their housing and adaptation strategies discuss aligning policy goals between the two sectors, with specific reference to sectoral strategies. For example, the Vancouver Housing Plan states that it aligns itself with other key City strategies including various climate change and development planning documents. Vancouver's adaptation plan makes a consistent effort throughout to integrate its objectives with the housing sector's goals.

Policy Instruments

The first dimension of horizontal integration among policy instruments examines the proportion of instruments concerned with housing contained in adaptation strategies, and vis à versa. British Columbia and Vancouver, and Ontario and Toronto are the only regional and local jurisdictions where housing strategies contain policy actions that address adaptation. Adaptation strategies on the other hand, include housing instruments more often (see Figure 2 below). Out of 85 instruments found in federal adaptation strategies, 19% are housing-relevant instruments such as low-income retrofit programs, climate risk assessments for infrastructure management (including housing) on Indigenous reserves, and financial supports for homeowners to improve their resilience to climate change. British Columbia's adaptation strategy from BC Housing contains the highest proportion (14 of 16 instruments) of housing policy actions out of all provinces and territories. It includes a $1.1 billion Capital Renewal fund dedicated to improving living conditions, energy efficiency, and reducing emissions in public housing, improving

building energy information to tenants and homeowners, and other retrofitting and educational initiatives. Montreal's municipal adaptation strategy contains the highest proportion (34%) of housing-relevant actions (e.g. adopting by-laws to improve energy efficiency and resilience in buildings, affordable housing renovation programs, incentive campaigns for environmentally responsible practices, eliminating the use of heating oil in buildings) out of all municipalities. Iqaluit's strategy also has a high proportion of housing-relevant instruments (36%), for example support for building retrofits, public information campaigns for homeowners, and investments in green products for public housing.

Figure 2. Proportion of housing-related policy actions in adaptation strategies



Note. This figure depicts the proportion of housing-related policy actions found in adaptation strategies. The darker green bar represents regional level strategies and lighter green bar represents municipal level strategies.
*Results are omitted from Nunavut (no updated climate change strategy), and the municipalities of Moncton, Charlottetown, Whitehorse, and Yellowknife (less than 2 adaptation-relevant instruments found in climate change strategies).

We also examine whether there are procedural instruments described in the strategies that signal coordination mechanisms between the housing and adaptation sectors. The federal climate change and housing strategies do not contain any instruments such as information sharing mechanisms that facilitate coordination between the two sectors. At the regional level, two provinces (Ontario and Alberta) have housing strategies that contain information-sharing tools to facilitate coordination between species conservation efforts (Ontario), social services (Alberta),

and health systems (Alberta), but none are specific to the adaptation sector. Ontario's housing strategy, for example, proposes changes to the Environmental Assessment Act, Environmental Protection Act, Conservation Authorities Act, and Endangered Species Act to "reduce red-tape" in housing planning and facilitate coordinated action between conservation authorities and municipal planners. Information-sharing tools include general information campaigns, exhortation, conferences and workshops, collaborative actor networks, and institutional reforms. Contrary to the housing strategies, five provincial governments (New Brunswick, PEI, Ontario, Quebec, Manitoba) have adaptation strategies identify these tools specifically between the adaptation and housing sectors. Manitoba's adaptation strategy, for example, has established a Provincial Psychosocial Planning Table (PPPT) that is tasked with doing planning and coordination for all hazards and consists of cross-sectoral stakeholders engaging in disaster recovery. The members also work to support populations that may be the most vulnerable to the psychosocial impacts of climate events such as Indigenous people, the elderly, women, children, and people experiencing homelessness. At the local level, four municipalities (Toronto, Moncton, St. John's, Vancouver) have housing strategies that contain information-sharing tools between the housing and adaptation sectors and five (Winnipeg, Toronto, Iqaluit, St. John's, Vancouver) have adaptation strategies that contain such tools. For example, the City of Moncton's strategy states that the City plans to create a housing agency whose core mandate includes ensuring sustainability of affordable housing. The City of Iqaluit's adaptation strategy specifies the continuation of its annual Housing Round Table that involves both climate- and housing-related stakeholders at the local, territorial, and federal levels of government.

The final dimension that assesses integration of policy instruments examines whether strategies create mechanisms for managing policy layering and mixing processes over time. This is assessed by looking at whether mechanisms are in place to facilitate policy reviews, reforms, or updates. Eight provinces/territories and ten municipalities contain mechanisms for reviewing policy actions (e.g. revising building and design codes, updating by-laws, removing out-dated regulatory barriers). This includes 13 adaptation strategies and 16 housing strategies. Overall, 87 instruments from 30 strategies that make explicit effort to coordinate policy mixing, including both intra-sectoral (internal policy reviewing actions) and cross-sectoral mechanisms (policy reviewing actions involving both sectors). Canada's Pan-Canadian Framework commits $40

million over five years to revise national building codes to integrate adaptation into housing design. Ontario's adaptation strategy also demonstrates a commitment to updating its Building Code to better support the adoption of adaptation measures in households and building practices. Halifax's housing strategy states that it will "complete a review of each use and update policies and remove unnecessary and outdated policy and regulatory barriers".

Table 6. Level of Horizontal Integration in Provinces, Territories, and Municipalities

Dimension		BC	AB	SK	MB	ON	QC	NL	NB	NS	PE	YU	NT	NU
1	Policy Frame	1	1.33	1	1	1	1.5	1	2	1	1.5	2	2	1.33
2	Subsystem Involvement	2	2	1	1	1	1	1	1	1	4	2	2	3
3	Range of policies	4	3	1	1	2	1	1	2	1	2	1	1	1
	Policy coherence	1	3	1	1	3	1	1	1	1	1	1	1	3
4	Range of subsystems'	3	3	2	1	3	1	3	1	1	3	2	1	1
	Procedural instruments	3	1	1	4	2	3	1	3	4	2	1	1	1
	Consistency	No	No	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Dimension		Vancouver	Calgary	Saskatoon	Winnipeg	Toronto	Montreal	St. John's	Moncton	Halifax	Charlottetown	Whitehorse	Yellowknife	Iqaluit
1	Policy Frame	3	1	1	1	3	2	4	2	1	1	1	1	2
2	Subsystem Involvement	2	2	2	2	2	2	1	1	2	2	1	1	2
3	Range of policies	1	1	1	2	3	1	2	2	2	1	1	1	1
	Policy coherence	4	1	1	1	4	1	1	1	1	2	1	1	2
4	Range of subsystems'	2	2	2	2	3	3	2	1	1	3	1	1	4
	Procedural instruments	2	1	1	3	3	1	2	4	1	2	1	1	4
	Consistency	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes

3.3.2.2 Vertical Policy Integration

Policy Frame

The policy frame dimension of vertical policy integration looks at whether housing and adaptation are described as boundary-spanning problems requiring action from multiple levels of government, or if they focus on the issue solely in the context of a single level of government. Most strategies (72%) discuss housing or adaptation within the context of only one level of government. A further 22% include some recognition of the importance of coordination across jurisdictions. Overall, there is a stronger framing around adaptation as a boundary-spanning problem compared to housing.

At the federal level, the Pan-Canadian Framework for Climate Change recognizes the multilevel nature of climate change action and in particular the role of the provinces and territories, but it is the only federal plan analyzed here to do so. At the regional level, the Pan-Territorial Adaptation Strategy is the only strategy demonstrating a highly integrated policy frame where achieving resilience is a concern for all levels of government. For example, it states:

> *Adaptation requires governments to manage risks and ensure that Northern infrastructure, closely with partners at all levels - local, national, international - as well as with Aboriginal governments and organizations by sharing climate change adaptation knowledge and developing collaborative activities (Territories Regional CCA Strategy)*

Only one local adaptation strategy, the Resilient St. John's Community Climate Plan, gives a similarly integrative framing. These policy frames indicate a commitment to collaborating with all levels of government and relevant actors to address policy issues. All 55 other strategies lack explicit recognition of inter-governmental involvement.

Subsystem Involvement

Governments at all three levels perform significantly higher with regards to vertical coordination between government actors than they did in horizontal coordination between adaptation and housing actors. Only 11 strategies showed no signs of vertical integration, while 24 of 60 strategies demonstrated high vertical integration scoring 3 or 4 on the Likert scale.

Canada's federal strategies for both housing and adaptation call for active involvement of all levels of government and other relevant subsystems. Most (82%) jurisdictions include at least one other jurisdiction in sharing responsibility for implementation, and 31% of jurisdictions include all three levels of government when considering responsibility for implementation. This means that federal, regional, and local departments are involved in the implementation of the policy action. In 5 provinces/territories (New Brunswick, Prince Edward Island, all three Territories), government actors at all levels and other relevant systems (i.e. civil society, private sector actors) have specific tasks assigned to their role in the governance of either housing or adaptation. At the local level, 5 municipalities (Halifax, Moncton, St. John's, Toronto, Yellowknife) have achieved the same. This makes a total of 6 adaptation (2 Federal, New Brunswick, Northwest Territories, Halifax, St. John's) and 8 housing strategies (Federal, Yukon, Nunavut, PEI, Halifax, Moncton, Toronto, Yellowknife) where multi-level actors are involved in policy action.

Policy Goals

To assess vertical integration of policy goals between levels of government, I examine whether strategies acknowledge policy goals from relevant strategies at other levels of government. About one-third (n = 19) of strategies make no reference to any strategies from other levels of government. At the federal level, the Pan-Canadian Framework dedicates a section of its strategy to outlining key goals and actions from all provinces and territories except for Saskatchewan (which opted out of adopting the framework at the time) and Manitoba. The Healthy Environment and Healthy Economy plan refers to the National Inuit Climate Change Strategy. Of the 33 provincial and territorial strategies analyzed here, 12 made no reference to strategies from other levels of government. Of those that do reference other strategies, most (n = 22) refer to a federal strategy. The only provincial and territorial strategies that reference both federal and municipal strategies are the Nova Scotia and Nunavut housing strategies. Overall, municipalities demonstrate some vertical integration. Out of 20 municipal strategies, 11 refer to both a provincial and federal strategy and four refer to either a provincial or federal strategy. Vancouver's climate change adaptation strategy provides an excellent example of high integration on this front, where it not only aligns its objectives with the Pan-Canadian

Framework and the province's Climate Leadership Plan, but also with it's own adjacent climate, economic, and social plans.

Policy Instruments

Looking at procedural instruments at each system-level, there is evidence of information sharing and coordination between jurisdictions. All federal adaptation and housing strategies have coordinating mechanisms between jurisdictions. The Pan-Canadian Framework proposes the creation of the Canada Infrastructure Bank and declares a commitment to work with provinces, territories, and municipalities to "further the reach of government funding directed to infrastructure," which could include housing. The National Housing Strategy sets off to create a new National Housing Council, Federal Housing Advocate, and Inuit-Crown Partnership Committee-- all with diverse participation across jurisdictions. Almost all regions (except Nova Scotia) and municipalities (except Saskatoon and Charlottetown) show evidence of some information sharing between jurisdictions.

Regionally, 6 adaptation strategies (Manitoba, New Brunswick, Ontario, Saskatchewan, Northwest Territories, Yukon Territories) and 5 housing strategies (BC, Ontario, PEI, Nunavut, Yukon) demonstrate robust coordinating mechanisms between jurisdictions. Manitoba is developing Municipal Water Sustainability Plans to encourage communities to incorporate climate considerations into their planning. PEI has created a Community Housing Liaison that brings together community partners, property developers, and other levels of government to develop solutions to housing affordability.

At the local level, there are 5 adaptation strategies (Halifax, Iqaluit, Toronto, Vancouver) and 8 housing strategies (Calgary, Moncton, Montreal, St. John's, Toronto, Vancouver, Whitehorse, Yellowknife) that also have policy instruments aimed at coordination and collaboration between levels of government. Halifax has established a central Climate Change Office to facilitate planning and coordination between levels of government and other relevant actors. Toronto hosts an annual meeting where local housing partners, provincial, and federal officials can address regional housing challenges.

Table 7. Level of Vertical Integration in Provinces, Territories, and Municipalities

Dimension		BC	AB	SK	MB	ON	QC	NL	NB	NS	PE	YU	NT	NU
1	Policy Frame	1.25	1	1	1	1.5	1.5	1.67	1	1	1	2.33	2	2.33
2	Subsystem Involvement	1.5	2	2	2	2	1.5	2.33	2.5	2.5	3.5	2.5	2.5	4
3	Policy coherence	1.5	1.5	2	1.5	1.33	1	2	2	2.5	2	1.5	2	2
4	Procedural instruments	4	2	4	4	4	2	2	4	1	2	4	4	4
Dimension		Vancouver	Calgary	Saskatoon	Winnipeg	Toronto	Montreal	St. John's	Moncton	Halifax	Charlottetown	Whitehorse	Yellowknife	Iqaluit
1	Policy Frame	2	2	1	1	2	1	3	1	1	1	1	1	1
2	Subsystem Involvement	2	2	3	2	3	1.5	3.5	2.5	4	2	2	4	2
3	Policy coherence	2.5	3	2	3	2.5	1	2	2	1.5	3	3	3	4
4	Procedural instruments	4	3	1	2	4	2	3	4	4	1	4	4	4

3.4 Discussion

Planning for housing adaptation in Canada is nascent and integration is scant between the two sectors. Policy language used in framework strategies is largely sector-specific, with few instruments to facilitate cross-sectoral planning. Instruments that do include coordination mechanisms are focussed on general issues related to housing development (i.e. amending building codes, land-use planning), lacking tenure-specificity. Although there are rarely adaptation considerations for different tenure categories, there is some attention at the Federal level to Indigenous housing. Indigenous and northern housing have become a key priority area in both sectors in the face of accelerated warming and consequences from historically negligent planning that have exacerbated housing issues for Indigenous Peoples. Surprisingly, explicit risks like permafrost melt are rarely identified in relation to northern housing concerns despite the known destructive implications for housing infrastructure. This observation is consistent with findings from the 2018 Auditors General Report on climate action in Canada, which finds that many jurisdictions have not developed precise steps for adaptation beyond initial risk assessments. Overall, strategizing for adaptation responses in different tenure categories is absent from framework strategies. British Columbia's Housing Management Commission (BC Housing) provides the sole outlier to this conclusion, where it is the only regional housing authority to be actively involved in adaptation planning in the province. The development and publication of their own adaptation framework in 2017, an extension of their sustainability plan, pays special attention to adaptation responses for social housing.

Although strategies are narrowly framed within their sector of focus, there is evidence of higher integration between levels of government. The vertical integration analysis reveals existing mechanisms for inter-jurisdictional coordination and communication, illustrative of the multi-level governance structure in Canada. Overall, regional to federal coordination and vis à versa is more present than regional or federal top-down coordination with local governments. Guidance from regional to municipal governments could be lacking despite the need for strong leadership for effective adaptation planning. It is denoted by the fact that regions predominantly outline high-level commitments in their strategies, scarcely including detailed next-steps for implementation (i.e. designated timelines, funding sources), and are therefore unable to or deliberately avoid assigning resources to local governments effectively. This birds eye view of

adaptation governance through framework strategies shows that the status quo perpetuates the fragmented governance regime surrounding adaptation in Canada. The primary decision-makers and first responders to climate hazards are local governments, where higher-forms of leadership have the burden to support and ultimately empower local adaptation through guidance and resource-sharing. Instead, efforts for adaptation planning are met with an absence of comprehensive institutional infrastructure (or 'voids') to traverse multiple levels of governance, resulting in autonomous, ad-hoc adaptation activities at the community level. The integration analysis results underscore this contradiction in adaptation planning, which perhaps demonstrate an unintentional polycentrism born of neglect, where local governments struggle to access resources that are stuck higher up in the funnel of governance.

Another challenge for policy integration is instrument choice. The policy instrument analysis shows that the adaptation sector prefers information- and authority-based policy instruments, while the housing sector largely relies on financial instruments (except at the municipal level). There are any number of possible policy mixes that can be employed to achieve a policy goal, but this trend suggests that the two sectors have distinct policy styles in which they tend to use different types of policy instruments to implement policy goals. The prevalence of informational and authoritative instruments in the adaptation sector reflects a preference for impact and vulnerability assessments, adaptation planning, and regulatory changes. In the housing sector, the reliance on financial instruments reflects in part the large amount of funding put towards housing from 2017 onwards. These financial instruments are focussed on generating new housing supply and providing grants and subsidies to property owners. Policy styles can be rather resistant to change, as they are deeply rooted in historical sectoral policy preferences (Freeman, 1985). This path dependence points to one of the governance challenges of policy integration where policy styles may have developed distinctly over time.

I find little discussion on the equity dimensions of housing and climate change impacts. While the federal government applied a specific equity-based analytical framework to develop the National Housing Strategy, it is unclear how well this is integrated into housing adaptation planning since most equity considerations in housing sector strategies are heavily focussed on affordability issues. Further, systematic approaches to equity planning are lacking completely in the adaptation space. Though it is well-established that climate hazards disproportionately impact

vulnerable groups, there is seldom recognition and planning for this in strategies, evidenced by the fact that the majority (93%) of policy instruments do not address social vulnerability dimensions of climate risk. These findings suggest that equity is still missing from the broader conversation in housing adaptation, highlighting a critical gap in equity planning across and between sectors.

The federal government announced the creation of its first National Adaptation Strategy (NAS) in the Healthy Environment and Healthy Economy plan back in 2020, the development of which was further motivated by the major flooding and heat dome events in B.C. the year after. In anticipation of its publication, this research provides a baseline for how the adaptation and housing sectors interact in Canada and opens opportunity for further comparative research. It illuminates the existing gaps in housing adaptation that have characterized Canada's policy landscape in the last 6 years, and raises important questions in anticipation of the NAS. Will the NAS address key policy gaps with respect to adaptation planning in the housing sector? Will the NAS consolidate adaptation as a long-term priority for the federal, and effectively support adaptation planning at regional and local levels? Further research looking at interactions between the housing and adaptation sectors will be critical following the publication of the NAS, particularly in understanding ongoing efforts at policy integration and policy implementation over time. Furthermore, Canada is geographically vast, diverse, and dispersed, with highly variable circumstances across the country. This study examines policy actions at three levels of government, but ultimately captures a high-level view of Canada's policy plane. For example, the most populous cities in each province and territory have more resources to undertake adaptation and may not be representative of adaptive capacity for medium and small municipalities. It is therefore crucial to expand the study of local adaptation and housing policy landscapes in Canada, particularly in rural and remote communities.

4. Conclusion

Canada is facing concurrent climate and housing crises, and we know that these two sectors affect each other in many ways. We see how climate change impacts housing when residents are unable to cope with intensifying heat waves due to lack of cooling infrastructure (Chen et al., 2020; Mavrogianni et al., 2015; Price et al., 2013; Smoyer-Tomic et al., 2003; Vandentorren et al., 2006). On the other hand, housing is a significant part of Canada's urban infrastructure and housing policy can support or constrain adaptation efforts. Although it is evident in climate change vulnerability research that housing and adaptation are intertwined, policy progress on addressing these linkages across Canada is tenuous in both sectors. In response to these concerns, my thesis examined the extent of policy integration between the two sectors by looking at how adaptation and housing are addressed in federal, regional, and municipal strategies for adaptation and housing. I operationalized a multi-dimensional framework to determine the levels of horizontal integration between the housing and adaptation sectors and vertical integration between levels of government in Canada.

The results of this study indicate that there is little policy integration between the housing and adaptation sectors. The housing sector is one of Canada's largest economic sectors, yet there is limited attention to how housing shapes vulnerability to climate change and will be impacted by changing environment hazards. There is also little evidence that governments recognize potential synergies between adaptation and housing priorities beyond hazards like flooding and extreme heat that have presented immediate risks to housing in the past few years. The policy language identified in the framework strategies is often sector-specific and "siloed" within their respective policy realms. I also found that policy actions are often non-specific, using vague terminology and or alluding to vague impacts. This lack of specificity is reflected in Tables 3 and 4, where for example, we see that adaptation strategies more often address climate impacts generally rather than rooting out specific climate hazards. This vagueness supports evidence for an 'implementation deficit' with respect to housing in adaptation planning in Canada. There is some recognition that inter-sectoral collaboration is important, however, explicit mechanisms to achieve this are rare. Integration tends to be more present between levels of government, which frequently share objectives and policy actions that encourage collaboration. In sum, there is still

a lot of work to be done to establish active communication and collaboration channels between the housing and adaptation sectors.

Adaptation in Canada is often framed as a local level issue (Government of Quebec, 2020), and Canada is one of the last high-income countries to produce a national adaptation strategy, belying the slow pace of national adaptation policy development. Paradoxically, local level governments deal with a chronic lack of policy guidance and resources to implement adaptation objectives (Nalau et al., 2015). This paradox is emphasized by the broad nature of most adaptation policy goals and an absence of clear action plans for implementing them. Canada's adaptation governance style is characterised by diffusion of power and roles between actors in government, public, and private spheres. Network governance can be an appropriate approach to adaptation planning, since adaptation is a complex, boundary-spanning issue that benefits from collaboration and resource-sharing (Bednar et al., 2019). Nonetheless, network governance can have its limitations. The diffusion of responsibility across systems makes it difficult to coordinate policy actions and avoid redundancies or contradictions. In addition, differences in policy styles and division of responsibility between sectors provides another obstacle to synergistic planning. Given the many moving pieces working in the adaptation and housing sectors, policy integration may be essential to maintaining effective network governance.

Policy integration is a reflexive and ongoing process that requires active and meaningful collaboration between a wide range of actors. Yet, the implementation of affordable housing policies and new housing construction continues to accelerate in Canada, seemingly without enough attention to climate risks. This highlights the urgency of examining the synergies and trade-offs between the housing and adaptation sectors. In anticipation of the publication of Canada's first National Adaptation Strategy (NAS), this research provides a baseline for how the adaptation and housing sectors interact in Canada and opens opportunities for further comparative research. It illuminates the existing gaps in housing adaptation that have characterised Canada's policy landscape for the last 6 years, and raises important questions for the forthcoming of the NAS. Will the NAS address key policy gaps with respect to adaptation planning in the housing sector? Will the NAS consolidate adaptation as a long-term priority for the federal, and effectively support adaptation planning at regional and local levels? Undoubtedly, the publication of the NAS shows that Canada's adaptation policy landscape is

progressing, and that we can expect continued development in adaptation policy over the coming years. Further research is warranted to better understand the processes driving or undermining policy integration, and how policy actions are implemented over time in the housing and adaptation sectors. Another iteration of this study could include diagonal or cross-dimensional analysis, which would combine the horizontal and vertical integration on a matrix to create cumulative scoring. A study focussed more on maladaptive actions arising from low integration could incorporate negative scoring, to delineate between neutral and actively harmful actions.

5. References

Aarland, K., & Reid, C. K. (2019). Homeownership and residential stability: does tenure really make a difference? *International Journal of Housing Policy*, *19*(2), 165–191. https://doi.org/10.1080/19491247.2017.1397927

Agyekum, B., Siakwah, P., & Kwame Boateng, J. (2020). Immigration, education, sense of community and mental well-being: the case of visible minority immigrants in Canada. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, *14*(2), 222–236. https://doi.org/10.1080/17549175.2020.1801488

Ajibade, I., & McBean, G. (2014). Climate extremes and housing rights: A political ecology of impacts, early warning and adaptation constraints in Lagos slum communities. *Geoforum*, *55*, 76–86. https://doi.org/10.1016/j.geoforum.2014.05.005

Alexandre K. Magnan, T. R. (2016). Global adaptation after Paris. *Science*, *352*(6291), 1280–1282.

Amundsen, H. (2010). *Overcoming barriers to climate change adaptationöa question of multilevel governance ? 28*, 276–290. https://doi.org/10.1068/c0941

Anguelovski, I., Connolly, J. J. T., Masip, L., & Pearsall, H. (2018). Assessing green gentrification in historically disenfranchised neighborhoods: a longitudinal and spatial analysis of Barcelona. *Urban Geography*, *39*(3), 458–491. https://doi.org/10.1080/02723638.2017.1349987

Anguelovski, I., Shi, L., Chu, E., Gallagher, D., Goh, K., Lamb, Z., Reeve, K., & Teicher, H. (2016). Equity Impacts of Urban Land Use Planning for Climate Adaptation: Critical Perspectives from the Global North and South. *Journal of Planning Education and Research*, *36*(3), 333–348. https://doi.org/10.1177/0739456X16645166

Armitage, D., Berkes, F., Dale, A., Kocho-Schellenberg, E., & Patton, E. (2011). *Co-management and the co-production of knowledge: Learning to adapt in Canada's Arctic*. https://doi.org/10.1016/j.gloenvcha.2011.04.006

Auditor General of Canada. (2017). *Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada -Report 2 Adapting to Impacts of*

Climate.

Austin, S. E., Ford, J. D., Berrang-Ford, L., Araos, M., Parker, S., & Fleury, M. D. (2015). Public health adaptation to climate change in canadian jurisdictions. *International Journal of Environmental Research and Public Health*, *12*(1), 623–651. https://doi.org/10.3390/ijerph120100623

Bauer, A., & Steurer, R. (2013). *Multi-level governance of climate change adaptation through regional partnerships in Canada and England*. https://doi.org/10.1016/j.geoforum.2013.10.006

Bednar, D., & Henstra, D. (2018). Applying a Typology of Governance Modes to Climate Change Adaptation. *Politics and Governance*, *6*(3), 147–158. https://doi.org/10.17645/pag.v6i3.1432

Bednar, D., Henstra, D., & McBean, G. (2019). The governance of climate change adaptation: are networks to blame for the implementation deficit? *Journal of Environmental Policy and Planning*, *21*(6), 702–717. https://doi.org/10.1080/1523908X.2019.1670050

Berrang-Ford, L., Biesbroek, R., Ford, J. D., Lesnikowski, A., Tanabe, A., Wang, F. M., Chen, C., Hsu, A., Hellmann, J. J., Pringle, P., Grecequet, M., Amado, J. C., Huq, S., Lwasa, S., & Heymann, S. J. (2019). Tracking global climate change adaptation among governments. In *Nature Climate Change* (Vol. 9, Issue 6, pp. 440–449). Nature Publishing Group. https://doi.org/10.1038/s41558-019-0490-0

Biesbroek, R. (2021). Policy integration and climate change adaptation. *Current Opinion in Environmental Sustainability*, *52*, 75–81. https://doi.org/10.1016/j.cosust.2021.07.003

Biesbroek, R., & Delaney, A. (2020). Mapping the evidence of climate change adaptation policy instruments in Europe. *Environmental Research Letters*, *15*(8). https://doi.org/10.1088/1748-9326/ab8fd1

Biesbroek, R., & Lesnikowski, A. (2018). Adaptation: The Neglected Dimension of Polycentric Climate Governance? *Governing Climate Change*, *May*, 303–319.

Bulkeley, H., & Betsill, M. M. (2005). Rethinking sustainable cities: Multilevel governance and the "urban" politics of climate change. *Environmental Politics*, *14*(1), 42–63.

https://doi.org/10.1080/0964401042000310178

Bulkeley, H., & Betsill, M. M. (2013). *Revisiting the urban politics of climate change*. *4016*. https://doi.org/10.1080/09644016.2013.755797

Candel, J. J. L., & Biesbroek, R. (2016). Toward a processual understanding of policy integration. *Policy Sciences*, *49*(3), 211–231. https://doi.org/10.1007/s11077-016-9248-y

Candel, J. J. L., & Biesbroek, R. (2018). Policy integration in the EU governance of global food security. *Food Security*, *10*(1), 195–209. https://doi.org/10.1007/s12571-017-0752-5

Canham, S. L., Wister, A., & O'dea, E. (2019). *Strengths, weaknesses, opportunities, and threats to housing first in Metro Vancouver*. https://doi.org/10.1016/j.evalprogplan.2019.05.004

Cejudo, G. M., & Michel, C. L. (2017). Addressing fragmented government action: coordination, coherence, and integration. *Policy Sciences*, *50*(4), 745–767. https://doi.org/10.1007/s11077-017-9281-5

Chen, M., Ban-Weiss, G. A., & Sanders, K. T. (2020). Utilizing smart-meter data to project impacts of urban warming on residential electricity use for vulnerable populations in Southern California. *Environmental Research Letters*, *15*(6), 064001. https://doi.org/10.1088/1748-9326/ab6fbe

Clar, C., & Steurer, R. (2019). Climate change adaptation at different levels of government: Characteristics and conditions of policy change. *Natural Resources Forum*, *43*(2), 121–131. https://doi.org/10.1111/1477-8947.12168

Collins, T. W., Grineski, S. E., Chakraborty, J., & Flores, A. B. (2019). Environmental injustice and Hurricane Harvey: A household-level study of socially disparate flood exposures in Greater Houston, Texas, USA. *Environmental Research*, *179*(June), 108772. https://doi.org/10.1016/j.envres.2019.108772

Cunsolo Willox, A., Harper, S. L., Ford, J. D., Landman, K., Houle, K., & Edge, V. L. (2012). *"From this place and of this place:" Climate change, sense of place, and health in Nunatsiavut, Canada the Rigolet Inuit Community Government e*. https://doi.org/10.1016/j.socscimed.2012.03.043

Curran, W., & Hamilton, T. (2012). Local Environment The International Journal of Justice and Sustainability Just green enough: contesting environmental gentrification in Greenpoint, Brooklyn. *Taylor & Francis*, *17*(9), 1027–1042. https://www.tandfonline.com/action/journalInformation?journalCode=cloe20

De Koning, K., & Filatova, T. (2020). Repetitive floods intensify outmigration and climate gentrification in coastal cities. *Environmental Research Letters*, *15*(3), 34008. https://doi.org/10.1088/1748-9326/ab6668

Di Gregorio, M., Nurrochmat, D. R., Paavola, J., Sari, I. M., Fatorelli, L., Pramova, E., Locatelli, B., Brockhaus, M., & Kusumadewi, S. D. (2017). Climate policy integration in the land use sector: Mitigation, adaptation and sustainable development linkages. *Environmental Science and Policy*, *67*, 35–43. https://doi.org/10.1016/j.envsci.2016.11.004

Dilling, L., Prakash, A., Zommers, Z., Ahmad, F., Singh, N., de Wit, S., Nalau, J., Daly, M., & Bowman, K. (2019). Is adaptation success a flawed concept? In *Nature Climate Change* (Vol. 9, Issue 8, pp. 572–574). Nature Publishing Group. https://doi.org/10.1038/s41558-019-0539-0

Dreier, P., & Hulchanski, J. D. (1993). The Role of Nonprofit Housing in Canada and the United States: Some Comparisons. *Housing Policy Debate*, *4*(1), 43–80. https://doi.org/10.1080/10511482.1993.9521124

Dupuis, J., & Biesbroek, R. (2013). Comparing apples and oranges: The dependent variable problem in comparing and evaluating climate change adaptation policies. *Global Environmental Change*, *23*(6), 1476–1487. https://doi.org/10.1016/j.gloenvcha.2013.07.022

Dupuis, J., & Knoepfel, P. (2013). The adaptation policy paradox: The implementation deficit of policies framed as climate change adaptation. *Ecology and Society*, *18*(4). https://doi.org/10.5751/ES-05965-180431

Edge, S., Brown, E. L., Ghosh, S., & Murnaghan, A. M. (2020). Procedural environmental (in)justice at multiple scales: examining immigrant advocacy for improved living conditions. *Local Environment*, *25*(9), 666–680. https://doi.org/10.1080/13549839.2020.1812554

Eriksen, S., Aldunce, P., Bahinipati, C. S., Martins, R. D. A., Molefe, J. I., Nhemachena, C., O'Brien, K., Olorunfemi, F., Park, J., Sygna, L., & Ulsrud, K. (2011). When not every response to climate change is a good one: Identifying principles for sustainable adaptation. *Climate and Development*, *3*(1), 7–20. https://doi.org/10.3763/cdev.2010.0060

Fayazi, M., Bisson, I. A., & Nicholas, E. (2020). Barriers to climate change adaptation in indigenous communities: A case study on the mohawk community of Kanesatake, Canada. *International Journal of Disaster Risk Reduction*, *49*, 101750. https://doi.org/10.1016/j.ijdrr.2020.101750

Ford, J. D., Berrang-Ford, L., Biesbroek, R., Araos, M., Austin, S. E., & Lesnikowski, A. (2015). Adaptation tracking for a post-2015 climate agreement. In *Nature Climate Change* (Vol. 5, Issue 11, pp. 967–969). Nature Publishing Group. https://doi.org/10.1038/nclimate2744

Ford, J. D., Berrang-Ford, L., Lesnikowski, A., Barrera, M., & Heymann, S. J. (2013). *How to Track Adaptation to Climate Change: A Typology of Approaches for National-Level Application*. *18*(3). https://doi.org/10.5751/ES-05732-180340

Ford, J. D., Champalle, C., Tudge, P., Riedlsperger, R., Bell, T., & Sparling, E. (2015). Evaluating climate change vulnerability assessments: a case study of research focusing on the built environment in northern Canada. *Mitigation and Adaptation Strategies for Global Change*, *20*(8), 1267–1288. https://doi.org/10.1007/s11027-014-9543-x

Ford, J. D., Pearce, T., McDowell, G., Berrang-Ford, L., Sayles, J. S., & Belfer, E. (2018). Vulnerability and its discontents: the past, present, and future of climate change vulnerability research. *Climatic Change*, *151*(2), 189–203. https://doi.org/10.1007/s10584-018-2304-1

Ford, J. D., & Smit, B. (2004). A framework for assessing the vulnerability of communities in the Canadian Arctic to risks associated with climate change. *Arctic*, *57*(4), 389–400. https://doi.org/10.14430/arctic516

Ford, J. D., Smit, B., & Wandel, J. (2006). Vulnerability to climate change in the Arctic: A case study from Arctic Bay, Canada. *Global Environmental Change*, *16*(2), 145–160. https://doi.org/10.1016/j.gloenvcha.2005.11.007

Ford, J. D., Stephenson, E., Cunsolo Willox, A., Edge, V., Farahbakhsh, K., Furgal, C., Harper, S., Chatwood, S., Mauro, I., Pearce, T., Austin, S., Bunce, A., Bussalleu, A., Diaz, J., Finner, K., Gordon, A., Huet, C., Kitching, K., Lardeau, M. P., … Sherman, M. (2016). Community-based adaptation research in the Canadian Arctic. *Wiley Interdisciplinary Reviews: Climate Change*, *7*(2), 175–191. https://doi.org/10.1002/wcc.376

Freeman, G. P. (1985). National Styles and Policy Sectors: Explaining Structured Variation. *Journal of Public Policy*, *5*(4), 467–496. https://doi.org/10.1017/S0143814X00003287

Freitas, C. R., D'Avignon, A. L. de A., & Castro, A. C. (2019). Urban social vulnerability and climate change in Rio de Janeiro city associated with population mobility. *Journal of Environmental Policy and Planning*, *21*(6), 797–810. https://doi.org/10.1080/1523908X.2019.1674135

Furgal, C., & Seguin, J. (2006). Climate change, health, and vulnerability in Canadian northern Aboriginal communities. *Environmental Health Perspectives*, *114*(12), 1964–1970. https://doi.org/10.1289/ehp.8433

Henstra, D. (2016). The tools of climate adaptation policy: analysing instruments and instrument selection. *Climate Policy*, *16*(4), 496–521. https://doi.org/10.1080/14693062.2015.1015946

Henstra, D. (2017). Climate Adaptation in Canada: Governing a Complex Policy Regime. *Review of Policy Research*, *34*(3), 378–399. https://doi.org/10.1111/ropr.12236

Henstra, D., Thistlethwaite, J., Brown, C., & Scott, D. (2019). Flood risk management and shared responsibility: Exploring Canadian public attitudes and expectations. *Journal of Flood Risk Management*, *12*(1), 1–10. https://doi.org/10.1111/jfr3.12346

Hoffman, J. S., Shandas, V., & Pendleton, N. (2020). The effects of historical housing policies on resident exposure to intra-urban heat: A study of 108 US urban areas. In *Climate* (Vol. 8, Issue 1). https://doi.org/10.3390/cli8010012

Hogl, K., Kleinschmit, D., & Rayner, J. (2016). Achieving policy integration across fragmented policy domains: Forests, agriculture, climate and energy. *Environment and Planning C: Government and Policy*, *34*(3), 399–414. https://doi.org/10.1177/0263774X16644815

Hooghe, L., & Marks, G. (2010). Types of multi-level governance. *Handbook on Multi-Level*

Governance, *5*, 17–31. https://doi.org/10.4337/9781849809047.00007

Howlett, M., Kim, J., & Weaver, P. (2006). Assessing instrument mixes through program- and agency-level data: Methodological issues in contemporary implementation research. *Review of Policy Research*, *23*(1), 129–151. https://doi.org/10.1111/j.1541-1338.2006.00189.x

Howlett, M., & Rayner, J. (2007). Design Principles for Policy Mixes: Cohesion and Coherence in 'New Governance Arrangements.' *Policy and Society*, *26*(4), 1–18. https://doi.org/10.1016/s1449-4035(07)70118-2

Howlett, M., Vince, J., & Río, P. (2017). *Policy Integration and Multi-Level Governance : Dealing with the Vertical Dimension of Policy Mix Designs*. *5*(2), 69–78. https://doi.org/10.17645/pag.v5i2.928

Hulchanski, J. D. (2006). What factors shape Canadian housing policy? The intergovernmental role in Canada's housing system. *Canada: The State of the Federation*, 221–247.

Instone, L., Mee, K. J., Palmer, J., Williams, M., & Vaughan, N. (2015). *41 Climate change adaptation in the rental sector*.

Juhola, S., Carina Keskitalo, E. H., & Westerhoff, L. (2011). Understanding the framings of climate change adaptation across multiple scales of governance in Europe. *Environmental Politics*, *20*(4), 445–463. https://doi.org/10.1080/09644016.2011.589571

Juhola, S., Glaas, E., Linnér, B. O., & Neset, T. S. (2016). Redefining maladaptation. *Environmental Science and Policy*, *55*, 135–140. https://doi.org/10.1016/j.envsci.2015.09.014

Kates, R. W., Travis, W. R., & Wilbanks, T. J. (2012). Transformational adaptation when incremental adaptations to climate change are insufficient. *Proceedings of the National Academy of Sciences of the United States of America*, *109*(19), 7156–7161. https://doi.org/10.1073/pnas.1115521109

Keenan, J. M., Hill, T., & Gumber, A. (2018). Climate gentrification: From theory to empiricism in Miami-Dade County, Florida. *Environmental Research Letters*, *13*(5). https://doi.org/10.1088/1748-9326/aabb32

Keskitalo, E. C. H., Juhola, S., Baron, N., Fyhn, H., & Klein, J. (2016). *Implementing Local Climate Change Adaptation and Mitigation Actions : The Role of Various Policy Instruments in a Multi-Level Governance Context*. https://doi.org/10.3390/cli4010007

Kohen, D. E., Bougie, E., & Guèvremont, A. (2015). Housing and health among Inuit children. *Health Reports*, *26*(11), 21–27.

Lafferty, W. M., & Hovden, E. (2003). Environmental policy integration: Towards an analytical framework. *Environmental Politics*, *12*(3), 1–22. https://doi.org/10.1080/09644010412331308254

Lee, J. Y., & Zandt, S. Van. (2019). *Housing Tenure and Social Vulnerability to Disasters: A Review of the Evidence*. https://doi.org/10.1177/0885412218812080

Lesnikowski, A. (n.d.). *The Global Adaptation Mapping Initiative (GAMI): Part 3-Coding protocol*. https://doi.org/10.21203/rs.3.pex-1242/v1

Lesnikowski, A., Ford, J., Biesbroek, R., Berrang-Ford, L., & Heymann, S. J. (2016). National-level progress on adaptation. *Nature Climate Change*, *6*(3), 261–264. https://doi.org/10.1038/nclimate2863

Lesnikowski, A., Ford, J. D., Biesbroek, R., & Berrang-Ford, L. (2019). A policy mixes approach to conceptualizing and measuring climate change adaptation policy. *Climatic Change*, *156*(4), 447–469. https://doi.org/10.1007/s10584-019-02533-3

Mach, K. J., Kraan, C. M., Hino, M., Siders, A. R., Johnston, E. M., & Field, C. B. (2019). Managed retreat through voluntary buyouts of flood-prone properties. *Science Advances*, *5*(10), eaax8995. https://doi.org/10.1126/sciadv.aax8995

Macintosh, A., Foerster, A., & McDonald, J. (2015). Policy design, spatial planning and climate change adaptation: a case study from Australia. *Journal of Environmental Planning and Management*, *58*(8), 1432–1453. https://doi.org/10.1080/09640568.2014.930706

Mavrogianni, A., Taylor, J., Davies, M., Thoua, C., & Kolm-Murray, J. (2015). Urban social housing resilience to excess summer heat. In *Building Research and Information* (Vol. 43, Issue 3, pp. 316–333). Routledge. https://doi.org/10.1080/09613218.2015.991515

McDowell, G., Ford, J. D., & Jones, J. (2016). *Community-level climate change vulnerability research: trends, progress, and future directions Related content A systematic review of dynamics in climate risk and vulnerability assessments The state of climate change adaptation in the Arctic*. https://doi.org/10.1088/1748-9326/11/3/033001

Mees, H. L. P., Dijk, J., van Soest, D., Driessen, P. P. J., van Rijswick, M. H. F. M. W., & Runhaar, H. (2014). A method for the deliberate and deliberative selection of policy instrument mixes for climate change adaptation. *Ecology and Society*, *19*(2). https://doi.org/10.5751/ES-06639-190258

Nalau, J., Preston, B. L., & Maloney, M. C. (2015). Is adaptation a local responsibility? *Environmental Science and Policy*, *48*, 89–98. https://doi.org/10.1016/j.envsci.2014.12.011

Novac, S., Darden, J., Hulchanski, D., & Seguin, A. (2002). *Housing Discrimination in Canada : The State of Knowledge*. *February*.

O'BRIEN, K., Eriksen, S., Nygaard, L. P., & Schjolden, A. (2007). Why different interpretations of vulnerability matter in climate change discourses. *Climate Policy*, *7*(1), 73–88. https://doi.org/10.1080/14693062.2007.9685639

Oulahen, G. (2021). Flood hazards, environmental rewards, and the social reproduction of risk. *Geoforum*, *119*, 43–51. https://doi.org/10.1016/j.geoforum.2020.12.021

Owusu, M., & Nursey-Bray, M. (2019). Socio-economic and institutional drivers of vulnerability to climate change in urban slums: the case of Accra, Ghana. *Climate and Development*, *11*(8), 687–698. https://doi.org/10.1080/17565529.2018.1532870

Pandey, R., Alatalo, J. M., Thapliyal, K., Chauhan, S., Archie, K. M., Gupta, A. K., Jha, S. K., & Kumar, M. (2018). Climate change vulnerability in urban slum communities: Investigating household adaptation and decision-making capacity in the Indian Himalaya. *Ecological Indicators*, *90*(March), 379–391. https://doi.org/10.1016/j.ecolind.2018.03.031

Pearce, T., Ford, J., Willox, A. C., & Smit, B. (2015). Inuit traditional ecological knowledge (TEK), subsistence hunting and adaptation to climate change in the Canadian arctic. *Arctic*, *68*(2), 233–245. https://doi.org/10.14430/arctic4475

Pepin, C., Muckle, G., Moisan, C., Forget-Dubois, N., & Riva, M. (2018). Household

overcrowding and psychological distress among Nunavik Inuit adolescents: a longitudinal study. *International Journal of Circumpolar Health*, *77*(1). https://doi.org/10.1080/22423982.2018.1541395

Perreault, K., Riva, M., Dufresne, P., & Fletcher, C. (2020). Overcrowding and sense of home in the Canadian Arctic. *Housing Studies*, *35*(2), 353–375. https://doi.org/10.1080/02673037.2019.1602720

Philip, S. Y., Kew, S. F., Oldenborgh, G. J. Van, Yang, W., Vecchi, G. A., Anslow, F. S., Li, S., Seneviratne, S. I., Luu, L. N., Arrighi, J., Singh, R., Aalst, V., Hauser, M., Schumacher, D. L., Marghidan, C. P., Ebi, K. L., Vautard, R., Tradowsky, J., Coumou, D., … Otto, F. E. L. (2021). Rapid attribution analysis of the extraordinary heatwave on the Pacific Coast of the US and Canada June 2021 . *World Weather Attribution*, *June*, 119–123. https://www.worldweatherattribution.org/wp-content/uploads/NW-US-extreme-heat-2021-scientific-report-WWA.pdf

Picketts, I. M., Curry, J., Déry, S. J., & Cohen, S. J. (2013). Learning with practitioners: Climate change adaptation priorities in a Canadian community. *Climatic Change*, *118*(2), 321–337. https://doi.org/10.1007/s10584-012-0653-8

Picketts, I. M., Déry, S. J., & Curry, J. A. (2014). Incorporating climate change adaptation into local plans. *Journal of Environmental Planning and Management*, *57*(7), 984–1002. https://doi.org/10.1080/09640568.2013.776951

Pielke, R., Prins, G., Rayner, S., & Sarewitz, D. (2007). Climate change 2007: Lifting the taboo on adaptation. In *Nature* (Vol. 445, Issue 7128, pp. 597–598). Nature Publishing Group. https://doi.org/10.1038/445597a

Porio, E. (2011). Vulnerability, adaptation, and resilience to floods and climate change-related risks among marginal, riverine communities in Metro Manila. *Asian Journal of Social Science*, *39*(4), 425–445. https://doi.org/10.1163/156853111X597260

Price, K., Perron, S., & King, N. (2013). Implementation of the Montreal Heat Response Plan During the 2010 Heat Wave. In *Can J Public Health*.

Quebec. (2020). *a Win-Win for Québec and the Planet. Framework Policy on Electrification and*

the Fight Against Climate Change. http://www.environnement.gouv.qc.ca/formulaires/renseignements-en.asp

Runhaar, H., Wilk, B., Persson, Å., Uittenbroek, C., & Wamsler, C. (2018). Mainstreaming climate adaptation: taking stock about "what works" from empirical research worldwide. *Regional Environmental Change*, *18*(4), 1201–1210. https://doi.org/10.1007/s10113-017-1259-5

Schaffrin, A., Sewerin, S., & Seubert, S. (2015). Toward a Comparative Measure of Climate Policy Output. *Policy Studies Journal*, *43*(2), 257–282. https://doi.org/10.1111/psj.12095

Schipper, E. L. F. (2006). Conceptual history of adaptation in the UNFCCC process. *Review of European Community and International Environmental Law*, *15*(1), 82–92. https://doi.org/10.1111/j.1467-9388.2006.00501.x

Siders, A. R. (2019). Social justice implications of US managed retreat buyout programs. *Climatic Change*, *152*(2), 239–257. https://doi.org/10.1007/s10584-018-2272-5

Siders, A. R., Hino, M., & Mach, K. J. (2019). The case for strategic and managed climate retreat. In *Science* (Vol. 365, Issue 6455, pp. 761–763). American Association for the Advancement of Science. https://doi.org/10.1126/science.aax8346

Smit, B., & Wandel, J. (2006). Adaptation, adaptive capacity and vulnerability. *Global Environmental Change*, *16*(3), 282–292. https://doi.org/10.1016/j.gloenvcha.2006.03.008

Smoyer-Tomic, K. E., Kuhn, R., & Hudson, A. (2003). Heat wave hazards: An overview of heat wave impacts in Canada. *Natural Hazards*, *28*(2–3), 463–485. https://doi.org/10.1023/A:1022946528157

Sovacool, B. K., Linnér, B. O., & Goodsite, M. E. (2015). The political economy of climate adaptation. *Nature Climate Change*, *5*(7), 616–618. https://doi.org/10.1038/nclimate2665

Thistlethwaite, J., & Henstra, D. (2017). Municipal flood risk sharing in Canada: A policy instrument analysis. *Canadian Water Resources Journal*, *42*(4), 349–363. https://doi.org/10.1080/07011784.2017.1364144

Tosun, J., & Lang, A. (2017). Policy integration: mapping the different concepts. *Policy Studies*,

38(6), 553–570. https://doi.org/10.1080/01442872.2017.1339239

Tsenkova, S., Youssef, K. W. F., & Youssef, K. (2011). *Green and affordable housing in Canada: investment strategies of social housing organisations*. https://www.researchgate.net/publication/233799634

Urwin, K., & Jordan, A. (2008). *Does public policy support or undermine climate change adaptation ? Exploring policy interplay across different scales of governance*. *18*, 180–191. https://doi.org/10.1016/j.gloenvcha.2007.08.002

Vale, L. J., Shamsuddin, S., Gray, A., & Bertumen, K. (2014). What Affordable Housing Should Afford: Housing for Resilient Cities. *Source: Cityscape*, *16*(2), 21–50. https://doi.org/10.2307/26326882

Valois, P., Bouchard, D., Talbot, D., Caron, M., Renaud, J. S., Gosselin, P., & Jacob, J. (2020). Adoption of flood-related preventive behaviours by people having different risks and histories of flooding. *Natural Hazards*, *102*(3), 1155–1173. https://doi.org/10.1007/s11069-020-03950-9

Vandentorren, S., Bretin, P., Zeghnoun, A., Mandereau-Bruno, L., Croisier, A., Cochet, C., Ribéron, J., Siberan, I., Declercq, B., & Ledrans, M. (2006). August 2003 heat wave in France: Risk factors for death of elderly people living at home. *European Journal of Public Health*, *16*(6), 583–591. https://doi.org/10.1093/eurpub/ckl063

Vogel, B., Henstra, D., & McBean, G. (2020). Sub-national government efforts to activate and motivate local climate change adaptation: Nova Scotia, Canada. *Environment, Development and Sustainability*, *22*(2), 1633–1653. https://doi.org/10.1007/s10668-018-0242-8

Walks, A. (2014). Canada's housing bubble story: Mortgage Securitization, the state, and the global financial crisis. *International Journal of Urban and Regional Research*, *38*(1), 256–284. https://doi.org/10.1111/j.1468-2427.2012.01184.x

Wang, B., Pan, S.-Y., Ke, R.-Y., Wang, K., & Wei, Y.-M. (2014). *An overview of climate change vulnerability: a bibliometric analysis based on Web of Science database*. https://doi.org/10.1007/s11069-014-1260-y

Wellstead, A., Howlett, M., Nair, S., & Rayner, J. (2016). Canada's Regional Adaptation

Collaboratives and Adaptation Platform: The importance of scaling up and scaling down climate change governance experiments. *Climate Services*, *4*, 52–60. https://doi.org/10.1016/j.cliser.2016.11.001

Appendix A: Coding Protocol

INDICATOR	DEFINITION	FIELD OPTIONS
Jurisdiction	Governing body	Federal Provincial/Territorial Municipal
Authors	Policy author(s)/contributors	Open
Active years	Years in force or year of adoption	Open
Policy category		Housing Climate change
Policy name	Name of document	Open
Policy aim	Overall vision for the strategy's outcome	Open
Policy objectives	Specified policy goals that address climate change adaptation (in housing strategies) and housing (in adaptation strategies)	Open (multiple)
Climatic hazard addressed Select all that apply	Type of climatic hazard addressed (Lesnikowski, 2021)	Sea level rise (including storm surges and coastal flooding)
		Extreme precipitation and inland flooding
		Storms
		Drought
		Wildfires
		Erosion and landslides
		Desertification
		Changing patterns of infectious diseases
		Extreme heat events
		Extreme cold events
		Permafrost melt
		Loss of Arctic sea ice
		Poor air quality
		Other
Climatic vulnerability addressed Select all that apply	Type of climatic vulnerability addressed (Lesnikowski, 2021)	Poverty
		Food security
		Health & Well-being
		Education
		Gender equality
		Inequalities (other than gender)

		Clean water & sanitation
		Energy security
		Work and economic growth
		Industry, innovation, and technology
		Sustainable cities and communities
		Consumption & production
		Marine & coastal ecosystem services
		Terrestrial & freshwater ecosystem services
		Peace, justice, and strong institutions
		Other
Policy tool category (general) Select all that apply	What policy instruments to address the housing-climate change nexus are specified in the strategy?	Information
		Regulation
		Finance
		Administration
Type of **substantive** policy tool (specific) Select all that apply	What policy instruments to address the housing-climate change nexus are specified in the strategy? Policy instruments intended to directly affect the nature, type, quantity, distribution of goods and services in society. (from Lesnikowski et al. 2019)	Not substantive
		INFORMATION
		Advice
		Education and training
		Reports and assessments
		Monitoring and evaluation
		REGULATION
		Inter-governmental mandate
		Spatial planning
		Infrastructure performance standards
		Building regulations
		Strategic planning
		Adaptation planning
		FINANCE
		User charges
		Grants or subsidies
		Loans
		Direct expenditures
		ADMINISTRATION
		Demonstration projects
		Operations
		Facilities
		Other
Type of **procedural**	What policy instruments to address the housing-	Not procedural
		INFORMATION
		Exhortation

policy tool (specific) Select all that apply	climate change nexus are specified in the strategy? Policy instruments intended to influence the network relationships among actors in a policy system. (from Lesnikowski et al. 2019)	Public outreach
		Labelling
		REGULATION
		Agreements
		Advisory groups creation
		Hearings
		Urban climate networks
		FINANCE
		Research funding
		Interest group funding
		ADMINISTRATION
		Conferences and workshops
		Institutional reforms
		Other
Policy target (actor category) Select all that apply	What types of actors do the policy instruments target?	Federal government
		Provincial government
		Territorial government
		Local government
		Private sector
		Civil society
		Households
		General public
		Other
Policy target (housing tenure category) Select all that apply	What types of housing tenure do the policy instruments target?	Owner occupied (with or without mortgage)
		Private rental
		Affordable private rental
		Social housing
		Temporary housing
		Unhoused
		Property investor
		Housing co-operative
		Indigenous on-reserve housing
		Indigenous off-reserve housing
		Other
Policy target	Specify actor(s)	Open
Instrument setting	Detailed descriptions of tool design	Open
Time horizon	Select all that apply to tools identified above	Single occurrence Fixed time Permanent

Equity	Is equity recognized in the strategy?	Yes No
	Is equity recognized in the link between housing and climate change?	Yes No
	Which vulnerable population groups are targeted by the policies above? Select all that apply.	Low-income individuals/households
		People experiencing homelessness
		Elderly
		Gender
		Immigrants/Migrants
		Youth
		Persons with disabilities
		Persons with social disabilities
		People experiencing family violence
		Indigenous Peoples
		Visible minorities
		Other
	Copy relevant text	Open

Appendix B: Summary Tables

Substantive instrument type

Adaptation			
	Federal	Prov./Terr.	Municipal
Information			
Advice	9%	8%	10%
Education and training	5%	9%	4%
Reports and assessments	7%	25%	14%
Monitoring and evaluation	7%	13%	5%
Regulation			
Inter-governmental mandate	5%	2%	-
Spatial planning	4%	5%	11%
Infrastructure performance standards	2%	3%	5%
Building regulations	11%	1%	9%
Strategic planning	5%	4%	10%
Adaptation planning	11%	3%	3%
Finance			
Grants and subsidies	2%	2%	2%
Direct expenditures	15%	9%	5%
Loans	-	-	0%
Administration			
Facilities	4%	1%	3%
Operations	11%	12%	14%
Demonstration projects	-	2%	4%
Housing			
	Federal	Prov./Terr.	Municipal
Information			
Advice	-	5%	8%
Education and training	2%	4%	6%
Reports and assessments	18%	11%	12%
Monitoring and evaluation	-	1%	1%
Regulation			
Inter-governmental mandate	11%	0%	0%
Spatial planning	-	7%	10%
Infrastructure performance standards	-	0%	1%
Building regulations	-	9%	12%
Strategic planning	2%	2%	11%
Adaptation planning	-	-	0%
Finance			
Grants and subsidies	11%	18%	11%
User Charges	-	2%	1%
Direct expenditures	31%	24%	9%
Loans	9%	3%	0%

Administration			
Facilities	-	1%	2%
Operations	13%	10%	14%
Demonstration projects	2%	2%	2%

Note. This table shows the distribution of substantive policy instrument types according to the NATO typology. Percentage totals are split by sector and then by jurisdiction. In categories with n=0, the value is removed for clarity.

Procedural Instrument Type

Adaptation			
	Federal	Prov./Terr.	Municipal
Information			
Exhortation	15%	13%	11%
Public outreach	9%	21%	29%
Labelling	15%	7%	3%
Regulation			
Agreements	-	1%	2%
Advisory groups creation	6%	6%	6%
Urban networks	29%	23%	31%
Finance			
Research funding	-	5%	3%
Interest group funding	21%	16%	8%
Administration			
Conferences and workshops	-	2%	2%
Institutional reforms	6%	6%	4%
Housing			
	Federal	Prov./Terr.	Municipal
Information			
Exhortation	8%	11%	26%
Public outreach	8%	15%	15%
Labelling	-	7%	6%
Regulation			
Agreements	-	1%	5%
Advisory groups creation	4%	3%	5%
Urban networks	15%	17%	17%
Finance			
Research funding	12%	-	3%
Interest group funding	31%	18%	9%
Administration			
Conferences and workshops	4%	-	4%
Institutional reforms	19%	27%	11%

Note. This table shows the distribution of procedural policy instrument types according to the NATO typology. Percentage totals are split by sector and then by jurisdiction. In categories with n=0, the value is removed for clarity.

Implementing Actors

Adaptation			
	Federal	Prov./Terr.	Municipal
Federal	40%	9%	1%
Provincial	11%	39%	2%
Territorial	12%	27%	2%
Private Sector	1%	3%	2%
General Public	7%	0%	3%
Civil Society	23%	10%	8%
Local	7%	11%	82%

Housing			
	Federal	Prov./Terr.	Municipal
Civil Society	15%	14%	16%
Federal	61%	5%	9%
General Public	2%	1%	1%
Households	-	0%	-
Local	5%	11%	49%
Provincial	8%	40%	12%
Private Sector	2%	6%	9%
Territorial	8%	22%	4%

Note. This table shows the distribution of different implementing actors for each policy instrument. Percentage totals are split by sector and then by jurisdiction. In categories with n=0, the value is removed for clarity. **Vulnerable groups**

Adaptation			
	Federal	Prov./Terr.	Municipal
Elderly	-	1%	1%
Gender Minority	1%	0%	0%
Persons Experiencing Homelessness	-	0%	1%
Immigrant/Migrant	-	-	0%
Indigenous Peoples	71%	7%	2%
Low-Income Groups	-	1%	0%
Persons with Physical Disability	-	0%	1%
Persons with Social Disability	-	0%	-
Visible Minority	-	-	0%
Youth	-	0%	1%
Not Specified	28%	90%	94%
Housing			
	Federal	Prov./Terr.	Municipal
Elderly	6%	7%	4%
Victims of Family Violence	6%	3%	1%
Gender Minority	4%	3%	2%
Persons Experiencing Homelessness	4%	5%	9%
Immigrant	2%	0%	1%

Indigenous Peoples	36%	5%	4%
Low-Income Groups	6%	14%	3%
Persons with Physical Disability	6%	5%	3%
Persons with Social Disability	3%	1%	2%
Sexual Orientation	1%	-	0%
Youth	4%	2%	2%
Other/Not Specified	24%	55%	70%

Note. This table shows the distribution policy instruments that include considerations for vulnerable groups. Percentage totals are split by sector and then by jurisdiction. In categories with n=0, the value is removed for clarity.

Appendix C: Cross-tabulation Tables

Climate Hazard vs. Instrument type (Adaptation only)

	Adaptation			
	Information	Regulation	Finance	Administration
Changing Patterns of Infectious Diseases	65%	6%	6%	24%
Drought	8%	58%	8%	25%
Erosion and Landslides	60%	20%	10%	10%
Extreme Cold Events	36%	18%	9%	36%
Extreme Heat Events	31%	27%	13%	29%
Extreme Precipitation and Inland Flooding	41%	36%	17%	7%
Loss of Arctic Sea Ice	80%	-	-	20%
Permafrost Melt	50%	21%	7%	21%
Poor Air Quality	32%	32%	-	37%
Sea Level Rise	58%	24%	8%	10%
Storms	32%	41%	5%	23%
Wildfires	41%	14%	17%	28%
Not Specified	41%	31%	13%	15%

Note. This table shows the distribution of instrument types for each climatic hazard. Percentage totals are split by instrument type (horizontally). Results are only reported for the adaptation sector due to low engagement with climate hazards in the housing sector. In categories with n=0, the value is removed for clarity.

Housing Category vs. Instrument type

	Adaptation			
	Information	Regulation	Finance	Administration
Tenure-Specific	28%	24%	29%	19%
Non-tenure specific	23%	68%	6%	3%
Not Applicable	45%	26%	12%	17%
	Housing			
	Information	Regulation	Finance	Administration
Affordable Private Rental	24%	30%	32%	13%
Housing Cooperative	13%	38%	38%	13%
Indigenous Housing (General)	28%	20%	24%	28%
Indigenous Off-Reserve Housing	7%	30%	53%	10%
Indigenous On-Reserve Housing	14%	36%	32%	18%
Owner-Occupied Housing	26%	26%	40%	9%
Property Investor	29%	31%	30%	10%
Private Rental	27%	40%	25%	8%
Social Housing	18%	23%	45%	13%
Temporary Housing	9%	9%	62%	20%
Unhoused	32%	19%	35%	15%
Not Specified	35%	26%	14%	25%

Note. This table shows the distribution of instrument types for each tenure category. Percentage totals are split by instrument type (horizontally).

Implementing actor vs. Instrument type

Adaptation				
	Information	Regulation	Finance	Administration
Civil Society	47%	34%	7%	11%
Federal	34%	38%	16%	12%
General Public	19%	54%	23%	4%
Local	37%	39%	8%	17%
Provincial	45%	26%	17%	13%
Private Sector	55%	32%	10%	3%
Territorial	51%	21%	13%	15%
Housing				
	Information	Regulation	Finance	Administration
Civil Society	31%	26%	20%	22%
Federal	36%	18%	29%	17%
General Public	29%	24%	5%	43%
Households	-	-	100%	-
Local	29%	33%	19%	19%
Provincial	25%	21%	39%	14%
Private Sector	27%	34%	25%	14%
Territorial	36%	22%	19%	23%
	31%	21%	29%	19%

Note. This table shows the distribution of instrument types for each implementing actor, showing which actors are more likely to be associated which instrument type. Percentage totals are split by instrument type (horizontally).

Climate hazard vs. Housing category (Adaptation only)

Adaptation			
	Tenure-specific	Non-tenure specific	Not Applicable
Changing Patterns of Infectious Diseases	0%	-	100%
Drought	0%	-	100%
Erosion and Landslides	0%	10%	90%
Extreme Cold Events	17%	-	83%
Extreme Heat Events	13%	13%	74%
Extreme Precipitation and Inland Flooding	5%	17%	78%
Loss of Arctic Sea Ice	0%	-	100%
Permafrost Melt	0%	7%	93%
Poor Air Quality	0%	16%	84%
Sea Level Rise	2%	14%	84%
Storms	5%	5%	91%
Wildfires	4%	11%	86%
Not Specified	8%	10%	82%

Note. This table shows which climatic hazards are more likely to be considered in each tenure category for adaptation strategies. Percentage totals are split by tenure category (horizontally).

Equity in Climate Change

Adaptation			
	Federal	Prov./Terr.	Municipal
Yes	100%	90%	77%
No	-	10%	23%
Housing			
	Federal	Prov./Terr.	Municipal
Yes	10%	10%	2%
No	90%	90%	98%

Note. This table shows the percentage of instruments with equity considerations that also consider equity in relation to climate change. For example, 100% of federal instruments that discuss equity also consider equity in relation to climate change.