Understanding climate risks facing housing finance stakeholders in British Columbia: Interview-based empirical evidence

by

Julia Howley
B.B.A., Simon Fraser University, 2019

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We acknowledge and respect the Lək̓ʷəŋən (Songhees and Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

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Abstract

The effects of climate change are yielding unprecedented extreme weather events in British Columbia. The impacts of these climate changes are felt across many sectors, including the housing finance sector. This study seeks to gain an understanding of how physical climate change risks are manifesting in British Columbia (BC)'s housing finance sector and impacting homeowners and homebuilders, and to uncover potential market failures, with a goal of developing recommendations for policy and regulatory responses. Methods comprise conducting eighteen (18) in-depth semi-structured interviews with stakeholders, including: homeowners, construction industry representatives, mortgage insurers, insurance industry representatives, financial lenders, real-estate industry representatives, academic researchers, data providers, and financial and technical regulators. Interview findings focus on gaps or inefficiencies in BC's housing finance ecosystem covering five key themes: (i) assessing and pricing risk, (ii) lender risk concerns and disclosures, (iii) improving data, modeling, and transparency, (iv) insurance accessibility (v), and adaptation education and incentivization. Based on interview findings, this study recommends policy and regulatory interventions be explored to address the gaps and market failures present within BC's housing finance ecosystem. Recommendations include expanding current and emerging adaptation policy and risk disclosure regulations, improving risk awareness, investing in data and modeling capacities, encouraging cross-collaboration between stakeholders, setting industry standards, incentivizing adaptation measures, and prioritizing risk mitigation.

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Dedication

To BC Housing —
Thank you, BC Housing, for the financial support to execute this research.
Thank you, Sarah Rutherford, for your expertise, for your guidance throughout the interview process, and for your patience as I slowly sculpted a report from our findings.

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To my loved ones —
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Thank you, to my friends, for supported me even when I haven't had much to offer in return.
And thank you, Will, for remaining steady through all of my highs and lows, for always offering a listening ear, for reminding me to leave my desk and see the sun, and for keeping the fridge full. This process would have been astronomically more challenging, and far less rewarding, without you.

Here's to a lifetime of free weekends!

Chapter 1 - Introduction

The climate is changing at an exponential rate with extreme weather events such as wildfires and floods occurring at higher frequency and intensity. In recent years, the province of British Columbia (BC) has experienced unprecedented extreme weather events. In fall 2021, BC's Sumas prairie flooded from a one-in-one-hundred-year flood event, and in summer 2023, wildfires scorched 25,000 square kilometres eclipsing Canada's previous single season record by nearly 14,000 square kilometres (Peters, 2023; CBC News, 2023). The impacts of this increase in frequency and severity of climate change events are felt across industry sectors, including the housing finance sector (Bakos & Feltmate, 2023). Private real estate and property in Canada is highly vulnerable to climate change, which is anticipated to be the most significant risk facing housing financing in Canada in the future (Canadian Institute for Climate Choices, 2021; Canadian Mortgage and Housing Corporation [CMHC], 2022).

Already, the costs of climate change disasters have been steadily increasing in recent decades, particularly for homeowners and homebuilders (Canadian Institute for Climate Choices, 2021). Nation-wide, flooding is the costliest disaster facing housing, with more than three million Canadians residing in one-in-one-hundred-year and one-in-two-hundred-year flood zones (Bakos et al., 2022). Since 2021 alone, BC has experienced two of Canada's top-ten most costly disasters in terms of insured losses (Mitham, 2022). The 2021 Sumas prairie floods yielded $675 million in insured losses and two of the BC-based 2023 fires totaled $720 million (Carey & Lloyd, 2023; Mitham 2022). As a result of events, such as those mentioned above, builders in BC's interior have reported financial losses and shortened building seasons due to difficulty securing course-of-construction insurance during the active fire season (O'Hara & Lundy, 2021). Homeowners are also facing unsuspected expenses from extensive flood damage due to misunderstanding of insurance policies (Smart, 2022) while financial institutions are denying loans to homeowners attempting to rebuild after flooding (Yeung, 2022).

The purpose of this study is to develop an understanding of the physical climate risks facing the housing finance ecosystem in BC. Specifically, this study explores how climate change risks are impacting, and are passed among stakeholders, including: homeowners; construction industry actors, including builders and contractors; insurance actors, including property and casualty (p&c) insurers and industry representatives; mortgage insurers; financial lenders, including banks and credit unions; real-estate actors including appraisers and realtors; private data suppliers; and regulatory bodies. Using semi-structured exploratory interviews with expert stakeholders and other experts from the identified groups, this study discusses risks and gaps in BC's housing finance ecosystem within the context of existing academic literature on climate risks in the housing finance sector and emerging cross-jurisdictional regulations and policy responses.

This work benefited from guidance and financial support of BC Housing and builds on the BC Housing Mobilization Building Adaptation and Resilience (MBAR) initiative by identifying and exploring potential market failures hindering climate action and adaptation in the building sector.

The thesis is organized as follows: Chapter 2 provides background information on climate risks in BC and maps out BC's housing finance ecosystem; Chapter 3 reviews academic literature and regulatory and policy documents to provide an overview of how climate change risks affect the housing finance system; Chapter 4 includes details on the exploratory, semi-structured interview methods utilized in this study; Chapter 5 details five themes of findings

from stakeholder interviews; finally, Chapter 6 discusses findings, highlights strengths and limitations, and makes policy recommendations and advises future work.

Chapter 2 — Background

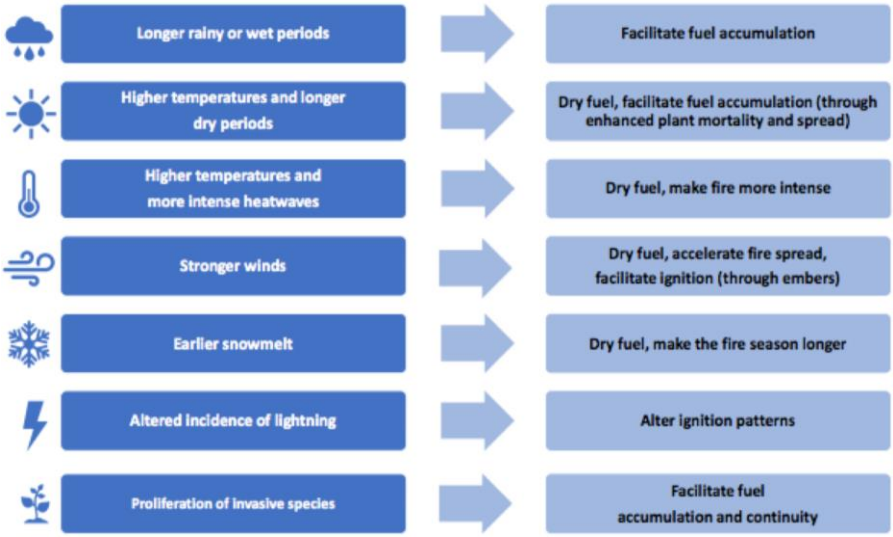
2.1 Physical climate change risk

This study examines the impact of climate risks on BC's housing finance ecosystem. Specifically, this study is focused on the impact of overland floods and wildfires, due to recent record shattering extreme weather events observed in BC (Carey & Lloyd, 2023; Mitham 2022), and due to research indicating overland floods and wildfires pose the highest overall potential impacts to BC among physical climate change risks (MECCS, 2019).

Existing literature defines climate change risk as the range of possible outcomes of extreme weather events and weather patterns arising from climate change (Brunetti et al., 2021). While climate change manifests in different categories of risk, including physical risk, transition risk, and liability risk, the scope of this research is physical risk. Physical risks can be defined as the physical losses and damages to infrastructure, property, and land, incurred from the growing harshness and frequency of extreme weather events connected with climate change (CMHC, 2022; Network for Greening the Financial System [NGFS], 2022). Physical risks include short term 'acute' risks that manifest episodically, such as heat waves, landslides, floods, fires and storms, as well as long-term progressive climate changes, appearing as 'chronic' risks, that manifest gradually, such as changes in precipitation, extreme changeability of weather, ocean acidification, and sea level and average temperature rise (Bakos & Feltmate, 2023; Kotecki, 2019). Impacts can differ based on geographic location and climate zone (IPCC, 2022).

Despite efforts by various nations, including Canada, to stem the curve of climate change, some impacts are unavoidable, and in some cases, have begun to materialize. BC has seen a 1.9 °C increase in annual temperatures from 1948 to 2016 (Ministry of Environment and Climate Change Strategy [MECCS], 2022). While climate change manifests differently across BC's geographical regions, in general for the province, this increase in temperature has manifested in hotter, dryer summers, and warmer, wetter winters. The province has seen an average annual precipitation increase of 12% which is materializing in sporadic, extreme precipitation events such as atmospheric rivers, yielding heightened flood risks (MECCS, 2022). At the same time, average summer precipitation is decreasing, resulting in increasing periods of drought that are conducive to wildfires (MECCS, 2022).

The aforementioned conditions, observable in BC, act as a feedback loop, perpetuating risks. Decreased summer precipitation is compounded by an increase in other wildfire drivers that are also increasingly observable in BC, including higher summer temperatures and more frequent, intense, and prolonged heat waves, stronger winds, and increased lightning storms (Organisation for Economic Co-operation and Development [OECD], 2023a). As these changes occur, they catalyze feedback loops that exacerbate risks from extreme weather events. Higher annual levels of precipitation increase vegetation levels; during droughts, this vegetation dies and increases the volume of flammable material available to wildfires (OECD, 2023a). Wildfires, in turn, burn vegetation, destabilizing soil that can increase risks of landslides and exacerbate flood damages under heavy rain conditions (MECCS, 2019; OECD, 2023a). Figure 1. describes the factors that contribute to the increasing frequency and intensity of wildfires observable in BC.



(OECD, 2023a).

Figure 1. Climate change factors fueling wildfires.

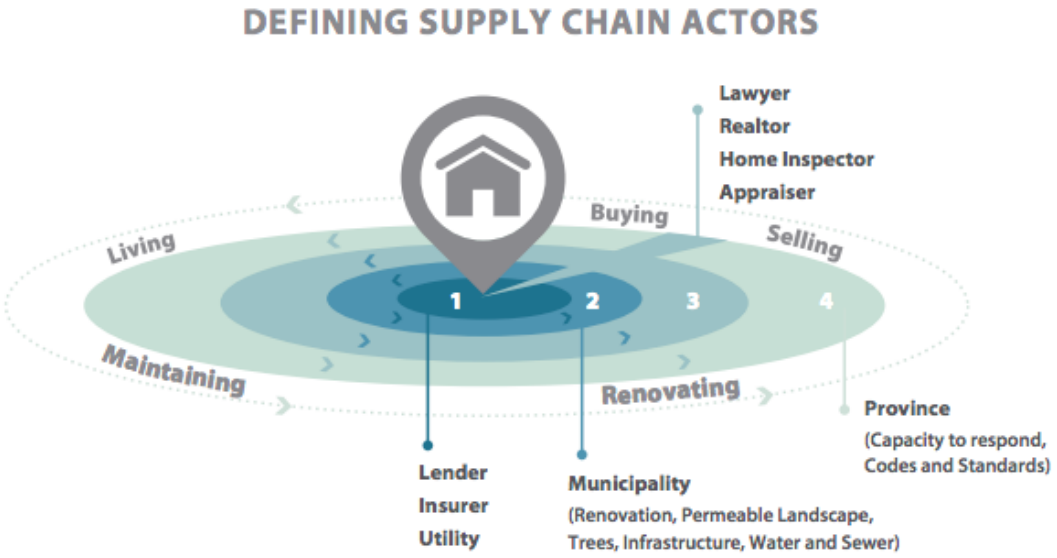
Increasing risks resulting from climate change are exacerbated by human land use planning and behaviour, such as development and population growth near wildland-urban interfaces, fire suppression strategies, and abandonment of traditional Indigenous practices (Kelly et al., 2017; OECD, 2023a). Similarly, overland flood risks are increased by land use planning and poor governance, including building in floodplains and mismanagement of flood mitigation systems (Canadian Institute for Climate Choices, 2021; Owen, 2023).

Damages from extreme weather events, occurring at increased frequency and intensity with climate change, are only expected to increase in the future as the climate continues to change (Johnston et al., 2023). It is projected that climate change will cause an increase in tail risk — events of lower probability but higher magnitude and resultant damages costs. These high-magnitude extreme weather events increase correlated or covariant risks by impacting many properties simultaneously (Johnston et al., 2023; Brunetti et al, 2021; CMHC, 2022; Insurance Bureau of Canada [IBC], 2015). Further, the feedback nature of climate change risks can co-increase risks not previously understood to be correlated, such as droughts and floods (Grippa et al., 2019). Even under emission reduction scenarios, the impacts of climate change are anticipated to increase in frequency and intensity in BC. For a moderate emission reduction scenario where future emissions are cut in half, research indicates the province will experience a doubling in the number of days above 25°C, and a 10% increase in rainfall on days during extreme precipitation events by 2050 (Carman, 2017). Further, by 2050, severe wildfire seasons and severe ravine flooding are projected to pose the highest risk of overall consequences, and highest potential for infrastructure damages, among all climate change risks in BC (MECCS, 2019). While greenhouse gas (ghg) emission mitigation has historically been the focus of climate change policy, and is still vital, adaptation efforts are in need of prioritization, particularly against wildfire and overland flood risk (Environment and Climate Change Canada [ECCC], 2023a)

2.2 British Columbia's housing finance ecosystem

Homeowners and homebuilders engage in financial interactions with financial system actors, through which physical climate risks are both passed to and from the housing sector. As

depicted in Figure 2., homeowners closely interact with a range of financial system actors, including lenders and insurers. These interactions exist within the context of regulation and policy across jurisdictions (IBC et al., 2022). As is depicted by the homeowner positioned within the financial system (1), climate-related financial risks can impact homeowners. Government actors (3 & 4) set the regulatory and policy framework for the financial system, thus impacting how climate risks are assessed and managed, which in turns affects the delivery of financial services to homeowners. While this study is focused on BC, many relevant financial stakeholders have a national scope; additionally, the decentralized nature of Canadian federalism implicates all levels of government (Intergovernmental Affairs, 2021). As such, while much of this discussion occurs at the federal level, it is applicable to the BC context.



IBC (2022).

Figure 2. Housing finance ecosystem actors.

Homeowners take loans from financial institutions to purchase properties. In Canada, more than one third (35.5%) of Canadian homeowners hold mortgages, with residential mortgage debt totaling 2.14 trillion nation-wide as of August 2023 (CMHC, 2023; Financial Consumer Agency of Canada [FCAC], 2023). Homeowners may also take out home equity loans against the value of their property, or construction mortgages for new builds or home improvement loan for renovation purposes; the latter of these stimulates the flow of funds through to builders or contractors completing the work. Builders and contractors are also borrowers in the housing finance ecosystem, as they take out loans from financial institutions to complete their housing construction work (WOWA, 2022). Financial institutions, including banks, credit unions and other lenders, provide loans to homeowners at fixed or variable interest rates. The level of interest rates reflects current economic conditions but also perception of risks related to the underlying assets and borrowers. Residential mortgage loans comprise an important part of financial institutions' portfolios; the promise of repayment, plus interest, make loans an asset for financial institutions (Grippa et al., 2019). Many financial institutions active in mortgage lending operate across the country and are subject to federal regulation (Federally Regulated Financial

Institutions known as FRFI's). In Canada, six major banks conduct the majority of financial transactions; in the first quarter of 2023, 73.1% of Canadian mortgages were in the portfolios of the six major banks (CMHC, 2023). Member-owned not-for-profit Credit Unions also provide loans; while some are FRFI's, others serve small regions with a more concentrated portfolio. Credit Unions comprise a smaller, but growing share of Canada's mortgages, accounting for 17.2% of mortgages nation-wide in 2021 (Canada's Credit Unions, 2023). These institutions that operate in BC, including Credit Unions, banks, and other lenders, are regulated by the provincial regulator, BC Financial Services Authority (BCFSA); insurers in BC are also subject to regulation from the Insurance Council of BC (Canada's Credit Unions, 2023; Insurance Council of BC, 2024).

Insurers transfer risk inherent to immobile physical real-estate assets and provide coverage for parties engaging in the transaction. In turn, insurers transfer risk on the international re-insurance market to manage portfolio risk (National Association of Insurance Commissioners [NAIC], 2024). In the context of the housing market, homeowners interact with insurance providers for different services. Mortgage default insurance protects lenders from default risk and enables buyers to enter the home-ownership market by paying a premium, based on the loan to value ratio of the property, to the insurer (CMHC, 2024). In Canada, lenders require mortgage default insurance for new mortgages with down-payments less than 20% of the purchase price due to the heightened risk (CMHC, 2018). Property & Casualty (P&C) insurance covers the property and contents of the insured home from perils, as specified in the policy, for a premium based on factors specific to the property, location, and homeowner. Some perils are not covered, while others can be covered through additional premiums; in Canada, fire is a basic peril, while overland flooding is not, but can be purchased as additional coverage from offering insurers (IBC, 2024). And finally, home insurance is generally a condition of the mortgage loan (Thistlewaite et al., 2020; IBC, 2024). Course of construction insurance covers the building and materials during construction, and is required by lenders to cover their investment during construction; mortgages for new builds require this coverage (Netsurance, 2021).

Other actors involved in housing transactions include appraisers, who assess the value of real-estate, and realtors, who represent homebuyers and sellers on the market. In pricing properties, appraisers send price signals about the risks facing properties to homeowners, potential buyers, and other financial system participants. These actors are compensated based on successful housing transactions.

Financial institutions, including banks, credit unions and insurers, are regulated within their jurisdiction of operation and registration in an effort to maintain stability and protect against losses (Office of the Superintendent of Financial Institutions [OSFI], 2024). Federally Regulated Financial Institutions (FRFI's) are subject to the oversight of the Office of the Superintendent of Financial Institutions (OSFI). Institutions that are registered solely in BC are regulated by the provincial regulator, BC Financial Services Authority (BCFSA), while all institutions operating in BC are subject to BCFSA supervision (Canada's Credit Unions, 2023; Insurance Council of BC, 2024).

In Canada, jurisdiction over the environment is not explicitly constitutionally assigned. As specified by the courts, responsibility for the environment falls under varied federal and provincial legislation as it relates to other areas of constitutionally assigned responsibility (Intergovernmental Affairs, 2021). At the provincial level in BC, the MECCS' mandate prioritizes action on climate change, with an emphasis on adaptation (Eby, 2022). Housing has been considered a local matter by jurisprudence and therefore a provincial responsibility

(Raycroft, 2023). In BC, the province shares housing duties with local governments as per the *Local Government Act* (2015). Provincially, the BC Ministry of Housing, is responsible for housing policy, programs, services, and technical codes aimed at improving the affordability and safety of housing (Ministry of Housing, 2024b). The Ministry of Housing is also granted capacity to set technical building requirements for construction within the province by the *Building Act*; the BC Building Code sets out the technical building requirements for construction within the province which applies to all provincial jurisdictions outside of the City of Vancouver, which regulates building within the municipalities jurisdiction through the Vancouver Building By-law (Ministry of Housing, 2024a). The BC Building Code regulates the building sector to align with ghg emission objectives through the BC Energy Step Code; thus far, climate risk mitigation and adaptation has not been regulated by the Building Code. Similarly, the Vancouver Building By-law's climate regulations focus on reducing energy use and carbon emissions from the building process (City of Vancouver, 2022). Under the Ministry, BC Housing, a crown corporation acting as the regulator for residential construction, regulates construction and administers affordable housing services, and conducting housing research (BC Housing, 2024). Local governments aid in implementation of housing policy, including planning, zoning, and permitting, and the distribution of financial incentives (Local Government Act, 2015; Ministry of Housing, 2024c).

The federal government leads climate action in areas within their jurisdiction in the *Constitutions Act*, through Environment and Climate Change Canada (ECCC) (ECCC, 2023a; Intergovernmental Affairs, 2021). The Government of Canada is not specifically responsible for housing but controls multiple institutions and policy areas of concern to the housing finance ecosystem, including the Canadian Mortgage Housing Corporation, and has established national Construction Codes (Raycroft, 2023). CMHC's responsibilities include administering mortgage loan insurance, as well as implementing the National Housing Strategy, and conducting research and collecting data on Canada's housing sector, with climate risk currently among the top priorities (CMHC, 2022). National Construction Codes set the base standard for provincial building codes, which are often modified or strengthened, as is the case in BC (Office of Housing and Construction Standards, 2015).

2.3 Relevant policy and regulation

Recently, government and regulatory actors have published and proposed strategies, regulations, and guidance aimed at addressing physical climate risk, at both the federal and provincial levels. Established and emerging measures include financial risk disclosure and management regulations, and climate adaptation strategies (BC Financial Services Authority [BCFSA], 2023; MECCS, 2022; ECCC, 2023a; OSFI, 2023).

In 2023, financial regulators at the federal and provincial level established and initiated efforts to address the increasing climate risks facing financial institutions. OSFI released B-15 Guidelines comprising new requirements for climate-related financial disclosures and climate risk management, set to be implemented in 2024 (OSFI, 2023). Disclosures aim to protect financial institution clients, including creditors, investors, and policy holders, and contribute to consumer and public trust by improving financial system transparency (OSFI, 2023). The B-15 Guideline includes principles that comprise standards for quality, clear, and useful disclosures. Based on guideline principles, disclosures should be: relevant, specific and comprehensive, clear, commensurate with the magnitude and nature of the risk, and consistently updated over time (OSFI, 2023). OSFI B-15 also included expectations for climate risk management and

governance, with aims of informing institutions of their risks, fostering development of risk knowledge, and imbedding risk management into organizations structures (OSFI, 2023). Management and governance expectations include expectations for investing in risk identification and measurement through data collection and future-oriented model development, as well as monitoring and reporting on risks. There are also expectations for the use of climate scenario analysis to examine the impact of different climate scenarios on portfolios, including loan portfolios. Finally, there is an expectation for the maintenance of a capital and liquidity buffer, based on climate risk assessments (OSFI, 2023).

OSFI's BC counterpart, BCFSA is currently seeking consultation on a provincial equivalent for addressing climate risk among BC-registered financial service providers to improve financial security and build consumer trust, similar to OSFI (BCFSA, 2023). BCFSA is exploring a similar two-pillar approach, focusing on identification, quantification, and tracking of risks (pillar one), as well as disclosures (pillar two) (BCFSA, 2023). BCFSA's proposed pillar is a version of OSFI's B-15 Governance and Management, modified for BC regulated institutions (BCFSA 2023). The disclosure plan in pillar two, however, involves market disclosures aimed at improving transparency of institution climate risk exposures, as well as property-specific disclosures aimed at improving risk awareness in real-estate purchases. Methods for effectively communicating and standardizing real-estate risks are being explored, such as through a climate risk score. This seeks to help real-estate investors make better-informed decisions and allow climate risks to be reflected in real-estate prices (BCFSA, 2023).

Since 2022, the ministries responsible for climate change at both the federal and provincial level, ECCC and the MECCS respectfully, released strategies for adapting to the changing climate (MECCS, 2022; ECCC, 2023a). ECCC finalized the National Adaptation Strategy (NAS), Canada's first adaptation-specific plan, in 2023. The NAS takes a bilateral approach to adaptation governance, including 'federal, inter-governmental, and Indigenous-led actions' (ECCC p. 16, 2023a); this includes setting out responsibilities for actors at different levels and across jurisdictions, including provincial and local governments, private actors, and professional associations (ECCC, 2023a). Included in the NAS are priority action areas with goals, objectives, and targets for achieving climate change resilience; two action areas, disaster resilience and infrastructure, include objectives that address housing finance risks (ECCC, 2023a). The pathway for achieving the NAS' objectives is laid out in the government of Canada Adaptation Action Plan, comprising through 73 specific new, existing, and expanding actions, falling under the responsibility of 22 federal ministries (ECCC, 2023b). Action Plan disaster resilience funding measures include investment in fire prevention, adaptation and mitigation, innovation, and the establishment of a wildfire Centre of Excellence; working with provinces to improve flood mapping and expanding the Flood Hazard Identification Mapping Program; establishing a national flood insurance program, available to high-risk households; creating a free online flood exposure portal; and supporting disaster mitigation efforts in high-flood risk regions through a Disaster Financial Assistance Arrangements program. Infrastructure funding measures include investment in local government resilience through the Disaster Mitigation and Adaptation Fund; financing a climate toolkit to facilitate community resilience; and updating codes and standards to embed adaptation in the built environment. Additional funding measures include investment in shared climate modeling and research through the Canadian Centre for Climate Services; conducting research on future Canada-wide climate scenarios; and supporting local adaptation efforts through the Green Municipal Fund (ECCC, 2023b). A complete list of funding initiatives that impact housing finance risk are summarized in Appendix B.

The MECCS released the Climate Preparedness and Adaptation Strategy, one year before the federal government's equivalent in 2022 (MECCS, 2022). The provinces adaptation strategy includes four pathways, containing specific financial initiatives aimed at achieving goals, including (1) Partnerships, Knowledge and Decision-Making, (2) Safe and Healthy Communities, (3) Resilient Species and Ecosystems, (4) Climate-Ready Economy and Infrastructure, (MCEES, 2022). Initiatives within pathways 1 and 2, in particular, aim to improve climate risk knowledge and understanding through measures that expand data and monitoring capacity, improve training and education, and promote collaboration (1), and aim to build resilience in communities throughout the province (2). Specific measures in Pathway 1 include investing in data and risk projections through StormSurgeBC and ClimateEx, conducting provincial Strategic Climate Risk Assessment and Provincial Hazard, Risk and Vulnerability Assessment, developing educational risk awareness campaigns, and expanding workforce adaptation training through the Adaptation Learning Network. Pathway 2 measures include contributing to funds aimed at implementing and expanding risk awareness and emergency preparedness at the local government and Indigenous government level, including the Community Emergency Preparedness Fund, the Hazard, Risk, and Vulnerability Analysis toolkit, the Community Resiliency Investment Program, and the BC Flood Resilience Plan, and consolidating resources for ease of use in the BC Community Climate Funding Guide. (MECCS, 2022). A complete list of initiatives that impact housing finance climate risk are outlined in Appendix C.

Chapter 3 — Literature review

Research on climate change risks facing the housing finance ecosystem is emerging, particularly in the Canadian context. Until recently, there has been limited research on current and future climate-related financial risks. Canada specifically is lagging peer nations, with the majority of research conducted in other jurisdictions. The need for further research on the Canadian context has been noted throughout existing literature (Johnston et al., 2023; Clayton et al., 2021; Grippa et al., 2019). Emerging Canadian research, thus far, has been focused on overland flood risks facing financial stakeholders and homeowners. Compared to overland floods, there is an absence of research on how wildfires impact housing markets in Canada. Additionally, there was very limited or no research on how climate change risks impact the building sector, particularly within the Canadian or BC context. Finally, there is limited literature conducted at the provincial level, with the majority conducted by national organizations and adopting a Canada-wide scale. This study contributes to filling these research gaps.

First, this literature review provides theoretical insights on market failures, the primary motivator for government intervention, within the context of climate risk in the housing finance ecosystem. Secondly, this literature review examines academic literature and regulatory and policy documents to provide an overview of how climate change risks affect the housing finance system, with potential negative impacts on homeowners.

3.1 Theoretical insights

Market failures are defined as an inefficient allocation of goods or services by the market, meaning welfare is not maximised (Bowen et al., 2014; Phang, 2013). The inefficiencies resulting from market failures are catalysts for government interventions or voluntary responses in the private sector. In the event of a market failure, governments and regulators may intervene with regulatory or policy actions in an effort to improve efficiency and maximise welfare; this applies across sectors, including the housing finance sector (Phang, 2013). In the context of climate risk in the housing finance ecosystem, information asymmetries and moral hazards can lead to market failures (Li & Chau, 2023). Information asymmetries occur when parties engaging in a transaction do not have equal access to relevant information, leading to a diversity of inefficiencies, including adverse selection (defined in Appendix A). Moral hazards occur when one party engages in risky behaviour where another party bears the economic consequences of their behaviour.

Literature on climate risks and housing financing provide examples of market failures that are observable or expected in the housing finance ecosystem as a result of physical climate risks. Examples of market failures described in the literature include the following examples, among others detailed in the discussion below:

- Information asymmetry: financial actors are not motivated to disclose risks as the information could negatively impact their portfolios.
- Information asymmetry - adverse selection: insurers offering optional flood insurance are more likely to engage in business with high-risk households.
- Moral hazard: insured homeowners are not incentivized to adapt their properties to withstand climate risks as the latter are viewed as insurer liability.

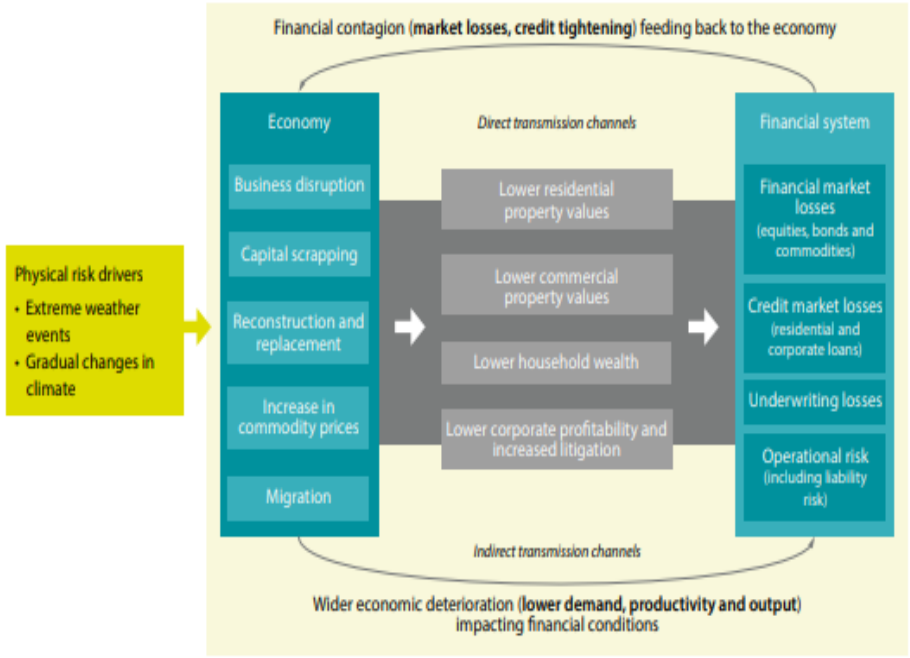
Based on the theoretical insights on market failures from the literature, this study aims to investigate how informational failures as described above are manifesting in BC's housing finance ecosystem. The purpose of understanding of how market failures are manifesting in BC's

housing finance ecosystem, as a result of physical climate risk, is to assist in developing policy and regulatory recommendations for addressing gaps in BC's housing finance ecosystem.

The primary research component of this study, as described in Chapters 4-6, was designed to gain insights into market failures in BC's housing finance ecosystem resulting from physical climate risks; this was conducted through the lens of the five risk themes apparent in the literature, and described in Section 3.2, below. Additionally, a detailed description of methods utilized in this study are described in Chapter 4.

3.2 Literature themes

Changes to BC's climate pose risks to properties and real-estate, impacting the housing finance system. As immobile physical assets, residential real estate, or property, is particularly vulnerable to damages from extreme weather events, occurring at increased frequency and intensity with climate change (Johnston et al., 2023). For the housing finance system, literature highlights *property damages* and *property devaluation* as significant risks from climate change (Johnston et al., 2023; CMHC, 2022). As depicted in Figure 3 below, extreme weather events impact the economy through physical damages to real-estate, migration from high-risk or impacted regions, and stifling the building of new homes or retrofits. This can cause lowering of property values and wealth, and result in financial institution losses, homeowner (borrower) losses, and insured losses (NGFS, 2020). In turn, economic losses and a heightened perception of risk can increase risk aversion and stifle economic activity, including spending and lending.



(NGFS, 2020).

Figure 3. How physical climate change risks impact the financial system.

3.2.1 Property values and devaluation risk

Real-estate is at risk of devaluation as climate change risks are not appropriately factored into real-estate prices, posing a threat to the housing finance system. Despite increasing climate risks, there is an overall increase in value of Canadian real-estate (CMHC, 2022; Bakos et al.,

2022). Research indicates that in Canada and similar jurisdictions, markets impacted by extreme weather may observe a short-term decrease in valuation, but observe a price rebound, indicating that climate risks are not yet accurately priced. A study from the INTACT Centre on Climate Adaptation, found that Canadian properties see a short-term decrease in value following exposure to flood, based on pre-and-post-housing market data from six separate flood events across four Canadian provinces (Bakos et al., 2022). While INTACT's research did not examine the long-term impacts, studies from other jurisdictions offer insight into market behaviour over the long-term post-flood (Miller et al., 2019; Beltrán et al., 2019; Clayton et al., 2021). A rebound in prices post-flood was observed in Miller et al.'s (2019) examination of the impact of major storms on single family home values in the US market, and Beltrán et al.'s (2019) long-term study of price-changes of flood-impacted real-estate in England. This rebound effect, however, was not observed following repeat flood events. Instead, flood risks were found to be incorporated into housing prices for communities with repeat flooding, attributable to an increased awareness of risk (Bakos et al., 2022; Beltrán et al., 2019). A similar phenomenon was observed following repeat wildfires due to saturation of risk perception; a 2009 study from the US found values to drop 22.7% after a second wildfire (Mueller, et al., 2009).

Demand for at-risk properties is driven by a lack of transparency and awareness of climate risks, as well as prior beliefs and issue salience. According to a review of relevant literature, factors contributing to a lack of risk awareness and thus driving demand for at risk property include insufficient data access and availability, inaccurate climate and finance models, and insufficient requirements for disclosing institutional climate risks (Brunetti et al., 2021; Johnston et al., 2023). Currently, models for projecting climate change econometrics are unable to accurately project future impacts; this work is being developed, but requires further refinement (Brunetti et al., 2021). As climate change increases exponentially, increased frequency and intensity of events poses the possibility of covariant events (multiple extreme weather events occurring at the same time) and of catalyzing other extreme weather events—this reduces the accuracy of historical economic and climate models and increases uncertainty over the long-term (Brunetti et al., 2021). Climate data access and availability presents another set of challenges for modeling financial impacts from climate change, and inadequate disclosure requirements lead to information asymmetries allowing for over-inflation of value of at-risk properties (Brunetti et al., 2021). Access to more granular data and improved modeling would further reduce uncertainty and aid in understanding risk, for pricing purposes (Johnston et al., 2023). Private financial actors with access to valuable property-level climate data, namely insurers, are not incentivized to share their data due to competitive advantage, and are protected by privacy laws and private actor corporate constraints. Additionally, transparency from financial actors on the risks embedded in their portfolios faces similar challenges from privacy laws and corporate regulations; there is little incentive for financial actors to reveal risk, as this information may cause non-disclosing actors to appear more attractive to clients; aligned and enforced disclosure regulation across jurisdictions avoids furthering transparency risks (IBC et al., 2022). Climate risk disclosure regulations, including from BCFSA and OSFI, aim to enhance transparency by requiring financial actors to determine and disclose the climate risks within their portfolios. By enhancing climate risk transparency, disclosure regulations should enable financial actors and clients to make risk-informed decisions.

Even when climate risk information is available, factors such as issue salience (as observed by the rebound effect in Bakos et al.'s 2022 study), prior beliefs in climate change, trust in government, and willful ignorance, influence how climate risk information is received by

homeowners and homebuyers (Chopik, 2019; Miller et al., 2019; Beltrán et al., 2019.; Clayton et al., 2021). Uncertainty and lack of risk disclosure are further theorized to be contributed to by a willful ignorance from stakeholders, all whom benefit in the short term from heightened valuations and will incur losses if the property is devalued. This creates a 'paradox of valuations' whereby stakeholders are discouraged from disclosing or comprehending climate related risks so as to keep values high, but face heightened risks from future devaluation once climate risks are realized (Chopik, 2019).

Despite factors impacting the availability and reception of information, awareness and recognition of associated risk are expected to increase and reflect in property prices, as climate change increases the frequency and magnitude of property-damaging extreme weather events, and through risk disclosure requirements for financial institutions (Clayton et al., 2021). Research also highlights the importance of incorporating risk into pricing and improve pricing efficiency to reduce the magnitude of future losses from a tail-risk event. While a more gradual devaluation is likely, a wide-spread event could elicit a price shock. A measured approach to improving risk awareness can reduce this risk (CMHC -1, 2022). Efforts to improve transparency and provide risk education will also contribute to pricing climate risk (OSFI, 2023).

3.2.2 Financial lending risk

Financial institutions offer loans, including to homeowners for residential real estate purchases, which comprises a significant portion of their portfolios (Johnston et al., 2023). From this transaction, lenders face climate change risks, including risk of default on loan payments (CMHC, 2022; Grippa et al., 2019). As properties are the security for mortgage loans, loss in property value impacts the financial position of lenders decreasing the loan-to-value ratio (the value of an asset compared to the amount of the loan) (Bank of Canada, 2023). For homeowners, devaluation represents a loss of value on their most significant asset, reducing their wealth (CMHC, 222). Devaluation can also result in stranded assets, cause unsellable or devalued assets to be abandoned and burdening lender portfolios (Chopik, 2019).

Lenders also face default risk, as borrowers incur losses from physical damages and are unable to repay loans following extreme weather events (CMHC, 2022; Grippa et al., 2019). When properties are damaged, homeowners for instance, the most vulnerable stakeholders in the housing finance ecosystem, may face financial burdens from property damages that can risk their ability to repay loans. As a result, homeowners may face collection of collateral or repossession by mortgage providers, even if insured (Bakos et al., 2022). For lenders, the financial burdens inflicted on homeowners result in toxic mortgages- or debts that are unlikely or unable to be paid off. Defaults pose a significant risk to lenders as the promise of repayment represents the value of the loan to lenders (Chopik, 2019). These risks are heightened for financial institutions with limited geographical diversification of their loan portfolios, who risk having many assets impacted by one extreme weather event (Pating, 2023). The anticipated future increase in high-magnitude tail risk events and accompanying correlated or covariant risks will exacerbate default risks by impacting many properties simultaneously (Bank of Canada, 2023; Brunetti et al, 2021; CMHC, 2022; IBC, 2015). Other stakeholders are also impacted by asset devaluation, including real estate professionals, who risk loss of trust from clientele and reduced income from lower sale prices, and municipalities, through lowered property taxes (Chopik, 2019)

In response to these risks, lenders may increase lending rates to be reflective of climate related damage risks, or refuse loans deemed too risky, passing risks on to borrowers (CHMC, 2022). They may also offer new products such as weather derivatives and catastrophe bonds, to

securitize mortgages against risk, or increase requirements for mortgage insurance to redistribute risk of the loan (Bakos et al., 2022; Coppola, 2015). Uncontrolled, climate risk pricing has the potential to become an unsustainable burden for at-risk mortgage holders; the unsustainability of risk pricing is furthered by the fact that climate risks are often inversely related to income levels (Canadian Institute for Climate Choices, 2021).

Research on the Canadian housing finance market found that, while physical climate change risks to lender mortgage portfolios in Canada generally appear manageable, lenders should anticipate increased future risks and portfolio impacts (Bakos et al., 2022; Johnston et al., 2023). A Bank of Canada study examines current and future flood risks facing residential real estate loan portfolios of Canadian financial institutions by shocking federal and provincial loan dataset using current and projected flood events under different climate scenarios (Johnston et al., 2023). Overall, the study found that impact of flooding on mortgage lenders portfolios 'generally appear to have a manageable impact', citing strong homeowner equity from high average home prices in the Canadian market as enabling homeowners to absorb losses and reduce default risk (Johnston et al., pg. 1, 2023). Similarly, Bakos et al.'s 2022 study on the impact of flooding on the Canadian mortgage market found no significant impact on mortgage arrears or deferrals following a flood event. This study attributed the insignificant impact to the robust mortgage requirements in Canada, like mortgage insurance requirements for down-payments below 20%, which insures homeowners are able to absorb flood damages before defaulting and passing risks on to banks (Bakos et al., 2022). Despite the projected manageable impacts in their study, the Bank of Canada highlighted the possibility of risk underestimations and smoothing due to a lack of granularity and complete data in their study and urged financial institutions to complete their own scenario analysis for portfolios. They also underscored the possible impacts of future tail risk events with impacts spreading through higher proportions of portfolios, encouraging climate risk management, despite the manageable impact predicted from this study (Johnston et al., 2023).

3.2.3 Insurance risk

Insurance plays an important role in the allocation of risk in the housing finance system (Bank of Canada, 2023). Resultantly, insurers face catastrophic risks from climate change. Insurance takes on risks, known as perils, from policy holders; as physical climate change risks facing insured properties increase, so too do insurer risks (CMHC, 2022; Hudson et al., 2016). This is already being observed in Canada, as insurance losses have increased from an average annual of $25-450 million per year from 1983 to 2008, to $1.69 billion per year from 2009-2021, in 2021 dollars (Bakos et al., 2022). The increase in frequency and magnitude of climate risks results in increasing insurer liability and threatening solvency (CMHC, 2022; Starominski-Uehara & Keskitalo, 2016). Insurers face increased liability (the amount required to pay out to policy holders) from an increased number and magnitude of claims resulting from climate change (CMHC, 2022; Starominski-Uehara & Keskitalo, 2016). If insurers have miss-priced risk, high-levels of claims following extreme weather events can risk insolvency or being unable to payout claims (Johnston et al., 2023; Grippa et al., 2019; IBC, 2015; Prabhakar et al., 2015). Adverse selection of optional flood insurance exacerbates the insolvency risk, as those at higher risk are more likely to purchase this product (CMHC, 2022). Further, the feedback nature of climate change risks can reduce insurer portfolio diversity by co-increasing risks not previously understood to be correlated, such as droughts and floods; this is exacerbated for small insurers with a small radius of operation, as their portfolios are already less diverse, and can be more

significantly impacted by extreme weather events (Grippa et al., 2019). Insurers offering optional flood insurance face adverse selection (as defined in Appendix A), as homeowners most likely to purchase policies are those facing higher risks, putting them in an increased financially precarious position of underpricing coverage (CMHC, 2022). Further, increased portfolio risk can result in insurers being downgraded by ratings agencies, which in turn can affect their ability to attract investors and recruit and maintain customers (Prabhakar et al., 2015).

To manage increased liability, insurers may increase capital reserves by increasing pricing, reducing coverage or withdrawing from at risk regions or jurisdictions where they cannot price according to projected risk, or offering new products such as weather derivatives and catastrophe bonds, as defined in Appendix A (Bakos et al., 2022; Coppola, 2015; CMHC, 2022). Evidence already highlights this occurring in the Canadian market, with 20-25% increases in home insurance premiums observed in Canada from 2015-2019 (Bakos et al., 2022). Insurers pass the costs from these risks on to homeowner customers in the form of increased premiums. At higher price points, homeowners may not be able to afford insurance, or may re-evaluate the value of risk transfer and elect to forgo coverage, particularly additional flood coverage (Hudson et al., 2016). For flood insurance, this risk is exacerbated by the finding that flood risk is often inverse to homeowner wealth (CMHC, 2022). Similar to homeowners, builders face increasing rates of course-of construction insurance, particularly during summer months due to heightened wildfire risks; ultimately these rate increases will be passed on to homeowners, further increasing the cost of home ownership (DuChene, 2023).

Additionally, evidence suggests that Canadian insurers are being more selective with insuring risky properties. Data on flood-prone cities points towards a decrease in insurance offerings (Bakos et al., 2022). The literature anticipates further withdrawal of coverage as climate risks continue to increase, particularly as flood zones increase and encompass more and more housing (CMHC, 2022). While there is limited reporting specific to Canada, evidence from south of the border suggests that insurers are withdrawing completely from fire-risk regions, as major national insurers are reported to no longer renewing policies for California homeowners, citing wildfire and corresponding policy concerns (Morris & Botros, 2023). As insurers reduce coverage in high-risk regions, some homeowners may not be able to find coverage, increasing from the current 6-10% uninsurable homes in Canada (D'Souza et al., 2021). Additionally, builders have reported difficulty securing course of construction insurance during wildfire season; in instances where builders are unable to secure insurance during wildfire season, projects will be delayed, compounding further construction costs for homeowners (DuChene, 2023).

Overall, increased costs and reduced availability of insurance results in a ‘protection gap’, leaving policy-holders responsible for full costs of damages from future extreme weather events (Public Safety Canada, 2022). Uninsured or underinsured homeowners can pass these risks on to lenders, through an increased risk of default or arrears can result from the burden of damages falling solely on homeowners, thus putting lenders at risk (Brunetti et al., 2021; CMHC, 2022; DuChene, 2023). Lenders are also impacted by insurers’ unwillingness to issue new insurance coverage for home-buyers in proximity to active fires, as reported on in BC (O'Hara & Lundy, 2021; O'Brien, 2021; Warren, 2021). This results in lost or delayed sales, with financial impacts filtering from homeowners to real-estate actors and lenders, as well as municipal governments dependent on property tax revenue (O'Brien, 2021). High costs or unavailability may prompt retreat from the region in exchange for lower rates and more accessible coverage elsewhere, resulting in knock-on effects of a reduced property-tax base for municipalities, as

well as a cascade of impacts on municipal debt markets, such as bond defaults (Brunetti et al., 2021). Further, without insurance, the burden often falls on federal and provincial governments to offer fiscal support post-extreme weather event to homeowners, particularly those without insurance, acting as a de-facto backstop insurer (Brunetti et al., 2021; IBC, 2015).

It should be noted that insurance price and availability should not be considered the sole determinant in homeowners' insurance decisions; low risk awareness among homeowners and the placement of financial incentives in repairs (rather than adaptation) are factors contributing to an underinsured population of high flood-risk homes in Canada (Public Safety Canada, 2022). Research cited in the CMHC's 2022 study, for instance, states that only 6% of homeowners were aware that they lived in a 'designated flood risk area,' and that homeowners may underestimate the risks facing their properties. Further, historically government financial support has supported remediation following a disaster rather than encourage insurance, from 1970 to 2013, 74% of federal funding for disaster relief was spent on flooding, acting as a de-facto federal flood insurer (IBC, 2015). By acting as a de-facto federal insurer, this disincentives flood insurance uptake as homeowners can elect to rely on government bail-outs post disaster rather than purchase insurance (CMHC, 2022; IBC, 2015).

3.2.4 Data, modeling and transparency

A significant contributor to miss-pricing of risk and subsequent impacts on stakeholders throughout the housing finance ecosystem is uncertainty in the magnitude and intensity of future physical climate change risks (Brunetti et al., 2021; CMHC, 2022). This is largely due to modeling and data gaps and information asymmetries (Johnston et al., 2023; CMHC, 2022). Data and modeling, in particular, are of note in Canada compared to contemporary nations (Johnston et al., 2023). Investment in data and modeling is needed to understand risks and take measures to avoid the most significant damage costs and maintain financial stability in the future (Brunetti et al., 2021; CMHC, 2022; Grippa et al., 2019), as the efficiency of both insurance and mortgage markets depends on the availability of information to inform risk assessments, especially catastrophic risks (CMHC, 2022). Data and analytics, derived from climate modeling, are also crucial for developing strategies to build resilience and avoid the most significant effects of the changing climate (IBC et al., 2022).

Projecting financial climate change risks is a challenge for both climate models and economic models (Brunetti et al., 2021; CMHC, 2022; Grippa et al., 2019). A CMHC (2022) review found that, in Canada, existing housing finance models found an inability of any existing model to incorporate all climate change risks facing the housing sector, or to accurately analyze financial risk, within Canada. Financial models are incongruent with long-term climate change impact projections as financial decisions typically occur on a shorter timeline compared to the materialization of climate risks (Grippa et al., 2019). Financial models rely on historical data, which is miss-aligned with the increasing intensity and magnitude of climate change, as well as with the implementation of risk mitigation and adaptation measures over time (Brunetti et al., 2021). Similarly, aggregate climate change models are imprecise at projecting shorter-term financial impacts, and accounting for disparities between jurisdictions, as they are geared to analyze a multitude of variables over time (Johnston et al., 2023; Brunetti et al., 2021).

Climate data access and availability presents another set of challenges for modeling financial impacts from climate change (Brunetti et al., 2021). Availability of sufficiently granular spatiotemporal and climate data is a challenge. Data is fragmented across Canadian communities, making comparison and data amalgamation difficult (Canada Water Network [CWN] & IBC,

n.dd). Additional challenges in data are finding aggregate and complete data sets, and finding data sets that are up to date (Johnston et al., 2023). Resultantly, data sets are often out of date or incomplete, and proxy data and multiple data sets are utilized; this impacts the specificity, accuracy, and comparability of projections (Johnston et al., 2023; Brunetti et al., 2021). For lenders, lack of data granularity can lead to underestimation of flood risks and can lead to smoothing by utilizing averages, such as at a postal-code level, rather than property-specific data. When accounting for flood hazards in particularly, the quality and resolution of data contribute to uncertainty (Johnston et al., 2023).

Notably, in Canada, these data challenges manifest in the lack of accessible, up to date, and granular flood maps (Evans, 2023; CMHC, 2022; CWN & IBC, n.d.). This poses a challenge for insurers to accurately assess property risks (CMHC, 2022). A 2021 study revealed significant gaps in Canada's flood mapping; available maps were approximately 20-years out of date, failed to account for approximately 500,000 at risk buildings, and did not consider how climate change could change maps in the future (CICC, 2021). Information gaps are even more significant for wildfires that are especially difficult to model and forecast (CICC, 2021; Jones, 2023).

3.2.5 Risk adaptation and mitigation

Literature on climate risks in the housing finance ecosystem underscores risk adaptation as crucial to reducing the overall impact of climate change, in terms of financial costs and physical damages (IBC et al., 2022). Climate risk adaptation, defined as the process of adjusting to current or future climate conditions in an effort to reduce damages, is emphasized in climate risk literature as a vital response to climate change risk (OECD, 2023b). It is estimated that each dollar investment in disaster adaptation and mitigation efforts yields 3-5 dollars of recovery cost savings (IBC & Federation of Canadian Municipalities [FCM], 2020). A 2022 study from the Insurance Bureau of Canada (IBC) and CMHC on physical climate risk disclosures in the housing finance system underscored the importance of accurate data and analytics, including accurate modeling capacities, in advancing climate change risk awareness and the uptake of risk adaptation among stakeholders, including homeowners.

Adapting to climate change risks comprise physical measures and behavioural changes, which can be encouraged or stimulated through financial incentives and education. Risk adaptation can occur through the implementation of physical measures, such as sump pumps to drain flooding in basements, or sprinklers to protect homes from wildfire blazes. It can also occur through financial measures, such as transferring risk through insurance (Hudson et al., 2016). A significant body of research on adapting to both wildfire and flood risks at both the local government and household level exists (Moudrak & Blair, 2020). Household flood measures include measures ranging from low cost, like cleaning drains, to high cost, like sump-pump installation. Local government flood measures include recommendations like adopting resilient building requirements and distributing flood risk and resilience materials (Moudrak & Blair, 2020). Fire adaptation measures, researched and administered by FireSmart BC, include home tools and recommendations, such as pruning trees to ensure clearance from the ground, and installation of non-combustible siding, as well as community-wide measures (FireSmart BC, 2021). In addition to the physical risk mitigation measures, financial instruments play a role in adapting to climate change risks and reducing risks in the housing finance ecosystem (Hudson et al., 2016). Other measures, targeting the building sector, for example, are needed, including updating codes to include adaptation standards (Dreessen, 2023).

Adapting to risks can also encompass mitigation measures aiming at reducing the possibility of realizing climate change risks, such as by moving away from high-risk areas. Physical risk mitigation measures are primarily carried out by actors with jurisdictional responsibilities, such as local governments, and include bylaw measures such as zoning restrictions. Multiple BC communities are already aiming to address wildfire risks through zoning restrictions on new construction, by disallowing construction along wildland-urban interfaces, or through combined bylaws, requiring construction in interface zones to include fire-resistant materials and other Fire Smart measures (Kovacs, 2018).

As the climate continues to change, and wildfire and flood risks increase in frequency and magnitude, an emphasis on the communication and financing of adaptation measures is needed, particularly to homeowners, to mitigate the most significant impacts of climate risk on the housing finance system; all stakeholders are impacted (CICC, 2021).

Chapter 4 – Methods

4.1 Data collection

This study takes an exploratory approach to examining how risks from wildfires and floods filter through the housing finance ecosystem in BC. The study also aims to identify potential market failures in current climate risk management practices in BC's housing finance ecosystem. Exploratory research seeks to define problems and form hypothesis by exploring novel research questions, rather than testing hypothesis (Sue & Ritter, 2012). Exploratory research is appropriate for this study as the aim is to understand how risks are filtering through the housing finance ecosystem, specifically in BC, rather than test a hypothesis; in other words, the study aims to induce how wildfire and flood risks filter through BC's housing finance ecosystem through exploratory interviews (Mainardes, Alves, & Raposo, 2010). This study also aims to develop recommendations for policy and regulatory action to address gaps in BC's housing finance ecosystem. Market failures are theorized to be the primary motivator for government action; interviews also aim to gain insights into how market failures are manifesting in BC's housing finance ecosystem. As such, this study utilizes conceptual areas and guidance questions, based on literature insights, to extract pertinent information and explore potential market failures in BC's housing finance ecosystem, and subsequently motivate recommendations for policy and regulatory responses (Knott et al., 2022).

Primary data on climate risks in BC's housing finance ecosystem was collected through individual in-depth semi-structured interviews (n=18). In-depth interviews are a method for collecting qualitative data through a conversation-like format that provides participants with space to interpret and answer questions, shedding light on thoughts, experiences, and beliefs (Berg & Lune, 2017; Knott et al., 2022). Interviews are a preferable method for exploratory data that aims to capture in-depth experiences and perspectives of specific, purposive participants (Berg & Lune, 2017; Knott et al., 2022). The semi-structured interview style is characterized by the use of topic guides as well as the addition of follow-up questions based on participant answers. Topic guides comprise pre-identified questions on conceptual areas that researchers are interested in investigating (Berg & Lune, 2017; Grayson et al, 2020). This studies' conceptual areas include questions designed to gain insights into informational asymmetries, as well as moral hazards. Participants were asked questions about their access to data and information; more specifically, financial actors were asked questions on their communication of internal processes with clients. Likewise, clients, including homeowners and builders, were asked about their understanding of risk exposures and the determinants of costs.

Interview participants included stakeholders with expertise and experience related to climate change risks from distinct groups: homeowners, construction industry representatives, technical regulators, insurance industry representatives, mortgage insurers, financial lenders, financial regulators, real-estate industry representatives, academic researchers, and data providers. Construction industry representatives (construction reps.) comprise builders, contractors, and industry associations. Similarly, insurance industry representatives (insurance reps.) consists of insurers, insurance brokers, and industry associations. Financial lenders (lenders') comprise banks and credit unions, and finally, Real-estate industry representatives (real-estate reps.) comprise appraisers. Stakeholder groups and number of participants per group included: homeowners (n=2), construction reps. (n=3), insurance reps. (n=3), lenders (n=2), financial regulators (n=2), technical regulators (n=1), researchers (n=2), mortgage insurers (n=1), data providers (n=1), and real-estate reps. (n=1). From a geographic perspective, stakeholders

include a diversity of perspectives; the twelve BC-based stakeholders represented four of the eight BC census regions, and more than half of the participants (7/12) were located outside of metro Vancouver (Government of BC, 2024).

Participants were recruited using the purposive sampling method and the snowball sampling method. Purposive sampling is a method of participant selection based on specific characteristics, such as expertise (Knott et al., 2022). This method is appropriate for interview participant selection when the sample size is smaller than necessary to be statistically representative of a broader population, as it prioritizes depth of insights per participant, rather than breadth of experiences (Knott et al., 2022). The purposive sampling method suits the exploratory nature and wide scope of the study. Participants were purposively selected from each stakeholder group based on knowledge, expertise, or experience of climate change risk impacts on their organization and industry more broadly. They were recruited utilizing contact information known to BC Housing and University of Victoria researchers' professional networks, and from information available on organizational websites. Participants were also selected utilizing the snowballing method, through recommendations from purposive participants. Snowball participants were recruited utilizing contact information acquired from recommending participants, and from information available on organizational websites (Knott et al., 2022). The interview recruitment process was rapid due to an interview success rate; interviews were secured with 73% of the institutions contacted for participation. One stakeholder group in particular, financial institutions, had the lowest response rate, due to expressed privacy concerns, lack of interest in subject matter, and lack of expertise in subject matter.

4.2 Interview process

Interviews were held from July - November 2023 in virtual online meetings utilizing Zoom video conferencing software. Two members of the research team attended each meeting, one acting as lead interviewer and the other acting as note-taker and assistant interviewer. Video and audio of the interviews were recorded through Zoom software and auto-transcribed through Echo-360 software. Interviews were approximately 60 minutes in duration and scheduled at the convenience of the participant. Prior to the interview, participants were emailed a consent form for review. At the commencement of each interview, participants were asked for verbal consent to participate and have their answers recorded and stored over Zoom and Echo-360 software.

Following the consent process, the lead interviewer commenced the formal semi-structured interview, comprising a series of questions covering conceptual areas identified in a topic guide. For this research, the topic guides were developed iteratively based on findings from literature relevant to climate change risks in BC's housing finance ecosystem (Berg & Lune, 2017; Grayson et al., 2020). Conceptual areas in the topic guide included: concern and action on climate risks; awareness and incentivization of adaptation; access to / availability of insurance, financing, data; perceived needs and recommendations. Topic guide questions were tailored to each stakeholder group to ensure applicability. During the interviews, participants were encouraged to speak uninterrupted and allowed to expand answers beyond the immediate question. Interviewers were responsive to participants' answers by adjusting the order of inquiry and adding follow-ups based on participant responses, while referring to the topic guide to ensure all themes were covered, in line with the semi-structured interview design (Berg & Lune, 2017; Grayson et al., 2020). Please see Appendices B-E for a complete list of questions per stakeholder group.

4.3 Data analysis

Upon the completion of each interview, a series of steps were taken to generate findings. First, after each interview, a brief memo summarizing key observations was written, as recommended by Knott et al.'s (2022) Interview Methods Primer. Transcripts were auto-generated through Echo-360, downloaded as MS word documents, and reviewed against corresponding audio and video files for accuracy. The quality of the Echo-360 auto-transcripts was variable, with speaker enunciation and audio quality factoring heavily into the quality of the transcript; accent or gender did not seem to factor into the quality of the transcript. Once transcripts were edited and verified for accuracy, they were anonymized for confidentiality--participant names were removed and replaced with a representative name comprising the participants stakeholder group and an identifying number (e.g., financial lender 1; insurance rep. 3). A log of all participant names and corresponding replacement representative names was created and securely stored on one of the researcher's personal computers. Specific institution names were also removed and replaced with their generic category (e.g., 'an insurance institution'). Transcripts were scrubbed of irrelevant data prior to analysis, as not all data transcribed from the interviews was relevant and useful for analysis. During the interviews, participants on occasion misinterpreted questions and, resultantly, provided inaccurate and irrelevant responses. Additionally, some participants embarked on tangents irrelevant to the study. Data was carefully analyzed for quality, ensuring participants responses corresponded with the question being posed, or were relevant to the study overall. Data was cleaned to remove these responses, prior to analysis. This was an important step to ensure that incorrect meaning was not derived from researcher responses.

Once prepared, transcript data was analyzed utilizing the content analysis method for qualitative data. Content analysis comprises reviewing data, identifying themes in the data, coding data themes, and deriving findings from the data (Berg & Lune, 2017). Researchers employed Maietta et al.'s (2021) approach to qualitative data analysis, dubbed 'Sort and Sift, Think and Shift.' Under this approach, researchers coded the data by working iteratively through cycles of 'Diving In,' examining each data set objectively in isolation, and 'Stepping Back,' contextualizing the data with other data sets. Analysis consisted of researchers examining each individual transcript utilizing tools from the 'Diving In' toolkit to sort and shift the data. Quotation identification was utilized to identify and log important or insightful quotes; topic monitoring was utilized to keep track of emerging themes and group corresponding quotes. Memos were utilized to capture researcher thoughts, record observations, and track the analytical process for reporting (Maietta et al., 2021). Once all transcripts were analyzed in isolation, researchers utilized the 'Stepping Back' toolkit to reflect and re-organize findings in the context of the whole data set. Mining was utilized to derive further meaning from identified quotes in the context of the findings from other transcripts. Bridging and threading tools inferred connections between quotation data from different transcripts and identified common themes across data sets (transcripts) (Maietta et al., 2021). The 'Diving In' and 'Stepping Back' analysis processes were repeated, deriving codes based on themes, supported by quotation data. Only once this process was complete, findings were considered and discussed in the context of the themes identified in the literature review.

4.4 Reflexivity and positionality

In this research, participants were experts in their field and, aside from the homeowners, speaking on behalf of their organizations. The included homeowners were professionals from

other stakeholders who had experienced impacts of wildfire or flood on their personal properties, and resultantly, had expert knowledge to draw upon in their experience with climate change risk. As such, there is not a significant power imbalance between researchers and any stakeholder participants. Questions were designed to be open ended and inquisitive and intentionally worded to avoid a semblance of judgement or lead participants to a particular response. Interview best-practices were reviewed prior to designing questions, and sample interview questions from peer-reviewed studies utilizing similar methods were utilized to guide the formatting of questions (Knott et al., 2022).

Chapter 5 – Findings

The semi-structured interviews revealed four broad themes: risk assessment and pricing; finance / lending risk; insurance risk; data, modeling, and transparency; and adaptation. The findings focus primarily on gaps or inefficiencies experienced or noted by stakeholders within BC's current housing finance ecosystem. Stakeholder recommendations and desired solutions also emerged through the interviews. The impact of climate risk on the housing finance ecosystem is an area of emerging priority at the policy and regulatory level. As such, new policy frameworks and regulation have recently been published, or are in the process of development and consultation, some of which aim to address gaps and inefficiencies identified in this study. Relevant policy and regulation, and their potential impact, are included in the following analysis and discussion. While this study is focused on BC, many relevant financial stakeholders have a national scope and thus some of the stakeholder comments are from a national scale. Additionally, the decentralized nature of Canadian federalism implicates all levels of government (Intergovernmental Affairs, 2021).

5.1 Risk awareness and concern

5.1.1 Homeowner risk awareness

Interview participants shared a perception that homeowners lack knowledge or understanding of climate risks facing current or potential properties. While some homeowners and homebuyers have an understanding of risk, the overarching perspective of interview participants was that homeowners do not know or understand the climate risks they face. One researcher stated, *"perception is below what the risk levels are" (Researcher 2);* a regulator conveyed a similar sentiment, stating *"the people taking on the risk aren't aware." (Technical regulator 1).* As regions face heightened risks from the changing climate, homeowner perceptions take time to catch up. A homeowner participant, with expert knowledge of climate risks and property adaptation, highlighted this lag in risk perception when speaking of his neighbors on Vancouver Island:

> *"We're seeing fires on the coastal side of the mountain ranges now... on Vancouver Island...people have assumed that that we were relatively immune because we were in the rain zone.... that's not the case anymore." (Homeowner 1)*

Even when homeowners have experienced climate risk from extreme weather events, salience is a determinant of risk perceptions; homeowners and homebuyers become less risk adverse as time passes, as observed by an insurer, stating "*once the fires are gone, people forget about it very quickly" (Insurance rep. 2).*

An appraiser in the real-estate representative category made a similar observation:

> "*…we've had a couple of examples lately where the whole town has been kind of blown out... People are still willing to go back and still willing to...reside in those areas, and the markets been strong." (Real-estate rep. 1)*

5.1.2 Homebuyer demand

Beyond climate risk, participants noted market factors driving housing demand, and requiring housing policy action beyond climate risk. Even with risk awareness, in the context of the housing shortage in BC, and particularly in major metro areas of Vancouver and Victoria, homeowners are forced to make trade-offs and take on risk either for affordability or due to lack of availability or options.

> *"so long as that demand without outstripping the supply overall in housing, you're going to see people making those trade-offs and take on those risks because they need to live somewhere." (Financial lender 2)*

Another factor impacting the continued demand for at-risk real-estate was homeowner preference or trade-offs of positive or desirable attributes that accompany at-risk locations, such as river-backing or beach-side properties. Homeowners or homebuyers may decide that the positive value they receive from the location of the property is more significant than the accompanying climate risk:

> *..."[some people] they prefer to be at the coast...very close to the beach, and that's the opinion that they're paying [for]...the surges or the sea level rise that can happen ... the value of a property, they offset each other". (Mortgage insurer 1)*

A builder participant added that cognitive dissonance, or the belief that they will not be affected by risks, even in at-risk locations, contributes to the continued desire for at-risk properties, stating *'' if they want to build a home on a lot of rural property with lots of trees, that's what they want." (Construction rep. 1)*

5.1.3. Risk valuations

Finally, it was revealed that real-estate actors are becoming increasingly aware of climate risks, but appraisers are not yet considering risk in property valuations. According to a real-estate representative, appraiser valuations are driven by consumer demand and appraiser participants indicated there is indeed continued demand. Participants indicated the need for a market reaction to climate risk to accelerate action, e.g.:

> *"nobody is making adjustments [for climate risk], or anything of that nature at this point....in order for us to apply it into the market, the market has to have proven to be reacting to it. So that's something that will come with time." (Real-estate rep. 1)*

An appraiser participant explained that due to the market conditions for real-estate in BC, value is based on the land, rather than the home: *"at the moment, housing prices only go up - the majority of the value is the land" (Financial regulator 1).* As such, risk to the property is not being expressed as a concern from the perspective of buyers, so appraisers are not considering it in valuations:

> *"The real estate market and land values are investments, have been investor driven, and they've been going up so fast that there's not a lot of consideration for the other aspects about the property." (Real-estate rep. 1)*

An appraiser additionally expressed that they rely on historical data for assessments, which is incompatible with the accelerating rate of climate change. Years of data indicating a negative market response to a climate risk would need to be accumulated in order for it to be reflected in valuation models.

Two participants discussed methods for better incorporating climate risk into valuations in the future. An appraiser cited that with improved data access, appraisers would be positioned to incorporate climate risk into their assessment formulas. Finance stakeholders, however, were wary of appraisers' capacity to transition from a primary visual assessment method to modeling, advocating for a separate system.

> *"…probably the best way to incorporate climate risk in the property evaluation is not through appraisers, but through the (CMHC EMILI) models that we [lenders] use to assess the property value." (Financial lender 2)*

5.1.4 Builder risk awareness

Construction industry participants indicated a varied level of knowledge and understanding of climate risks, revealing a general level of risk awareness, but varied desire and ability to act in response to risks. Builders are aware of their environment, as weather and climate impact their work; as observed by a builder participant *"this is not new to the construction sector, it's just becoming increasingly acute." (Construction rep. 1).*

and;

> *"I would say, it's [climate risks] top of mind... but awareness doesn't necessarily mean that each of our builders are prepared, or can sort of keep up with those changes... there is a diversity of builders who have the skills and the knowledge to keep up with that changing landscape." (Construction rep. 2)*

Construction representative participants indicated that among their climate risk concerns, safety and liability were top of mind, resulting from increasingly extreme conditions during the summer building season.

> *"we have longer and hotter, drier summers, which leads to a variety of different challenges. One is the health obviously, of our crews. We actually have had people with heat, stroke and things. So how do we mitigate that?" (Construction rep. 3)*

> *"there is a liability so one, worker safety, two, there's a liability risk for small companies.... and then third is financial for us [builder] and our clients... we can experience delays which cost our company money, or we can experience decreased productivity which costs our clients money." (Construction rep. 1)*

Financial risks were also cited as a concern for builders, primarily as a result of the shortened building window due to unsafe working conditions. These conditions delay work, extend project timelines, and result in costs to builders and homeowners, as expressed by a construction representative participant:

"We can experience delays which cost our company money, or we can experience decreased productivity which costs our clients money." (Construction rep. 1).

5.2 Financial lending and portfolio risk

5.2.1. Lender risk awareness and concern

Lenders expressed an awareness and concern for climate risks, but that they did not view it as an urgent concern; *"We don't see it as a we do not see it as an immediate risk" (Financial lender 2).*

As risks have increased in visibility in recent years, lenders awareness and attention is increasing. One financial regulator spoke to lender risk awareness, and attributed it to the increase in frequency and intensity of extreme weather events in BC:

"awareness is more... now, if we have discussions with institutions... we definitely get their attention ... now it's really acknowledged. In BC, we face the highest level of physical risk exposure cost among all the provinces in Canada. So, you're seeing that maybe some of the actors that you regulate are sitting up a bit more and paying more attention." (Financial regulator 1)

A lender participant stated that climate risks were becoming an increasing priority for their organization., stating "*We bring more and more climate risk thinking into our thought process." (Financial lender 1).* This same lender, however, also stated that climate risks are not currently impacting lending decisions indicating that, despite awareness, climate risks are not yet factoring into lender portfolio decisions or mortgage prices:

"We have not made changes to our lending guidelines to so significantly that we say ... 'we're not gonna lend over here... over there'...we have not implied or put any changes into our policy. We don't want to exclude people from financing opportunities if they need it for various reasons." (Financial lender 1)

and;

"…we got billions and billions of dollar portfolio. So, in terms of risk exposure, we know we are in a financial position, that if we had to take a loss on those properties, it's not going to disrupt our... organization." (Lender 1)

Another lender repeated a similar pattern, indicating risk awareness by virtue of having conducted stress tests, but a lack of immediate concern. They stated, "*we did a... stress test of...our mortgage book, looking at the three risks - flooding, wildfires, and earthquake " (Financial lender 2),* and concluded, based on the stress test that risks were not of actionable concern:

"really, there wasn't much to worry about in the short term... in totality I would say that we don't see it as an immediate risk, but as an evolving and emerging risk." (Financial lender 2)

A credit union in the lender participant category did express more concern for smaller credit unions, as the often have less portfolio diversity and may face more significant impacts from one extreme weather event:

> *"...this is why I worry about some of the smaller, more rural credit unions. ... if a particular Northern BC Credit Union is doing nothing about their climate risk you know, all it's gonna take is one sudden something to happen. And it could have a ripple effect throughout the Credit Union system." (Financial lender 1)*

5.2.2. Disclosures and lender risk

Financial regulators at the federal and provincial level have initiated efforts to address these increasing climate risks facing financial institutions. OSFI's B-15 disclosure requirements include standards and principles for disclosures aiming to protect financial institution clients, including creditors, investors, and policy holders, and contribute to consumer and public trust by improving financial system transparency (OSFI, 2023). BCFSA is in the process of developing similar measures for provincially regulated institutions (BCFSA, 2023).

Regarding the potential impact of disclosure requirements to impact lender actions in practice, participants were in agreement. One regulator mused that the increased risk awareness from collecting and assessing data would deepen lenders knowledge of portfolio risks, causing them to act on risk:

> *"the fact that they [financial institutions] have to do all this work, and then they're eventually going to have to disclose it - that transparency... it's forcing them to look at their portfolios, get better data from their from their clients...or counter parties on the commercial side, and then start doing that risk quantification... so when they start collecting better data, ...analytic capabilities, marrying that with climate risk models, it's going to lead to better or to different business decisions." (Financial regulator 2)*

A lender had a similar response:

> *"It should, because the regulations talk about not only an understanding and identifying your risks, but also the opportunities and demonstrating how you embed those risks and opportunities in your climate thinking and strategy." (Financial lender 1)*

In response to increased risk awareness, lending rates may increase due to the increased awareness of lenders taking on risk and pricing it into their offerings, among credit unions and banks, as expressed by a data provider participant:

> *"As more folks [credit unions] adopt climate risk into their everyday lending practices, there will be some normalization in the market where there will be opportunities for lenders to ... charge a higher fee ...because there's more risk involved…federally regulated banks, should be the same. It should behave the same as the credit." (Data Provider 1)*

Another participant expressed a similar view, but elaborated that they expect changes in lending decisions to occur over time, as the quantification of risks will require investment in analytical capabilities:

> *"...I think at some point it will...for now many lenders it's very difficult to quantify that risk... the actual losses that you're exposed to... and transfer that into those potential losses into the pricing. But that I think it can take some time." (Mortgage insurer 1)*

A regulator expressed hope that disclosures would prompt action, as reliance on insurance is less guaranteed with climate change, as insurers may react to climate risk by withdrawing coverage or increasing costs for a lender, rendering a mortgaged property uninsured, without lenders being alerted to their increased vulnerability, a concern reflected in the literature. Insurers may increase capital reserves by increasing pricing, reducing coverage or withdrawing from at risk regions or jurisdictions where they cannot price according to projected risk (Bakos et al., 2022; Coppola, 2015):

> *"When a bank underwrites a mortgage, they'll ask you for proof of insurance... But then next year your insurance might change...you might default... The bank won't know... We know that this is a blind spot … the bank may not know that that collateral is not covered and they could be on the hook if there's a disaster." (Financial regulator 2)*

Concern for small credit unions regulated by BCFSA, was expressed by a credit union in the financial lender category. They highlighted the limited capacity and knowledge of their smaller counterparts to meet potential disclosure requirements under BCFSA, and to develop internal risk awareness, measurement, and monitoring capacities, expressing the need for embedded support:

> *"We've stood this up and grown our knowledge over time. But I can guarantee you there's a lot of credit unions who have yet to begin.... I will do it when my government or my regulator tells me I need to. But I don't want to do it in advance, because it's overwhelming and don't know where to begin.'" (Financial lender 1)*

5.3 Data, modeling and transparency

5.3.1. Climate finance data and modeling challenges

Participants highlighted data gaps and inconsistencies as one of - or the - most significant issue for addressing climate risk in housing finance in Canada. A financial regulator, for instance, stated " *data is a huge issue' (Financial regulator 2).* Similarly, another participant, a lender, echoed the lack of singular methodology and comparable, transparent, and available data as a problem:

> *"The bigger issue... is around lack of data, lack of consistent data…There is no one central repository of a risk, physical risk data." (Financial lender 2)*

and;

> *“That could be the biggest issue that we're facing in Canada. There is not a one version of truth either on the data side or on the methodology that we use.” (Financial lender 2)*

Data and modeling is relied upon by financial actors for stress testing for risks. Interview participants views were aligned on the challenges they face with data and modeling in the Canadian context. In Canada, there are challenges with access to granular, recent and complete data sets, and suitable modeling technology. As such, stakeholders rely on different data sets and proxy data for modeling, making comparison a challenge. The granularity and accuracy of the data set were noted to be important challenges to the accuracy and utility of risk modeling projections. This is particularly notable for rural or remote regions with less data points available:

> *“You need to make sure that it’s accurate, otherwise garbage in garbage out. So trying to verify the accuracy of it is a challenge. And… there’s a gap in the data, both in the completeness of it and also the scope of it…depending on the geography you may get much more, much richer data and some geographies you get very little data.” (Financial lender 2)*

Another lender highlighted the same problem, stating the need for granular data to make accurate risk assessments, and the current reliance on incomplete data sets, stating *"We need this very granular individual building by building type information." (Financial lender1)*, and "*[proxy data is utilized] until such a time that better data is available" (Financial lender 1).*

Another data gap that was highlighted is that financial actors' data is not focused on the efficacy of adaptation measures:

> *"we have been trying to identify how many properties in Canada overall are exposed to flood risk, but ... not estimate whether the home is resilient or not. That's where we have the gap of data. We don't have that data." (Mortgage insurer 1)*

Data was also highlighted as one of the anticipated challenges for financial institutions adhering to disclosure requirements; institutions may not have been collecting the data now needed to meet requirements:

> *"a lot of disclosure and analysis and the underpinning of that is... data. Once you rewind time and you knew this data element would be needed to that minutia level of detail, you would have captured it a long time ago" (Financial lender 1)*

A financial regulator suggested that disclosure requirements may force financial institutions to expand data collection:

> *"the fact that they [financial institutions] have to do all this work, and then they're eventually gonna have to disclose it - that transparency... it's forcing them to look at their portfolios, get better data from their from their clients...or counter parties on the commercial side, and then start doing that risk quantification... so when they start*

collecting better data, ...analytic capabilities, marrying that with climate risk models, it's going to lead to better or to different business decisions." (Financial regulator 2)

5.3.2 Data sharing

One factor that participants highlighted as contributing to data asymmetry is the lack of data sharing between stakeholders. Some stakeholders, including insurance, were highlighted to have superior data, but are unlikely to share data due to proprietary and privacy concerns. A lender participant explained insurance's data position:

"the only industry we found where there was cleanest data were property insurance companies…probably had the most historical information, the richer database because they get the claims and the claims come in, and they will have an idea. And the price insurance based on that. But that's their information. They're not sharing it with anybody." (Financial lender 2)

Another participant stated that some data sharing does occur with governments, but that it is primarily one-sided:

"if and when Bank Act changes we [financial institutions] will compete directly with them [insurers], and because of that there is very little appetite from the insurance... to share anything or partner with the banks in any way, shape or form. So, you need an honest broker, which would be the regulator or the government to provide that information" (Financial lender 2)

5.3.3 Data standardization

Participants advocated for a centralized, common and collaborative data source and model. They cited the provincial and federal governments as being in the most optimal position to develop up to date and granular, standardized, and accessible data sets, including a finance participant who stated, *"this should really be on the government to develop that database again" (Financial lender 2).* Another lender confirmed this view:

"it would be great if the Government said 'thou shalt use all the same model, use all the same data set'... So there needs to be some standardization on how physical risks can and should be viewed and monitored." (Financial lender 1)

An insurance provider stated that a government data source would be the most robust due to access to data and lack of proprietary concerns, compared to a private data actor:

"Fundamentally federal and provincial data sets are going to be far, far more robust than anything that we [private actors] could [provide]." (Insurance rep. 3)

A similar approach for modeling was advised by a lender participant, particularly for smaller lenders without the in-house resources or capacity to develop models independently:

"We don't have the ability... We're not client-model developers. That's not our business." (Financial lender 1)

Participants indicated that efforts to standardize data are underway, with conversations occurring across provinces and at the federal level:

> *"I'm trying very, very hard with my provincial colleagues to make sure that we have a Pan-Canadian approach... we want to make sure that we standardize the data asks and the definitions." (Financial regulator 2)*

> *"Federal departments are working on these [data], and that might be even better provided than us. The Federal Department that's responsible for all climate data is now ECCC....So they're they are collecting that...there is some communication... at some point we were working with the ECCC to define some of the metrics for that [wildfire risk], to be able to estimate... the fire weather index ...So there's a bit of feedback there in in the process". (Mortgage insurer 1)*

A financial regulator echoed the idea that efforts are emerging at the federal level:

> *"national standardization of models or data.... that's gonna have to be either driven by finance or Natural Resources Canada (NRCan) or ECCC, which I think they all have little initiatives around data." (Financial regulator 2)*

An insurance industry representative confirmed federal prioritization of data quality and availability, speaking of emerging efforts to update flood mapping:

> *"Certainly, the Federal Government is moving ...the flood mapping, that is ongoing work that's very needed. And will ideally inform the National Fund Insurance program." (Insurance rep. 3)*

5.3.2. Private data solutions

While private data suppliers are emerging on the market, participants highlighted that this does pose a challenge of standardization and accuracy, particularly with proprietary concerns limiting transparency of data sources and modeling methodology:

> *"We're coming to the market with something that's hopefully going to fill some blanks is going to help the credit ends, at least go back to the regulator and say, 'we've got this third party that's created this modeling. Here's their techniques. Here's their source of information', all those, all those questions that the regulator is going to have. And now...we're able to measure risk like really at a per property level." (Data supplier 1)*

Data suppliers emerging on the market themselves expressed the value of an indicator or industry standard to assure quality and accuracy or products:

> *"...it'd be good if there was some sort...of indicator that would help consumers understand ...an important distinguisher for consumers to have confidence in relying on this model versus the other, because they're going to make some pretty important*

decisions based on the information they gather...absolutely the biggest financial decision of the life. You want it to be relying on specific data." (Data supplier 1)

Another participant, a mortgage insurer, called for more private actors to enter the data market as well, highlighting the availability of free, open-access flood and wildfire maps:

"I wish we could have something like in the States... I'm sure you have seen Risk Factor ... a company in the States that provides freely access to maps for flood risk areas or wildfire". (Mortgage insurer 1)

5.4 Insurance

5.4.1 Insurance risk awareness and response

Insurers expressed an awareness and concern for climate risks, paying particular note to flood risks.

"It's [climate risks] a changing story year over year...When we're considering 'how do these significant weather events impact our portfolios?', we tend to look at them as a whole and understand 'what is the what is the story of all of those major over time?'" (Insurance rep. 1)

"awareness is more... now, if we have discussions with institutions... we definitely get their attention ... now it's really acknowledged. In BC, we face the highest level of physical risk exposure cost among all the provinces in Canada. So, you're seeing that maybe some of the actors that you regulate are sitting up a bit more and paying more attention". (Financial regulator 1)

All three insurance representative participants responded by risk based pricing, rather than withdrawing from a region.

"[We employ] risk-based pricing and what that means is, if you are in a higher zone, you have higher premium" (Insurance rep. 1)

"[Insurers] are constantly reviewing to ensure…whether the risks that they are basing premiums on… are actually reflective of the risk that Canadian face - is it hire or lower? -and pricing around that." (Insurance rep. 3);

"what they do is they'll do it, but they'll charge astronomical rates, so nobody ever buys it from them... essentially just saying 'if you can't get anywhere else, sure, we'll sell it to you, but we don't really want it' " (Insurance rep. 2)

Without the option to price insurance at a cost commensurate with the risk, institutions were split on their reaction whether to withdraw coverage:

"'we can't force the insurance companies to do anything, because they'll leave...'...can you force the insurance companies to be more reasonable?' ... 'No, because they'll leave you, and we need competition in insurance'." (Insurance rep. 2)

> *"it's important to us from an organization as in from an organizational standpoint to not leave clients in a situation where they don't have the coverage they need for the risks that they're facing. And they the reality is that overland flood and storm surge are very real exposures in the Canadian climate right now, and we anticipate for many years, and it is upon the industry to offer protection in the event of these losses." (Insurance rep. 1)*

5.4.2 Re-insurance as an insurance backstop

Participants indicated that insurers are unlikely to withdraw coverage as long as reinsurance is available; thus far, reinsurance remains available in the Canadian market. Costs, however, have been increasing, and are reflected in insurance prices. Reinsurance is an insurance backstop; as long as reinsurance is available, insurance is unlikely to leave the market completely.:

> *"what we've heard is they are increasing deductibles, they are looking at increasing premiums...also for them...the cost itself has gone up because re-insurance has gone more expensive." (Financial regulator 3)*

> *"In a costly reinsurance period, as global events driven by climate change have an impact on the reinsurance market… it's costlier for [insurers]... to reinsure their book of business. And it has a direct knock on effect." (Insurance rep. 3); and*

> *" The reinsurance costs in the US has been going up just steadily…I think that it will mainly manifest as an increase in the cost of [homeowners / property] insurance, which is usually required in you know in the mortgage"' (Researcher 2)*

5.4.3 Decreasing insurance accessibility

Resulting from insurance risk response and rising reinsurance, access to homeowner insurance is decreasing for some homeowners, due to elevated costs or reduced offerings.

> *"Now you have to pay very high insurance costs. It's not prohibitive... for the richer folks... for lower income people, it's probably prohibitive." (Researcher 2)*

Participants connected the increases in insurance prices to a costly reinsurance market, as insurers are having to paying higher prices to cede risk. This is creating an equity challenge for lower income homeowners for whom costs may become prohibitive, putting poorer homeowners at heightened financial risk, which in turn, increases risk of default.

Some participants highlighted reducing insurance availability, particularly for high-risk properties. For optional flood insurance, some insurers are withdrawing from high-risk regions in Canada, putting Canadians at heightened risk of insolvency following a flooding event. Insurers are also restricting their issuing of new premiums for required home insurance during active wildfires, impairing home purchases from going through:

> *"There are certain areas of the country about 1.5 million homes that are essentially uninsurable in this country. It's about 10%...And that is a very real concern, absolutely." (Insurance rep. 3)*

“When a homeowner is trying to move from one house to another house and they're trying to close on a deal, and they can't because of the wildfires.” (Construction rep. 2)

This was observed by a homeowner participant, stating that flood insurance access have been a challenge in the flood-prone region of the Suman Valley:

"out here [in the Sumas Valley] it was difficult for most of the people to have actual flood insurance, or if you do have flight insurance like in my case overland flood insurance, they will only insure you to the small value." (Homeowner 2)

5.4.4 Insurance solution

In an effort to address the problem of optional flood insurance, the federal government has committed to a federal flood insurance program for all Canadian homeowners by 2025, closing coverage gaps exacerbated by increasing rates and decreasing offerings, which one participant did acknowledge, enthusiastically:

“The federal government is actively working on a National flood insurance program for those highest at risk with alongside with the industry.” (Insurance rep. 3)

"so many places are in the potential flood zone and not able to buy insurance anymore, which makes it a government problem." (Insurance rep. 2)

5.4.5 Lender insurance risk

An additional insurance risk that was highlighted by a participant was the risk to lenders due to incompatible timelines between insurance and mortgage renewals. As insurance increases in cost and decreases in access, the risks to homeowners can be passed on to financial institutions in the form of default risk. Under the current structure, insurance is required by financial lenders to commence a loan, but is not constantly verified. If a homeowner’s insurance changes, financial institutions may not know if the homeowner does not inform them, thus putting repayment on the loan at risk:

“it is very difficult to constantly verify … unless there's a centralized database. Otherwise you're relying on the consumer to somehow show you a piece of paper every year to say that because they could change insurance… any time that they still have a policy in force. And so, this is an industry-wide challenge and that we face, that is true.” (Financial lender 2)

Another problem highlighted was the fact that underwriting is concentrated in different geographies than the insured locations:

“a lot of the insurers are based back East, and when they hear about a fire...there's this misconception that the risk is equal.... downtown core versus...fire perimeter” (Data supplier 1).

As such, risks are not perceived to be fully understood, and may be over exaggerated based on the underwriters' perception and not based on the reality of BC. The data supplier participant explained how homes within a city, even if near a fire, for example, are not necessarily at-risk due to the challenges of fires spreading in urban areas, compared to rural.

5.4.6 Construction insurance incompatibility

The current format of course-of-construction insurance is perceived to be incompatible with BC's construction season. Insurers are denying coverage during active wildfires due to heightened risk. As insurance is required for construction to commence, its absence or delay in securing coverage contribute to project delays, resulting in financial losses for construction companies, and shortening of the building season. This problem was conveyed by participants spanning stakeholder groups:

> *"Lost revenue… if there's a period of time that we can't work that's going to coincide generally with times of extreme heat." (Construction rep. 1); and*
>
> *"Typically, the building industry is comprised of smaller home builders ...this is the project that you're working through the construction season with, so you're really at risk of not being able to complete this work and your business is in jeopardy." (Construction rep. 2)*
>
> *"for credit union...insurance is a condition to underwrite a loan, and what we've heard is ... if there was an active wildfire region in a year and people couldn't get insurance then they would not underwrite" (Financial regulator 1)*

An insurance representative conveyed this same sentiment of concern for construction industry players due to lost business from being unable to bind insurance during wildfire season, stating:

> *"my major concern is the economy, because if you have it that year from July first through to October fifteenth, I believe we could not write new business, which meant you had probably over a hundred homes that were meant to start, but a bank would not release funds for them to start. So now you got contractors who are meant to be paying their bills, feeding their families paying their mortgages, not going to work for a month and a half" (Insurance rep. 2)*

This also stifles the rate of construction within a province in need of increased housing supply. For an industry composed primarily of small businesses working on a single project at a time, stifling projects can jeopardize financial viability:

> *"How are we going to have to run our business in future? …how do we deal with delays? How do we communicate with our clients about who pays for that? How…stressed do people get and stop building?" (Construction rep. 1)*

The incompatibility arises in the cycle of insurance. Most housing projects take a full year while insurance plans typically last the same amount of time. This implies most builds are

taking place during the fire season. Insurance only stifles a build timeline if it is being purchased during the fire season:

> *"If they apply in November, nobody asks any questions about it, but a new build...usually takes some more than a year, so the risk of wildfire exists for all new builds, timing is everything." (Construction rep. 1); and*

> *"If builders were not able to meet their specific building permit in time to qualify for course of construction insurance, and this new policy was introduced during that interim period ... you're stuck in this purgatory period, where you can't proceed with your work because you're waiting for a wildfire nearby to resolve itself" (Construction rep. 2)*

To avoid this, builders have been advised to seek insurance early in the season, which incurs additional costs for months of premium, and also requires early action on permitting.

> *"Your best bet to avoid this scenario is to try to get all this in place ahead of time, which is challenging because you are waiting for some municipal approvals to be able to move forward." (Construction rep. 2)*

Another perceived insurance incompatibility was the ability to access insurance immediately after flood events. A homeowner who has experienced damages from extreme flooding noted that the speed of insurance claim access following the flood significantly impacted the extent of damages, as *"timing is critical in these [flood] instances; a lot of damage can be mitigated if it's dealt with right away" (Homeowner 2).*

> *"In a lot of cases, a lot of damage could have been mitigated with a rapid response. And that's to get in there to get those walls open. Get those floors open, get the insulation removed. Get the humidification set up. Get cleaning in place. Some people were... waiting up to 4 months for their insurance company to ... give them the okay to hire a remediation company to come in." (Homeowner 2)*

5.4.7 Insurance wildfire blackout inconsistency

The criteria for binding new insurance during active wildfires lack clarity and cohesion, according to participants reported experiences. Participants expressed a lack of clear criteria for inactivity around fires among insurers, and a lack of consistency between brokers. As insurers become more risk averse, the radius of non-binding surrounding fires is expanding, often without notice, prompting unforeseen work-stops for builders seeking construction insurance. This is further fueled by many underwriters being located outside of BC and not understanding the nuances of wildfire risks, such as the difference between a property downtown and on a wildland-urban interface. As one builder explained:

> *"Insurance groups have changed the policy...on the radius of when they would issue a course of construction insurance. Typically, ... if you were within 25-kilometer radius of a wildfire you wouldn't be eligible for course of construction insurance, but ... we're seeing larger, more significant fires, we saw insurance companies changing that policy*

> *...and it would be changed at the drop of a hat...and just saying a full stop-work approach." (Construction rep. 2)*

An insurance rep. expressed a similar frustration:

> *"5 years ago, if there is a fire 25 kilometers away from a state Kamloops or Kelowna, but that fire was on the other side of a lake, we could still get insurance. In today's day and age - No - 25-kilometers is 25- kilometers is 25-kilometers" (Insurance rep. 2)*

Even when fires were outside of the radius, stakeholders were denied insurance due to broker fears stoked by the news of fires elsewhere, or a reliance on out of date wildfire data from the government:

> *"Insurance brokers are charging for and issuing course of construction insurance policies based on what they're reading in the news and their understanding of geography, rather than having clear policy." (Construction rep. 1)*

Builder participants connect this inability to bind insurance as further contributing to the stifling of work for the building industry. The lack of clear criteria for non-binding makes planning challenging. Additionally, the increasing risk aversion of brokers and radiuses of non-binding around fires threatens stifling the building season, completely, in an active fire year.

Stakeholders from other groups, including appraisers, also expressed awareness and cited financial impacts from an inability to find insurance, as it stifles transactions down the line:

> *"If there was a sale occurring, and there is an active fire occurring...insurance companies will not insure the property. Therefore, you can't close the deal because the mortgage needs to have insurance on the building, so those do create you know, issues of concern for appraisers." (Appraiser 1)*

5.5 Adaptation

5.5.1. Adaptation communication

Adaptation measures are known to researchers and government but are not yet widely implemented, based on participant reports. Wildfire and flood adaptation and resiliency measures need to be communicated to homeowners for implementation. Researchers have determined the best actions for building resiliency and adaptation into homes:

> *"We have developed very good tools in Canada; standards, guidelines, best practices to mitigate risk at the level of the home or the level of the community for both flooding and wildfire. We now know what to do. We know where the risks are, we know what to do to mitigate those risks." (Researcher 1)*

The challenge, as expressed by the researcher, is that *"we're not mobilizing the solutions that we have in hand nearly quickly enough" (Researcher 1)* to mitigate damages from increasingly frequent and severe extreme weather events.

A participant identified communication of adaptation measures with homeowners as a primary barrier to adaptation. Communication is important to ensure homeowners know the risks facing their properties, and the measures they can take to mitigate risks; often for little time and cost. The role of communicating adaptation measures to homeowners should fall on all stakeholders engaging with the homeowner, including lenders and insurers, as they benefit from reduced damage risks facing the property:

> *"The limitation for homeowners isn't that they won't act to protect their properties. It's that they don't know what to do. When they're actually presented with what to do, they will take the actions." (Researcher 1);*

In terms of encouraging adaptation, there is a need for communication with homeowners. Participants highlighted the need for communication from stakeholders interacting with homeowners, to educate and incentivize the uptake of adaptation measures, including but not limited to insurers:

> *"Insurance...is in their best interests now that they prevent that the home has a flood, so they don't pay that the damage for that flood". (Mortgage insurer 1)*

> *"It's not just the insurers. It should be the banks when you get a mortgage...they should be incentivizing homeowners or providing guidance to the homeowners to put the measures in place to mitigate flood risk, wildfire risk." (Researcher 1);*

Mortgage providers, or lenders, also are in a position to communicate with homeowners:

> *"When people get their mortgages, and twice per year they mail out these infographics to mortgage holders, to say to them, 'Here's a reminder to check on these things around your house, so you don't flood or your house doesn't burn down', spring and fall. And this is in the best interest of you know of both the mortgage holder, you know, and the homeowner." (Researcher 1); and*

Risk and adaptation is disjointed and is needed for widespread adaptation uptake:

> *"The greatest contribution Canada could make right now... to mitigate flood and wildfire risk…is to launch a national home flood protection education program and a National Wildfire Risk education program for those who live in the wild and urban interface." (Researcher 1)*

5.5.2. Enabling adaptation

Participants highlighted a policy window for adaptation uptake; immediately after a disaster, homeowners are more concerned about climate risks, according to participants. Without policy support there are barriers to improving resiliency post-disaster, including costs and time. Finances are tight and resources are often scarce limiting the ability to act:

> *"There is a heightened interest in doing the right thing, however, availability and the timeline of response after a disaster significantly hinders that. You may be more aware of your risk, and you may want to do the right thing, but...there was lack of supply. If*

you're just trying to get back you, you're likely to just take whatever is available off the shelf." (Technical regulator 1)

While salience and concern for risks is heightened, homeowners just want to get back to normalcy as efficiently as possible:

'When you build back after fires…very often people are stressed to the point, and all they really want is, 'I want my life back as it was', and they kind of rebuild…without taking into account the directives of Fire Smart." (Construction rep. 1)

In the event of floods, timing is of high priority to avoid mold damages, requiring whatever materials are available to be utilized:

"If you have a flooded basement, if you flood on a Monday morning, you have to solve the problem by Wednesday of that week, or the house is uninhabitable." (Researcher 1)

Another barrier to improving resilience post-disaster is that in general, insurance is not covering upgrades, just replacement for what was losses or damaged; additional adaptive and resilient building would come at an additional cost to homeowners during a precarious time:

"The cost to build to those [adaptive] standards is more, so you'll see insurance policies be higher, but also, what the benefit of building to that is, you're reducing other risks. So how do you kind of get compensated in that way?" (Construction rep. 2).

Other barriers to adaptation in general are costs, knowledge, and time, as highlighted by a homeowner experienced in climate adaptation.

"there's the technical stuff that you have to teach yourself that most people don't have the time" (Homeowner 1)

"then it's just on time consuming. And we had to move out of the house. I haven't been in the house for a year. For most people (a huge constraint) ... they have to rent" (Homeowner 1)

"the construction costs are, I mean, they've escalated way more than the rate of inflation over the last two years" (Homeowner 1)

Measures targeted at building back to higher standards post-disaster would be an effective strategy, rather than repeating the cycle.

5.5.3. Homeowner adaptation insurance incentives

Insurance and industry-adjacent participants affirmed premium discounts for climate risk adaptation measures by most insurers. As a regulator participant confirmed:

> *"The major insurers, as a general rule of thumb for homes that put in place measures to… mitigate flood risk or wildfire risk, they will offer up about a 5 to 15% reduction in insurance premiums." (Researcher 1)*

A homeowner who has invested heavily in adaptation measures, however, expressed uncertainty regarding insurance discounts for the work completed on his property, indicating that insurers, if incentives are available, are not well communicated, or significant enough to be of note to homeowners:

> *" I'll have to say, [to insurers] 'look, we've got all these things done. Do we get any credit?' We get credit for an alarm system. I don't know if we get credit for the sprinkler system. We should" (Homeowner 1)*

The same homeowner also noted that premiums are increasing overall; *"we're getting 20 to 30% increase in premiums a year. That's what I've been discovering" (Homeowner 1).* Any deductions from adaptation measures are less than the increases in premiums.

Participants attributed the dilution of incentives for homeowners to the size of the discount, the lack of transparency from insurers on the discount, and the awareness of discounts from homeowners. In general, insurance stakeholders confirmed a marginal discount on insurance premiums for measures to mitigate wildfire or flood risk. Premium-holding stakeholders, conversely, expressed uncertainty regarding the availability of discounts. This is attributable to the lack of transparency and communication from insurers on incentives to homeowners:

> *"...if you don't know what you're going to get, if you replace your roof to be more wind resilient ... who...would want to undertake such a thing? '...'it's… imperfect information." (Researcher 1)*

The idea of a regulated insurance discount to spur adaptation was mentioned but countered with the threat of contributing to driving insurers out of high-risk regions. Required discounts may make it increasingly difficult for insurers to charge amounts they deem commensurate with the risk they are taking on and may actually cause more insurers to withdraw from at risk regions:

> *"Very high-risk areas …if they are already not able to charge that, and if you mandate a discount, it would make that deviation even larger, and so you can conceive that that might drive them to pull out even more from the high-risk areas." (Researcher 2)*

Reducing risk through adaptation measures, including retrofits and measures in new homes, may not be feasible for all homeowners. Efficient financial incentives that target people who would not otherwise adapt are necessary for ensuring adaptation at the homeowner level:

> *"...wealthy people will be able to do it, and vulnerable people will not, and so when people talk about like a big boom in retrofit work ...There is an opportunity there, but it*

is much smaller in the absence of government investment incentives, insurance incentives…" (Construction rep. 1)

5.5.4 Subsidizing homeowner adaptation

Based on participant responses, subsidizing is perceived to be effective and important for encouraging the uptake of adaptation measures:

'I want to see more, more benefits, and really make it easier for you either to make your home...more climate resilient' (Mortgage insurer 1)

Participants, however, highlighted the importance of communication for ensuring subsidy efficacy. The only major cost for adapting to flooding is a backwater valve, which requires retrofitting; ultimately in the event of basement flooding, which costs an average $43,000 in Canada, the valve results in significant savings (Bakos et al., 2023). A well-communicated subsidy that conveys the potential benefits is an effective strategy for spurring adaptation:

"We've got to make these subsidies better known and more user-friendly and accessible in terms of people applying for them." (Researcher 1); and

"What we have found to be the most effective way of getting homeowners to move in that direction [of adaptation measures in building] is through incentives that will offset the cost to include that type of building in their homes." (Construction rep. 2)

Participants also underscored the importance of designing user-friendly subsidies. A homeowner with experience in accessing adaptation funding highlighted problems with the availability of information, as well as the method for receiving the financial assistance. Retroactive financial assistance can be a barrier to access for some homeowners without the means to purchase up-front:

"there are subsidy arrangements., but they are almost impenetrable, for it's a really hard for people to understand where the money is, how they can use it. ... So, you're supposed to get your designs done and your estimates, and then you submit all that. Then you get the money." (Homeowner 1)

5.5.5 Builder adaptation incentivization

Adaptation measures for new homes and retrofitting old homes are established and known by experts. Based on our interview findings, however, the majority of builders are not equipped or incentivized to educate homeowners on adaptation measures they can implement in their homes. As such, there is perceived to be little incentive to take on additional learning, without requirements:

"They're [most small builders and contractors] not knowledgeable about...what's required to get actually in an energy efficient install. They're not well versed in building science." (Construction rep. 1);

> *"The time, resource, or financial resource constraints…how can they reasonably be empowered to take on that pause, to talk about climate risk with that asset to think about it if they're not required to, from their education and from the code aspect? And how do you compensate them, too?" (Technical regulator 1); and*
>
> *"There is a massive communications gap…there's so much good climate change information available... how do we communicate to builders in a way that says, 'here's why the energy step code we're talking about energy efficiency?'...How do we communicate with those people about how they are climate change heroes?" (Construction rep. 1)*

Participants recommended builder education be approached through collaboration and resource sharing. Consolidating available tools in a central place and promoting the shared library would reduce redundancy and remove the burden of additional material reaction:

> *"I think that will be another one of those cross organizational collaborations that would be useful is that instead of us trying to do it as a continuing education and supplementary material, can it be something that can get included in the schooling [for builders]." (Technical regulator 1) and*
>
> *"Can we put tools that are available that will really make that large impact at a small-scale effort and make them available in one place that people...and they can go to and through that space get linked to the other organizations." (Technical regulator 1)*

This is occurring informally but requires time and effort to search for resources; a library of trusted sources would improve efficiency and utility for all stakeholders:

> *"We're referring actually to like the resource libraries...we don't have content produced...from within our organization. I don't know that we will. I think that...we're looking for partnerships." (Financial regulator 2)*

Builder participants identified a gap in builder knowledge of the measures. Overwhelmingly, there is a sentiment that they are not aware of the measures or how to communicate with homeowners. There is a need for measures to close this gap and improve adaptation education requirements. Technical builder training requirements could be improved to include more required skills for building to higher efficiency and climate adaptive standards.

5.5.6 Building code adaptation

Participants indicated that builders are not incentivized to learn or build to a standard higher than the Building Code. The sentiment among interview participants is that widespread implementation of resilient new homes and retrofits requires strengthening of building requirements, namely, the Step Code:

> *"In the absence of...implementation of the BC Energy Step Code, (only) a few builders would be building at Step Code 3, let alone anything above that. They are doing it because they must...The regulation is making it happen." (Construction rep. 1);* and

> *"No builder is going to do anything that they do not have to do. Period." (Construction rep. 1)*

The BC Building Code includes an Energy Step Code that increases the requirements for efficiency in the interest of climate change mitigation. Currently, there is not an equivalent for adaptation within the Building Code. The NAS, however, includes a target of integrating climate change resilience standards in the National Building Code by 2026 (ECCC, 2023b). As provincial building codes are based on the National Building Code, and as a climate leader, it can be expected that the BC Building Code will include resiliency and adaptation measures in the near future (Government of BC, 2024):

> *"In order to really get at...some of these misaligned incentive problems, and then the fundamental issue of...low risk perception, you need...a combination of risk education or like information provision, and... some kind of building code improvement." (Researcher 2)*

5.5.7 Local government adaptation and mitigation

Some municipalities or regions take measures to reduce risks. While local government actions were not a theme within our study, nor were local governments a stakeholder group within our study, some participants did highlight local government's involvement, particularly as it relates to permitting construction within their jurisdiction. In particular, local governments were mentioned in regard to their different bylaw strategies for addressing liability of building in high-risk zones. Local government strategies of issuing building permits for building near wildland urban interfaces or in high-risk flood zones, for example, were highlighted as ineffective at reducing risk. Permits, rather, shift liability away from the local government and on to the homeowner - so long as they are willing to take on the risk, they are permitted to build. This type of liability policy enables continued development on the interface. Builder participants highlight the need to push for densification and building away from high-risk zones - in particular, wildland-urban interfaces:

> *"There's not a holistic risk mitigation approach to land use decision making' will mitigate risk of wildfire with wildfire permit - shifts liability to homeowner away from municipality, doesn't actually reduce builds in at risk areas." (Construction rep. 1)*

Instead, local mitigation actions, like zoning laws that prioritize building away from the urban-wildland interface, and increasing urban density would actually reduce risk for residents; as another construction representative stated, *"we've got to densify on the existing land that is defensible." (Construction rep. 2).*

Chapter 6 – Conclusions and discussion

6.1 Summary of findings

This study aimed to develop an understanding of how climate change risks are impacting and are passed among stakeholders in BC's housing finance ecosystem. Using semi-structured interviews with financial stakeholders, sixteen main themes emerged to inform further discussions, research, and action on this subject matter. Findings cover five categories including (i) assessing and pricing risk, (ii) lender risk concerns and disclosures, (iii) improving data, modeling, and transparency, (iv) insurance accessibility (v) adaptation education and incentivization.

For each theme of findings, areas in need of policy or regulatory response were identified; recommended responses are summarized in Table 1 and Table 2, below, and are detailed in the discussion to follow. In summary, recommendations include addressing gaps identified through participant interviews through policy measures that focus on: education, standards, financial incentives, regulations, and collaboration and communication. Policy mixes, including information-based policies and regulatory or financial policies, are recommended to enhance efficacy.

Some identified areas correspond with emerging policy and regulatory responses, including the financial regulations and climate adaptation policies described in Chapter 2; once emerging policies and regulations are implemented, improvements should be observed in these areas. These emerging responses are summarized in Table 1 below. Table 1 categorizes emerging responses by theme from interview findings, and by the actor implementing the corresponding emerging policy, regulation, or action; these categories are demarked by the teal, red, and purple colours. Teal comprises climate adaptation policy actions, namely from the BC MECCS Climate Preparedness and Adaptation Strategy, and the ECCC NAS. Red comprises financial regulatory actions, including OSFI B-15 and, when finalized, BCFSA's disclosure regulation. Purple comprises responses from private and non-government actors, such as private companies and professional associations.

Table 1. Emerging policy responses

Themes				
Risk awareness and concern	**Financial lending and portfolio risk**	**Data, modelling and transparency**	**Insurance risk**	**Adaptation challenges**
Climate disclosure requirements	Climate risk disclosure requirements	Investment in updated flood maps & flood hazard data	Federal flood insurance program	Municipal adaptation incentives
Community risk awareness education measures	Disclosure assistance for smaller institutions	Consolidation of flood data in accessible data bank		Adaptation education toolkit; homeowners and local governments
Climate data on real-estate listings		Private data actors entering market		National Building Code update – adaptation code standards
Appraiser climate risk guidance		Investment in risk model development		Multi-lateral adaptation approach; coordinate efforts between levels of government
Creation of employee adaptation learning network		Investment in flood forecasting and warning		Investment in community wildfire prevention and research
		Conducting a national risk assessment		Consolidate climate financial opportunities for local governments in hub

Private or non-government actions
Government - climate adaptation policy measures
Government - financial regulations

The remaining areas not covered by emerging policies and regulations, are in need of additional action; these action areas are summarized in Table 2, below. Additional recommendations are categorized by finding theme and by policy response type; this includes education (pink), regulation (blue), incentives (yellow), standards (green), and collaboration and communication (peach).

Table 2. Further recommendations

Themes				
Risk awareness and concern	**Financial lending and portfolio risk**	**Data, modelling and transparency**	**Insurance risk**	**Adaptation challenges**
Coordinate homeowner and homebuyer education between stakeholders	Incentivize lenders to incorporate climate risks in decisions	Standardize climate projection models	Incentivize insurers to explore other options for improving insurance accessibility, such as price caps	Coordinate with stakeholders on homeowner adaptation education
Incorporate risk education in mandatory builder training		Develop model 'goodness' metrics, certification	Improve communication of insurance status between insurers and lenders	Explore inclusion of adaptation building in required builder training; not optional courses
Consolidate existing risk education tools into accessible data-base		Encourage data sharing between institutions, particularly insurance, lenders	Facilitate development risk training for insurers on location-specific risk	Facilitate inter-governmental discussion, working group focused on improving communication, division of adaptation efforts, efficiency
Require / regulate climate risks to be incorporated in housing pricing			Explore standardization of insurance black-out periods from risks	Promote and communicate adaptation subsidies and financial support
Incentivize purchasing or building housing away from high-risk regions / subsidize housing densification				Fund homeowner adaptation incentives
				Explore incentives, requirements for insurance
				Explore standardizing / facilitating consistency, transparency on insurance adaptation incentives
				Regulate the building of housing away from high-risk regions (zoning bylaws)

Education *paired with a complementary subsidy or regulatory policy to maximize efficacy
Regulation
Incentivization
Standardization
Collaboration and communication

6.2 Risk awareness and pricing

On the theme of risk awareness, it was observed that homeowner and homebuyer financial decisions are not aligned with climate risks; there is demand for at-risk properties. Interview participants attribute this to insufficient homeowner and homebuyer risk knowledge and awareness, as well as market factors beyond the scope of climate risks; all participant attributions align with the research. Research on real-estate prices following extreme weather events observed a rebound in prices, suggesting limited concern for climate risks (Beltrán et al.'s, 2019; Miller et al., 2019). As suggested by participants, action is needed to educate homeowners on climate risks. This can be done both at the time of transaction for homebuyers, and more generally for homeowners, as suggested by participants.

Currently, efforts are being undertaken, publically and privately, across jurisdictions, to improve risk awareness for homeowner and homebuyers. The following regulatory and policy proposals and plans include measures that, if implemented, will improve risk awareness:

- BCFSA climate disclosure proposal: includes a plan for property-specific disclosures aimed at improving risk awareness in real-estate purchases, such as through climate-risk scores assigned to real-estate listings. This seeks to help real-estate investors make better-informed decisions and allow climate risks to be reflected in real-estate prices (BCFSA, 2023).
- MECCS Climate Preparedness and Adaptation Strategy: initiatives include partner with educational stakeholders for risk awareness program development; and developing a CleanBC public risk awareness campaign (MECCS, 2022).
- NAS: initiatives including creating a free online flood exposure portal (ECCC, 2023b).

Additional measures from the MECCS Strategy and the NAS aimed at improving analytics through investment in data and modeling further contribute to risk awareness.

In addition to ministries and regulators, private actors are also aiming to improve risk awareness, through data provision. Measures to inform prospective homeowners of risks facing properties are beginning to be rolled out by private data providers in BC; early in 2023, three real estate sites, including Sotheby's International Realty Canada, REW and Royal LePage, began including climate change risk information on property listings (Climate Check, 2024; Labbé, 2023). Climate Check rankings score future risks and projected changes to risks over time, for wildfire, precipitation, and flood risks, among others. This advancement was made through partnerships between Canadian location data company Local Logic, and US-based risk data company Climate Check, in an effort to advance Canada's comparatively lagging data industry (Climate Check, 2024).

It is advisable for regulators, including BCFSA, to move forward with climate -risk scoring requirements for real-estate transactions, as this ensures homebuyers are informed at the time of transaction. The federal counterpart, OSFI, should consider incorporating a real-estate component to its disclosure requirements (OSFI, 2023). Disclosure requirements such as BCFSA's, require data and modeling, and standards of practice to ensure comparability across actors. Data and modeling support are of particular importance for small actors under the jurisdiction of BCFSA, as they are unlikely to have the resources, knowledge, or capacity for climate risk data and modeling. Additionally, continued investment in education, targeted specifically at homeowners, is encouraged across levels of government.

As suggested by participant observations of factors beyond climate risk impacting demand, addressing climate risk awareness alone will not be capable of decreasing market interest in at-risk housing. Policy aimed at addressing housing supply needs, away from

wildland-urban interfaces and outside of flood zones, is needed, but falls outside the jurisdiction of this study.

On the theme of risk pricing, participants indicated that, as homebuyers are not currently driven by climate risk, appraisers are not currently considering climate risk factors in their valuations. Appraisers, as described in the interviews, are driven by demand; as such they are not incentivized to incorporate a factor into pricing without a market push. Once implemented, risk awareness measures, as described above, should influence the market, encouraging appraisers to reflect climate risks in pricing. This is an emerging action item for appraisers; the Appraisers Institute of Canada (AIC) has started to create guidance for members to incorporating climate risk into valuations. Data and modeling capacities will be required by appraisers (Evans, 2023). To ensure comparability and accuracy of risk assessments, it is advised that data and modeling standards be considered. Continued investment in publically available data and modeling, as included in the MECCS Strategy and the NAS, will aid in ensuring the efficacy of risk assessments. Other strategies for standardizing risk valuations, external to appraisers, and internal to a ministry or government institution, could also be explored, as this would ensure a standard of assessment and allow for comparability across listings.

Builder risk awareness was not a topic present in the literature; as such, this topic merits further investigation. Based on construction industry representative participant observations however, builders can be supported through risk education and financial assistance for adapting business practices to align with shortened working seasons. This revealed the need for further research targeted towards builder risk.

It must be noted, however, that informational policy instruments, including education-based policies, are most effective at spurring action among actors with previously held knowledge or beliefs knowledge related to the policy topic; comparatively, information-based policy instruments are less effective at spurring action among actors without previously held related knowledge or beliefs (Bengtsson et al., 2010). Homeowners are a heterogeneous group with varied knowledge bases and belief systems, which impact the reception and impact of climate risk information. As such, information policies, including homeowner risk education and builder education, should be paired with financial or regulatory policies for effective results (Bengtsson et al., 2010). Some examples of policies to complement education recommendations include:

- Regulation: regulate real-estate appraisal and pricing to require the incorporation of climate risks
- Subsidization: subsidies for home purchases or builds outside of high-risk areas; subsidies or grants encouraging housing densification; financial levees or taxes for building or buying in flood zones or fire interfaces

Additionally, in the context of the housing shortage and increasing climate risk, more stringent mitigation policies that limit or prohibit building away from risks, rather than encouraging risk-adverse building and purchasing, should be explored. These zoning regulatory options are further discussed in 6.2.5.

6.3 Lender risk concern and disclosures

On the theme of lender risk concern and disclosures, lenders revealed a lack of concern and action with regards to climate risk. This position is consistent with the findings from the Bank of Canada's (2023) analysis of modest climate risks on lenders real-estate portfolios, as discussed in the literature. While potential impacts were found to be modest, however, the study

did cite limitations, and concluded with recommendations to actively manage crisis facing mortgage portfolios (Johnston et al., 2023). Research also highlights the importance of incorporating risk into through a measured approach to improving risk awareness and reduce price shocks (CMHC -1, 2022). Efforts to improve transparency and provide risk education will also contribute to pricing climate risk (OSFI, 2023). OSFI and BCFSA's climate disclosure regulations take aim at improving risk awareness and action among financial institutions, including lenders. This seeks to help real-estate investors make better-informed decisions and allow climate risks to be reflected in real-estate prices (BCFSA, 2023). In turn, disclosures will help financial institutions reduce risk by providing insights into their risk profiles and allowing for informed, investment decisions.

It is advised that the BCFSA pursue the proposed disclosure plan, to improve risk awareness and action at all scales of lending institutions. Participants vocalized climate risk concern for small regional credit unions as they have less portfolio diversity and are subject to higher risks from a single extreme weather event; this concern is consistent with literature findings (Grippa et al., 2019). Disclosure regulations rely on the use of data and modeling. To ensure the efficacy and comparability of risks across institutions, it is advisable that regulators provide data and modeling for institutional use. This is particularly important for small institutions within the jurisdiction of BCFSA, as they are less likely to have the internal knowledge, resources, or capacity to conduct quality and comparable risk assessments internally, without aid. Interviews revealed the importance of emerging disclosure regulatory requirements, and the need to bolster current actions with data and modeling standardization and support.

Information-based climate risk disclosure regulations targeted at financial institutions can be expected to yield a more effective response, compared to policies targeted at homeowners or other sectors, due to the background knowledge of financial institutions to contextualize and understand the significance of information (Bengtsson et al., 2010). Financial institution climate risk knowledge is attributable to factors such as increased regulatory requirements including climate risk disclosures (OSFI, 2023), increased awareness of the materiality of climate risk on financial institution financial health (BMO Financial Group, 2023; Vancity, 2022), and increased competition and investor pressures (Eceiza et al., 2020). It is recommended to explore financial incentives that accompany information-based disclosure regulations, to further encourage financial institutions to act upon disclosures and incorporate climate risks into their financial decisions.

6.4 Data, modeling, and transparency

On the theme of data and modeling, participants highlighted data availability as a major shortcoming for addressing housing finance risk in Canada. This is consistent with literature findings, citing Canada as behind peer nations in terms of data availability and modeling capacities compared to contemporary nations (Johnston et al., 2023). In particular, participants highlighted the challenges with data access for conducting accurate stress tests to understand future risks. Lenders also highlighted the reliance on incomplete or out of date data as posing a risk of underestimating risks, consistent with literature findings (Johnston et al., 2023; Brunetti et al., 2021). Flood mapping in particular was highlighted as a shortcoming in Canada, requiring investment - also consistent with literature findings (Evans, 2023; CMHC, 2022; CWN & IBC, n.d.). Participants suggested that disclosure regulations may result in expanded data, to meet requirements. This is consistent with B-15 objectives of enhancing data and modeling capacity

(OSFI, 2023). A lack of data sharing was also cited as an issue; insurers have data, but are unwilling to share due to proprietary constraints.

Participant data recommendations focused on data standardization and data sharing. Some participants advocated for a centralized data solution, calling on governments to supply more accessible and reliable data. Other participants highlighted the emerging efforts from the federal government, in particular, towards updating and standardizing data. Emerging data-specific measures include investment in high-quality and accessible flood hazard data and flood maps, and a national climate risk assessment to inform future adaptation, among other investments (ECCC, 2023a). MECCS' Adaptation plan also includes data and modeling measures, including expanding the ClimateEx project through university partnerships to develop high-resolution climate data projections (MECCS, 2022). Based on findings, it would be advisable for the federal and provincial governments to continue exploring avenues for collaboration on a centralized, open-source data strategy to collect and provide reliable, consistent, granular, and up to date data, as well as modeling and analytical tools, for actors across the housing finance sector. Strategies for facilitating data sharing between actors to fill in holes and reduce redundancy are advisable as well. A centralized government-run data strategy, including publicly available data sets, modeling tools and standards, and data education, allows for more equitable data access for all financial participants, regardless of in-house knowledge and development capacities. Additionally, investing in data can help identify areas facing high risks from climate as well as other factors that may impact the ability of households to respond to increased climate risk awareness, or recover from extreme weather events, and enable more efficient and equitable policy responses.

It should be acknowledged that improving granular data access among financial service providers risks negatively impacting at-risk homeowners. Increased climate risk data threatens to decrease the value of at-risk properties – the most significant investment for most Canadians (Sherren, 2023). Additionally, increased data will enable financial actors to target high-risk households, with higher costs for services, or with reduced service availability. The aforementioned challenges associated with access to granular data are exasperated by the fact that climate risks are often inversely related to income levels, as referenced in the literature review (CICC, 2021). As such, access to granular data threatens exasperating socioeconomic inequities, such as leaving households with less financial means to recover from extreme weather events without affordable insurance coverage. Further, granular data access may reveal other information to financial actors, such as income or demographics, that financial institutions may utilize to inequitably target homeowners deemed higher risk. As data granularity improves, it is important that data is made accessible and transparent, and that institutional data use is transparent and intentionally equitable. Methods to embed transparency and equity in financial institutional data practices should be considered by regulators. Efforts should be made to utilize data to address, not enhance, inequities (Pottinger, 2019).

On the theme of insurance accessibility, interviews revealed that homeowner insurance is decreasing in availability as climate risks increase, due primarily to increasing insurance rates; while less significant thus far, decreased insurance offerings are also contributing to decreasing coverage among homeowners. The finding of decreasing insurance accessibility is consistent with literature findings, which found insurer liability management strategies to include increasing pricing, reducing coverage, or withdrawing from at risk regions (Bakos et al., 2022; Coppola, 2015; CMHC, 2022). Decreasing availability is a particular risk is particularly pronounced for optional flood insurance. Current measures aimed at addressing gaps in flood

insurance availability are emerging. For example, under the NAS, the federal government is investing up to $31.7 million over three years to develop a flood-insurance program for uninsurable homes; if implemented, this national flood insurance program will address the expanding gap in insurance accessibility (ECCC, 2023a). Additional measures to explore include insurance rate caps; while controversial, as insurers may elect to leave if they cannot charge premiums to a level commensurate with their perceived risk, there has not been research conducted on insurance caps in the Canadian context and could be worth exploring as a policy option.

Additional insurance discussions focused on incompatibilities between the insurance sector and the residential construction sector during wildfire season. Insurers will not bind new insurance while there are active wildfires within a certain distance. As insurance is required for construction to commence, wildfires cause delays for the residential construction industry. The problem arises as builders report inconsistencies with the radius around a wildfire in which insurance won't be bound. The lack of consistency poses planning and uncertainty challenges. Additionally, construction representatives report expanding back-out radiuses, and lack of consideration of geographical factors impacting the ability of a fire to spread. The seeming lack of reason behind insurance decisions is causing insurer frustration, and stifling work. Further, the data utilized to inform insurance binding decisions is often found to be out of date or inaccurate. To address this problem, insurers are advised to explore an industry standard practice, informed by building and wildfire science. Additionally, investment in wildfire data and forecasting will contribute to this solution, as this information will allow for more informed, accurate insurer decisions. Wildfire data measures are included in the NAS, in the form of up to $284 million over five years for community prevention and mitigation, support innovation, knowledge and research (ECCCb; 2023). Further training for insurers to have a more nuanced approach to risk assessment, would aid in allowing case-by-case decisions that enable construction to continue in low-risk situations, within the black-out radius, such as within the city centre away from the wildland-urban interface, for example.

6.5 Risk adaptation and mitigation

Participant interviews revealed that adaptation measures are well researched and understood at the academic level; participants, however, shared a sentiment that adaptation measures are not yet being sufficiently implemented or incentivized to mitigate the most significant impacts of climate change for housing finance stakeholders. Interviews identified adaptation barriers including knowledge, costs, knowledge, and time, salience, and insurance. To improve knowledge and awareness, a coordinated effort is needed to educate homeowners, between stakeholders, including insurers and lenders and public actors, all of whom benefit from resilient properties. Efforts in the NAS and the MECCS aim to improve knowledge of adaptation and resilience measures; coordinating these efforts across stakeholders is recommended.

These educational policy recommendations should be paired with financial or regulatory policies for maximum efficacy. Financial incentives, for example, play an important role in encouraging adaptation, based on participant comments. Within the NAS and the MECCS CPAS, financial adaptation measures are targeted primarily at local governments, rather than individual households (ECCC, 2023a; MECCS, 2022). It is recommended that subsidies targeted at homeowners are made available to incentivize and enable the implementation of the more cost-intensive measures, such as sump pumps; homeowner subsidy information should also be targeted, particularly at low-income households, to encourage an efficient and equitable use of

funds. Requiring renovations and new builds to include adaptive measures, particularly in high-risk zones, as conditions of building and renovation permits, are regulations worth exploring, particularly at the local-government level. At a national level, the NAS does include measures for updating the National Building Code to include adaptation standards by 2025; once implemented, this measure should result in an increasingly climate-resilient, adapted housing fleet.

The NAS's propose Building Code update also plays a role in encouraging builder adaptation education; the inclusion of adaptation in the Building Code will incentivize builders to engage in education to update their skills in line with adaptation building requirements. Additionally, building code measure will encourage the BC Government to include adaptation in the BC Building Code, improving the resilience of new homes throughout the province and requiring builders to update their skillset. Interviews revealed that including adaptive measures within building codes is necessary for widespread adaptation, and builder uptake in particular, as builders, according to interview participants, are not incentivized to engage in further education without regularity requirements.

Additionally, builders have a role in the communication of adaptation measures to homeowners and homebuilders. A challenge arises in the knowledge and awareness of builders on adaptive and resilient building; currently they are largely ill-equipped to inform others. Builder technical training does not require this knowledge, and currently there is sufficient demand for building just to-code. Based on the interviews, few builders are expected to seek out adaptation training on their own, or complete unrequired courses. Current builder training requirements do not include adaptation or resilience measures. Improvements to builder training requirements are needed to ensure the construction workforce is educated and prepared to carry out the necessary adaptations and retrofits to build resilience into the housing stock.

Finally, within the context of adaptation, several participants discussed physical risk mitigation strategies; namely, discussion focused on zoning-based bylaws as the recommended local-government climate risk bylaw strategy. Many existing municipal risk mitigation strategies rely on development or building permits, rather than focus on zoning, are seen as ineffective at reducing risk; instead they reduce local government liability. It is advised that local governments utilize zoning bylaws to encourage densification and construction away from the wildland-urban interface to reduce wildfire risk. With the help of flood mapping and data, it is also advised that permits are not granted within flood zones, to mitigate future flood damages to homes within the community. This is of particular importance in the context of BC's housing crisis. As the housing supply is expanded, to address BC's housing shortage, it is advised that zoning bylaws facilitate densification and building within city or community centres, and away from at risk zones, including flood zones and wildland-urban interfaces. The literature we reviewed, and the scope of this study, focused on individual homeowners, rather than local governments. As such, physical risk mitigation was not a focus of our discussions. Participant comments, however, revealed the need for further investigation into local government zoning and permitting strategies for adopting to climate risks; while this study provides preliminary recommendations, it is advisable that further research is conducted, focusing on local government mitigation and response to physical climate risks.

6.6 Limitations and future work

The semi-structured interview method was advantageous for the purpose of this study, but it has limitations. The constrained number of stakeholder participants as well as the lack of

causal analysis may reduce the applicability and replicability of findings about each stakeholder group. Additionally, as a limited number of participants comprised each stakeholder group, saturation, when no additional insights are arising from additional interviews, was not reached in the responses from each stakeholder group, suggesting that further insights could be gained from additional participants (Knott et al., 2022). Future research could address this limitation by focusing on one stakeholder group and employing quantitative and multiple-choice response options. The investigative nature of this study necessitated a wide range of findings, covering multiple themes. This limits our ability to delve into each theme and finding and develop prescriptive recommendations or solutions. Future research should be scoped to focus on a risk theme, such as data or adaptation, to develop more granular findings.

The broad scope of this study also limits the specificity of findings and recommendations for BC's diverse regions. As this study focused on the entire province, the findings were generalized; in reality, climate impacts and adaptive capacity vary significantly across regions. Additionally, this study did not consider geographical differences and regional context informing participant positions, when analyzing interviews. Considering geographic and regional perspectives and differences in the analysis could provide richer insights into risks and corresponding recommendations. Further research is advised to adopt a geographic scope to develop targeted recommendations based on regional risks, capacity, and needs. Additionally, while this study does adopt an equity lens when considering policy recommendations, the included discussion of equity and climate risks is only preliminary, and merits further consideration in future work. A geographic lens that examines diversity in risk exposure and needs within a specific region would enable a richer examination of equity concerns, and the development of richer, more equitable recommendations.

This study did not consider risk mitigation as a stand-alone theme, despite the importance of mitigation for reducing risk damages and costs. While physical risk mitigation was included briefly in the findings and discussion due to participant comments made in response to adaptation questions, the subject of mitigation merits further discussion than what is included in this study. The omission of mitigation as a theme was in part due to the focus of this study on homeowners and actions, rather than local governments, as zoning bylaws. However, local government zoning bylaws are too important a tool for reducing physical damage costs from extreme weather events to be excluded from the discussion (Burgess et al., 2023). The vital role of risk mitigation merits exploration beyond brief mentions in this study; future research should focus specifically on local government's role in climate risk mitigation. It is particularly important that risk mitigation is considered in the development of policy measures aimed addressing the housing supply shortage in BC, to ensure that new housing stock is built away from high-risk zones.

Other possible limitations with this research are related to potential interview biases, both from interviewers and participants. Social desirability bias may have appeared through participant over-inflation of current or planned actions addressing climate change risks. Further, participants in these interviews were speaking on behalf of their institutions of employment. In some cases, participants may have answered questions from their personal perspective or desires, rather than the position of their institution; this bias may have been particularly apparent for institutions with a weak position, or without a position on an issue. In some cases, participants acknowledged this reality, including a stipulation such as “I can’t speak for my institution, BUT from my perspective…” prior to answering; these responses were flagged and cleaned from the data to reduce bias. Strategic bias may have influenced participant responses. Participants were

made aware that this study aimed to inform housing finance policy; as such, participants may have answered questions from a strategic position of advancing their organizations policy objectives. Finally, bias may have arisen through the framing or ordering of questions. The topic guides were designed with open ended, non-leading questions to avoid biases; as the interviews were semi-structured, unplanned follow-up questions were added, which could have been influenced by our researcher biases.

First Nations were also a stakeholder group that we excluded from the scope of this study, thus limiting the scope of applicability of this work. Reserves are often located in more rural settings, have less access to sources, and face financial constraints. Initially, climate change risks to on-reserve housing financing was considered within the scope of this work, but the scope was narrowed later. The decision to narrow the scope was made following preliminary research and an exploratory interview with a First Nations' participant regarding financial of on-reserve housing that revealed significant discrepancies with on-reserve housing financing and non-reserve housing. The unique factors posing financial risk to reserves, and the First Nation perspective on climate and relationship with finances render this a separate research project. The constraints of resources and timelines for this project limited the ability to satisfactorily study the impacts on reserve housing.

6.4 Strengths and contributions

Despite limitations, this study helps fill in knowledge gaps in housing finance literature, specific to BC, and explores market failures in the context of climate risk in BC's housing finance ecosystem. This study provides an overview of the housing finance system and stakeholders, specific to BC; by including perspectives from across BC, with more than half of BC-based participants located outside of metro-Vancouver, this study considers risks facing stakeholders in BC's different regions. Additionally, this study contributes novel knowledge on how climate risks are impacting BC's housing finance stakeholders; the problems climate risk is posing to stakeholders and the broader housing finance system; and the measures stakeholders are undertaking or would like to see advanced to address risks.

Notably, this study contributes to the understanding of market failures by observing their presence in BC's housing finance ecosystem and supports the literary understanding of asymmetric information and adverse selection market failures in the housing finance context. Of note, this study found informational market failures, in particular information asymmetries to be contributing to the impact of climate risks within BC's housing finance ecosystem; adverse selection was also observed by study participants. Examples of market failures reported in BC's housing finance ecosystem include:

- Risk of adverse selection by financial institutions, namely smaller Credit Unions with limited portfolio diversity without the capacity to invest in climate data, continuing to engage in business with high-risk clients facing covariant risks
- Risk of informational asymmetry between lenders and insurers where lenders face unknown liability risks from uninsured properties, contributed to by differing renewal timelines and changing property insurability
- Risk of moral hazard due to a lack of motivation from insured homeowners to invest in risk adaptation measures

By establishing an understanding of how climate risks are impacting BC's housing finance stakeholders, and housing finance ecosystem as a whole, this study provides a foundation for future work of a narrowed scope. Studies specific to stakeholder group, region, or climate

risk would provide more specific insights and allow for more targeted recommendations. Future researchers are encouraged to utilize this study as a starting point for advancing climate risk research - and action - in BC.

References

Bakos, K., & Feltmate, B. (2023). *Transitioning from Rhetoric to Action: Integrating Physical Climate Change and Extreme Weather Risk Into Institutional Investing*. Intact Centre on Climate Adaptation, University of Waterloo. https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2023/07/UoW_ICCA_2023_07_Integrating_Physical_Climate_Change_Risk_Into_Investing.pdf

Bakos, K., Feltmate, B., Chopik, C., & Evans, C. (2022). *Treading Water: Impact of Flooding on Canada's Residential Housing Market*. Intact Centre on Climate Adaptation, University of Waterloo. https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2022/04/UoW_ICCA_2022_02-Treading-Water_Flooding-and-Housing-Market.pdf

Beltrán, Allan., Elliott, Robert., & Maddison, David. (2019, May). The impact of flooding on property prices: A repeat-sales approach. *Journal of Environmental Economics and Management, 95*, 62-86. https://doi.org/10.1016/j.jeem.2019.02.006

Bengtsson, Magnus., Hotta, Yasuhiko., Hayashi, Shiko., & Akenji, Lewis. (2010, January 1). The four main types of policy instruments. *Policy Tools for Sustainable Materials Management: Applications in Asia,* 7-15. Institute for Global Environmental Strategies. http://www.jstor.com/stable/resrep00758.4

BC Financial Services Authority. (2023, July). *Natural Catastrophes and Climate-Related Risks: 2023 Discussion Paper*. https://www.bcfsa.ca/media/3400/download

BC Housing. (2024). *Governance.* https://www.bchousing.org/about/governance

Local Government Act, RCSB 2015, c1, s1(1)

Berg, Bruce L., & Lune, Howard. (2017). *Qualitative Research Methods for the Social Sciences*. (9th ed.). Pearson Education Limited

BMO Financial Group. (2023). *2023 Climate Report.* https://our-impact.bmo.com/wp-content/uploads/2024/03/BMO_2023_CR_EN.pdf

Bowen, A., Dietz, S., & Hicks, N. (2014, March 21). *Why do economists describe climate change as a market failure?* The London School of Economics and Political Science. https://www.lse.ac.uk/granthaminstitute/explainers/why-do-economists-describe-climate-change-as-a-market-failure/

Brunetti, Ceslo., Dennis, Benjmin., Gates, Dylan., Hancock., Ignell, David., Kiser, Elizabeth K., Kotta, Gurubala., Kovner, Ann., Rosen, Richard J., & Tabor, Nichols K. (2021, March 19). *Climate Change and Financial Stability*. Board of Governors of the Federal Reserve System. https://doi.org/10.17016/2380-7172.2893.

Burgess, Katherine., Rodriguez, Michael., Howard, Jordan., Klukas, Jared., & Wright, Megan. (2023, June). *The Case for Climate-Informed Zoning: A Study of Fiscal Impact in Norfolk, VA.* Lincoln Institute of Land Policy. https://go.lincolninst.edu/Burgess_WP23KB1.pdf?_ga=2.129747086.386307756.1689602775-799266633.1689265581

Canada Water Network & Insurance Bureau of Canada. (n.d.). *Improving Flood Risk Evaluation through Cross-Sector Sharing of Richer Data*. https://a-us.storyblok.com/f/1003207/x/3211cbe8d0/ibc-cdn-water-network-improving-flood-risk-evaluation-en.pdf

Canada's Credit Unions. (2023). *Why More Canadians Are Choosing to Borrow From Canada's Credit Union's to Reach Their Home Ownership Goals*. https://canadascreditunions.ca/why-more-canadians-are-choosing-to-borrow-from-canadas-credit-unions-to-reach-their-home-ownership-goals/

Canadian Credit Union Association. (2024). *Facts and Figures*. https://ccua.com/about-ccua/reports-and-publications/facts-and-figures/

Canadian Institute for Climate Choices. (2021, September). *Under Water: The Cost of Climate Change for Canada's Infrastructure*. https://climateinstitute.ca/reports/under-water/

Canada Mortgage and Housing Corporation. (2018, June 3). *What is CMHC Mortgage Loan Insurance?* https://www.cmhc-schl.gc.ca/consumers/home-buying/mortgage-loan-insurance-for-consumers/what-is-mortgage-loan-insurance

Canada Mortgage and Housing Corporation. (2022, February*). Impact of climate on models related to housing and housing finance*. https://assets.cmhc-schl.gc.ca/sf/project/archive/research_6/20221003001_impact_of_climate_on_models_related_to_housing_and_housing_finance_oct_14.pdf

Canada Mortgage and Housing Corporation. (2023). *Residential Mortgage Industry Report*. https://assets.cmhc-schl.gc.ca/sites/cmhc/professional/housing-markets-data-and-research/housing-research/research-reports/housing-finance/residential-mortgage-industry-report/2023/residential-mortgage-industry-report-fall-2023-en.pdf?rev=36d6acff-dc70-4334-9805-7ff68279eb77&_gl=1*1o3u4y9*_ga*MjEzNzQ1NDc3Ny4xNzA1NDQ4MDcy*_ga_CY7T7RT5C4*MTcwNTQ0ODA3Mi4xLjEuMTcwNTQ0ODE1Ny41My4wLjA.*_gcl_au*MTAyMDYyOTIwMy4xNzA1NDQ4MDcx

Canada Mortgage and Housing Corporation. (2024). *Mortgage loan insurance and premiums.* https://www.cmhc-schl.gc.ca/professionals/industry-innovation-and-leadership/industry-expertise/resources-for-mortgage-professionals/mortgage-loan-insurance-and-premiums

Cao, Melanie., & Wei, Jason. (2004). Weather Derivatives Valuation and Market Price of Weather Risk. *The Journal of Futures Markets, 24*(11), 1065-1089. DOI: 10.1002/fut.20122

Carey, C., & Lloyd, M. (2023, October 4). *2023 BC wildfires most costly insured event ever recorded: insurance bureau.* City News. Retrieved November 24, 2023. https://vancouver.citynews.ca/2023/10/04/bc-wildfires-insured-cost-record/

Carman, Tara. (2017, June 11). *Climate change in BC: Here's how 2050 could look.* CBC News. Retrieved December 11, 2023, from https://www.cbc.ca/news/canada/british-columbia/climate-change-in-b-c-here-s-how-2050-could-look-1.4146580

CBC News. (2023, September 27). *2023 is now officially the most expensive, most destructive wildfire season on record in BC.* CBC News. Retrieved November 15, 2023, from https://www.cbc.ca/news/canada/british-columbia/wildfire-danger-reducing-1.6980041

Chopik, Chris. (2019, April). *Property Value in an Era of Climate Change*. OCAD University. https://openresearch.ocadu.ca/id/eprint/2540/9/Chopik_Chris_2019_MDES_SFI.pdf

City of Vancouver. (2024). *Vancouver Building By-law (CBO).* vancouver.ca/your-government/vancouver-building-bylaw.aspx

Clayton, Jim,, Devaney, Steven., Sayce, Sarah., & Van de Wetering, Jorn. (2021, July 4). Climate risk and real estate prices: what do we know? *Journal of Portfolio Management, 47(10).* doi: https://dx.doi.org/10.3905/jpm.2021.1.278

Climate Check. (2024). *Our Methodologies*. https://climatecheck.com/our-methodologies

Dreessen, Toon. (2023, February 27). *Canada's building codes and standards need to get with the times.* The Globe and Mail. Retrieved February 24th, 2024, from https://www.theglobeandmail.com/opinion/article-canadas-building-codes-and-standards-need-to-get-with-the-times/

DuChene, Courtney. (2023, February 28*). Insuring the Climate Transition: How Can the Construction Industry Confront Escalating Storm Damage?* Risk & Insurance. Retrieved January 12th, 2023, from https://riskandinsurance.com/insuring-the-climate-transition-how-can-the-construction-industry-confront-escalating-storm-damage/

D'Souza, Steven., McDonald, Jeremy., Cowley, Jenny. (2021, November 26). *Up to 10% of homes could now be 'uninsurable' because of flood risk. Yours may be one of them*. CBC News. Retrieved February 3, 2024, from https://www.cbc.ca/news/canada/marketplace-home-insurance-1.6262386

Eby, David. (2022, December 7). *Mandate Letter Minister of Environment and Climate Change Strategy*. Government of British Columbia.

https://www2.gov.bc.ca/assets/gov/government/ministries-organizations/premier-cabinet-mlas/minister-letter/env_-_heyman.pdf

Eceiza, Joseba., Harreis, Holger., Härtl, Holger., & Viscardi, Simonela. (2020, June 1). *Banking imperatives for managing climate risk.* McKinsey & Company. https://www.mckinsey.com/capabilities/risk-and-resilience/our-insights/banking-imperatives-for-managing-climate-risk

Environment and Climate Change Canada. (2023a). *Canada's National Adaptation Strategy*. https://publications.gc.ca/collections/collection_2023/eccc/en4/En4-544-2023-eng.pdf

Environment and Climate Change Canada. (2023b). *Government of Canada Adaptation Action Plan*. https://publications.gc.ca/collections/collection_2023/eccc/En4-529-2023-eng.pdf

Evans, Cheryl. (2023). Integrating climate risks into property appraisals helps protect Canada's real estate market. *Canadian Property Valuation Magazine, 67*(2), 22-24. https://www.aicanada.ca/wp-content/uploads/CPV2-23-Integrating_Climate_Risks-English.pdf

Financial Consumer Agency of Canada. (2023, June). *FCAC Report: The financial well-being of Canadian homeowners with mortgages.* https://www.canada.ca/content/dam/fcac-acfc/documents/programs/research-surveys-studies-reports/financial-well-being-mortgages.pdf

FireSmart BC. (2021). *FireSmart BC Begins At Home Guide.* https://begins-at-home-guide.firesmartbc.ca/#firesGrow

Government of BC. (2020). *Census Boundaries*. www2.gov.bc.ca/gov/content/data/geographic-data-services/land-use/administrative-boundaries/census

Government of BC. (2024, March 8). *BC Codes 2024.* https://www2.gov.bc.ca/gov/content/industry/construction-industry/building-codes-standards/bc-codes/2024-bc-codes

Grayson, Shira., Doerr, Megan., & Yu, Joon-Ho. (2020, July 8). Developing pathways for community-led research with big data: a content analysis of stakeholder interviews. *Health Research Policy and Systems*, 18(76), https://doi.org/10.1186/s12961-020-00589-7

Grippa, P., Schmittmann, J. M., & Suntheim, F. (2019, December). *Climate Change and Financial Risk: Central banks and financial regulators are starting to factor in climate change*. International Monetary Fund. https://www.imf.org/en/Publications/fandd/issues/2019/12/climate-change-central-banks-and-financial-risk-grippa

Havard, Cassandra Jones. (2023, March 21). *What does 'moral hazard' mean?* University of South Carolina. https://sc.edu/uofsc/posts/2023/03/conversation_moral_hazard.php

Hudson, Paul., Botzen, W. J. Wouter., Feyen, Luc., & Aerts, Jeroen, C. J. H. (2016, March 4). Incentivising flood risk adaptation through risk based insurance premiums: Trade-offs between affordability and risk reduction. *Ecological Economics, 125*, 1-13. http://dx.doi.org/10.1016/j.ecolecon.2016.01.015

Insurance Council BC. (2024). *Other Regulatory Bodies*. https://www.insurancecouncilofbc.com/consumer-information/other-regulatory-bodies/

Insurance Bureau of Canada. (2015, December). *A Primer of Financial Risk from Natural Disasters: The Case for Public-Private Collaboration*. https://a-us.storyblok.com/f/1003207/x/c5bf218d9a/2015_pubic-private-collaboration.pdf

Insurance Bureau of Canada. (2024). *Types of Home Coverage*. https://www.ibc.ca/insurance-basics/home/types-of-home-insurance-coverage

Insurance Bureau of Canada., Canada Mortgage and Housing Corporation., & Government of Canada. (2022, October). *Designing the Path to Climate Compatibility: Climate Risk Disclosure and Action in the Canadian Housing Context*. Insurance Bureau of Canada. https://a-us.storyblok.com/f/1003207/x/886181a298/designing-the-path-to-climate-compatibility.pdf

Insurance Bureau of Canada., & Federation of Canadian Municipalities. (2020, February). *Investing in Canada's Future: The Cost of Climate Adaptation at the Local Level*. https://data.fcm.ca/documents/reports/investing-in-canadas-future-the-cost-of-climate-adaptation.pdf

Intergovernmental Affairs. (2021, October 5). *The constitutional distribution of legislative powers*. https://www.canada.ca/en/intergovernmental-affairs/services/federation/distribution-legislative-powers.html

Johnston, Craig., Vallée, Geneviève., Hosseini, Hossein., Lindsay, Brett., Molico, Miguel., Tremblay, Marie-Christine., & Witts, Aidan. (2023, December 1). *Climate-Related Flood Risk to Residential Lending Portfolios in Canada*. Bank of Canada. https://www.bankofcanada.ca/wp-content/uploads/2023/12/sdp2023-33.pdf

Jones, Alexandra. (2023, September 12). *How wildfire smoke can damage property, pose risk for real estate investors.* Climate Check. https://climatecheck.com/blog/how-wildfire-smoke-can-damage-property-pose-risk-for-real-estate-investors

Kelly, Mary., Kleffner, Anne., Halek, Martin., & Nickerson, David. (2017, December). *The Role of Insurance in Reducing the Frequency and Severity of Fire Losses.* University of the Fraser Valley. https://cjr.ufv.ca/wp-content/uploads/2018/04/WLU-The-Role-of-Insurance-in-Reducing-the-Frequency-and-Severity-of-Fire-Losses.pdf

Kenton, Will. (2023, February 19, 2024). *Understanding Value at Risk (VaR) and How It's Computed.* Investopedia. Retrieved March 16, 2024, from https://www.investopedia.com/terms/v/var.asp

Kirabaeva, Koralai. (2011). *Adverse Selection and Financial Crises.* Bank of Canada. https://www.bankofcanada.ca/wp-content/uploads/2011/02/kirabaeva.pdf

Knott, Eleanor., Rao, Aliya Hamid., Summers, Kate., & Teeger, Chana. (2022, September 15). Interviews in the social sciences. *Nature Review Methods Primers, 2*(73), https://doi.org/10.1038/s43586-022-00150-6

Kovacs, Paul. (2018, May). *Development permits: An emerging policy instrument for local governments to manage interface risk in a changing climate*. Institute for Catastrophic Loss Reduction. http://www.iclr.org/wp-content/uploads/2018/05/Development-Permits_2018.pdf

Labbé, Stefan. (2023, March 31). *Canadian property listings now warn buyers of wildfire, flood and extreme heat*. Squamish Chief. Retrieved June 27, 2023. https://www.squamishchief.com/highlights/canadian-property-listings-now-warn-buyers-of-wildfire-flood-and-extreme-heat-6786344

Li, L.& Chau., K.W. (2023, January 24). Information Asymmetry with Heterogeneous Buyers and Sellers in the Housing Market. *The Journal of Real Estate Finance and Economics, 68,* 138-159. http://doi.org/10.1007/s11146-023-09939-y

Maietta, Raymond., Mihas, Paul., Swartout, Kevin., Petruzzelli, Jeff., & Hamilton, Alison. B. (2021, June 22). Sort and Sift, Think and Shift: Let the Data Be Your Guide An Applied Approach to Working With, Learning From, and Privileging Qualitative Data. *The Qualitative Report, 26*(6), 2045-2060. https://doi.org/10.46743/2160-3715/2021.5013

Mainardes, Emerson Wagner., Alves, Helena., & Raposo, Mário. (2010, December 1). An Exploratory Research on Stakeholders of a University. *Journal of Management and Strategy, 1*(1), 76-88. doi:10.5430/jms.v1n1p76

Miller, Norm G., Gabe, Jeremy., & Sklarz, Michael. (2019). The Impact of Waterfront Location on Residential Home Values Considering Flood Risks. *The Journal of Sustainable Real Estate, 11*(1), 84-107. https://doi.org/10.22300/1949-8276.11.1.84

Ministry of Environment and Climate Change Strategy. (2019). *Preliminary Strategic Climate Risk Assessment for British Columbia*. https://www2.gov.bc.ca/gov/content/environment/climate change/adaptation/riskassessment

Ministry of Environment and Climate Change Strategy. (2022). *Climate Preparedness and Adaptation Strategy: Actions for 2022-2025*. https://www2.gov.bc.ca/assets/gov/environment/climate-change/adaptation/cpas.pdf

Ministry of Housing. (2023). *Policy and planning tools for housing*. https://www2.gov.bc.ca/gov/content/housing-tenancy/local-governments-and-housing/policy-and-planning-tools-for-housing

Ministry of Housing. (2024a). *Building Act*. https://www2.gov.bc.ca/gov/content/industry/construction-industry/building-codes-standards/building-act

Ministry of Housing. (2024b). *Ministry of Housing*. https://www2.gov.bc.ca/gov/content/governments/organizational-structure/ministries-organizations/ministries/housing

Ministry of Housing (2024c). *Local governments and housing.* https://www2.gov.bc.ca/gov/content/housing-tenancy/local-governments-and-housing

Mitham, Peter. (2022, June 20). *Cost of catastrophic flooding rises.* Business in Vancouver. Retrieved November 16, 2023. https://biv.com/article/2022/06/cost-catastrophic-flooding-rises

Morris, Chris., & Botros, Alena. (2023, October 31). *4 more insurers are leaving California after Allstate and State Farm flee wildfire risk. yahoo! finance*. Retrieved January 24th, 2024, from https://finance.yahoo.com/news/4-more-insurers-leaving-california-161957340.html?guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAH40IoXAZZT7loXQfz2tC4MLsGxyOGkZZNYxbSeqxMkeDoJ5wX5e7ocaCWO3hJoA0ymE9B0QzKL0c-O2yLozbdkJAI-vYUDsmYTrUvAa7IbD3kJ4P8f77jC8-PSosqz2YWe9JB70pKROBTA6lLAq5-F5HJTissTmWmk5aBeucFsU&guccounter=2#:~:text=Fortune-,4%20more%20insurers%20are%20leaving%20California%20after,State%20Farm%20flee%20wildfire%20risk&text=It's%20getting%20harder%20to%20find,in%20California%20starting%20next%20year.

Moudrak, Natalia., & Feltmate, Blair (2020, November). *Under One Umbrella: Practical Approaches for Reducing Flood Risk in Canada*. Intact Centre on Climate Adaptation University of Waterloo. https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2022/10/UoW-ICCA-Under-One-Umbrella-Report.pdf

National Association of Insurance Commissioners. (2024, January 31). *Reinsurance*. Retrieved February 20, 2024, from https://content.naic.org/cipr-topics/reinsurance

Netsurance. (2021). *Course of Construction Insurance*. Retrieved January 30, 2024, from https://www.netsurance.ca/insurance/course-of-construction-insurance/

Network for Greening the Financial System. (2022, September). *Physical Climate Risk Assessment: Practical Lessons for the Development of Climate Scenarios with Extreme Weather Events from Emerging Markets and Developing Economies*.

https://www.ngfs.net/sites/default/files/media/2022/09/02/ngfs_physical_climate_risk_assessment.pdf

Network for Greening the Financial System. (2020, May). *Guide for Supervisors Integrating climate-related and environmental risks into prudential supervision*. https://www.ngfs.net/sites/default/files/medias/documents/ngfs_guide_for_supervisors.pdf

O'Brien, Frank. (2021, August 17*). Fire insurance hard to find for B.C. wildfire zone homebuyers.* Business In Vancouver. Retrieved January 16th, 2024, from https://www.biv.com/news/real-estate/fire-insurance-hard-find-bc-wildfire-zone-homebuyers-8265163

Office of Housing and Construction Standards. (2015, June). *Understanding BC's Building Regulatory System*. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/guides/buildingactguide_sectiona1_june2015_web.pdf

Office of the Superintendent of Financial Institutions. (2023, March). *Guideline - Climate Risk Management B-15*. https://www.osfi-bsif.gc.ca/Eng/Docs/b15-dft.pdf

Office of the Superintendent of Financial Institutions. (2024). *Financial institutions*. https://www.osfi-bsif.gc.ca/en/supervision/financial-institutions

O'Hara, Clare., & Lundy, Matt. (2021, September 20). *B.C. property insurers tighten rules for homeowners, builders in forest fire regions.* The Globe and Mail. Retrieved November 18, 2023, from https://www.theglobeandmail.com/business/article-bc-property-insurers-tighten-rules-in-forest-fire-regions/

Organisation for Economic Co-operation and Development. (2023a, May 17). *Taming Wildfires in the Context of Climate Change*. https://doi.org/10.1787/dd00c367-en

Organisation for Economic Co-operation and Development. (2023b, October). *OECD Work on Climate Adaptation*. http://www.oecd.org/climate-change/theme/resilience/brochure-OECD-work-on-climate-adaptation.pdf

Owen, Brenna. (2023, September 13). *B.C. aware of dike problems before destructive flooding in 2021, documents show.* Vancouver Sun. Retrieved January 4, 2024. https://vancouversun.com/news/local-news/b-c-aware-of-dike-problems-before-destructive-flooding-in-2021-documents-show

Pating, Alfonso. (2023, June 21). *Credit Unions Need to Manage Climate Risks*. Natural Resource Defence Council. https://www.nrdc.org/bio/alfonso-pating/credit-unions-need-manage-climate-risks

Peters, Jessica. (2023, March 2). *Devastation from flooding on Abbotsford's Sumas Prairies still evident on roadways*. The Abbotsford News. Retrieved November 18, 2023, from

https://www.abbynews.com/news/devastation-from-flooding-on-abbotsfords-sumas-prairie-still-evident-on-roadways-1833929

Phang, Sock-Yong. (2013). *Housing Finance Systems*. Palgrave Macmillan, London. https://doi.org/10.1057/9781137014030_3

Pottinger, Lori. (2019, November 13). *Addressing Inequality in Flood Risk*. Public Policy Institute of California. Retrieved February 17, 2024, from https://www.ppic.org/blog/addressing-inequality-in-flood-risk/

Prabhakar, Sivapuram V.R.K., Abu-Bakar, Arpah., Becker, Sobiah., Pereira, Joy J., & Solomon, Divya S. (2015). Chapter 2 – Insurance for Disaster Risk Reduction and Climate Change Adaptation – An Overview. In Prabhakar, Sivapuram V.R.K., Pereira, Joy J., Pulhin, Juan M., Rao, Gattineni Srivasa., Scheyvens, Henry., & Cummins, Jay. *Effectiveness of Insurance for Disaster Risk Reduction and Climate Change Adaptation: Challenges and Opportunities. Institute for Global Environmental Strategies,* 4-19. Institute for Global Environmental Strategies. http://www.jstor.com/stable/resrep00848.11

Public Safety Canada. (August, 2022). *Adapting to Rising Flood Risk - An Analysis of Insurance Solutions for Canada.* https://www.publicsafety.gc.ca/cnt/rsrcs/pblctns/dptng-rsng-fld-rsk-2022/dptng-rsng-fld-rsk-2022-en.pdf

Raycroft, Richard. (2023, August 3). *Trudeau says feds aren't primarily responsible for housing, but how responsible are they?* CBC News. Retrieved December 28, 2023. https://www.cbc.ca/news/politics/trudeau-housing-responsible-feds-provinces-1.6924290

Sherren, Kate. (2024 ,March 7). *Flood risk mapping is a public good, so why the public resistance in Canada? Lessons from Nova Scotia.* The Conversation. Retrieved April 5, 2024, from https://theconversation.com/flood-risk-mapping-is-a-public-good-so-why-the-public-resistance-in-canada-lessons-from-nova-scotia-224902

Starominski-Uehara, Marvin., & Keskitalo, E. Carina H. (2016). How Does Natural Hazard Insurance Literature Discuss the Risks of Climate Change? *Journal of Insurance Regulation, 35*(6), https://content.naic.org/sites/default/files/inline-files/JIR-ZA-35-06-EL.pdf

Sue, Valerie. M., & Ritter, Lois. A. (2012). *Conducting Online Surveys.* (2nd ed). SAGE Publications, Inc. https://doi.org/10.4135/9781506335186

Thistlewaite, Jason., Henstra, Daniel., Brown, Craig., Scott, Daniel. (2020, May 4). Barriers to Insurance as a Flood Risk Management Tool: Evidence from a Survey of Property Owners. *International Journal of Disaster Risk Science, 11*, 263-273. https://doi.org/10.1007/s13753-020-00272-z

United States Environmental Protection Agency. (2024, March 8). *Climate Risks and Opportunities Defined*. https://www.epa.gov/climateleadership/climate-risks-and-opportunities-defined

Vancity. (2022). *2022 Annual Report*. https://annualreport.vancity.com/_doc/Vancity-2022-annual-report.pdf

Warren, Émilie. (2021, August 30). *Buyers and builders frustrated after being refused insurance for homes near wildfires.* CBC. Retrieved January 23th, 2024, from https://www.cbc.ca/news/canada/british-columbia/builders-and-home-buyers-frustrated-with-insurance-companies-1.6153681

WOWA. (2022, June 21). *Construction Loans in Canada 2024.* Retrieved February 20, 2024, from https://wowa.ca/construction-loans

Appendix

Appendix A. Definitions

Acute physical risks occur as an event marked by a significant increase in hazard over a relatively short period of time (United States Environmental Protection Agency [USEPA], 2024). In the context of climate change, acute risks include extreme weather events such as floods or fire; these events pose immediate threats, often affecting many persons or communities within an affected region, concurrently.

Adverse selection occurs when one party in a negotiation has relevant information the other party lacks. The asymmetry of information often leads to making bad decisions, such as doing more business with less profitable or riskier market segments (Kirabaeva, 2011).

Catastrophe bonds: high-yield debt instruments, also known at CAT bonds, designed to raise money for companies in the insurance industry in the event of a natural disaster, allowing the issuer to receive funding from the bond only if specific conditions, such as an earthquake or tornado, occur. In short, CAT bonds transfer climate risk to investors who are willing to bear it (Starominski-Uehara, & E. Carina H. Keskitalo., 2016).

Covariant risks: risks impacting many parties concurrently, such as a hurricane or forest fire impacting many homes in a geographic region, and resulting in many homeowners place claims at the same time, thus requiring concurrent payouts from insurers (Starominski-Uehara, & E. Carina H. Keskitalo., 2016).

Cumulative physical risks occur at a slower rate, with the effects accumulating over time, often reaching a tipping point at which the risk drastically increases in severity and requires immediate action, as exemplified by coastal erosion (USEPA, 2024).

Liability risks an element of transition risks affecting parties responsible for realized risks, or, if they have coverage for liability risk, their insurers. Liability risks are realized when affected parties seek compensation (OSFI, 2023).

Market failures are defined as an inefficient allocation of goods or services by the market, meaning welfare is not maximised. In the event of a market failure, governments and regulators may intervene with regulatory or policy actions in an effort to improve efficiency and maximise welfare (Bowen et al., 2014; Phang, 2013). In the context of climate change, *moral hazards* and *adverse selection* provide examples of market failures in the housing finance ecosystem.

Moral hazards occur when one party engages in risky behaviour because another party bears the economic consequences of their behaviour (Havard, 2023). In the context of the housing finance ecosystem, moral hazards are exemplified by insured homeowners failing to implement adaptations for flood or fire as insurance will pay for the repairs following an extreme weather event.

Physical risks are economic costs directly attributable to climate change, resulting from acute, extreme weather events such as wildfires and floods and gradual changes such as rising sea levels and coastal erosion (CMHC, 2022; NGFS, 2022; OSFI, 2023).

Scenario analysis: a method of testing the value (of a financial institution or portfolio) given a change in a variable or circumstance; in the case of climate, scenario analysis tests value under different climate change futures (OSFI, 2023).

Transition risks are economic risks incurred by transitioning to a low-emissions economy, including: the financial cost of mitigating and adapting to the changing climate; the revaluation of assets in light of shifting policy, technology, and societal priorities, such as a pressure to decarbonize; and employment losses resulting from shifting industry and technology (CMHC, 2022; OSFI, 2023).

Value-at-risk: a statistical calculation of financial losses expected by a firm, or a subset of a portfolio, within a specified time period; the result is a measure of the probability of an amount ($) of potential loss over a certain timeframe (Kenton, 2024).

Weather derivatives: financial instruments used to hedge against financial loss related to adverse weather conditions or climate events. Working with a similar structure to insurance, the buyer of a weather derivative pays a premium to the seller of a weather derivative in exchange for the guarantee that the seller will pay the buyer a certain amount if they experience financial loss from a weather even (Staro minski-Uehara, & E. Carina H. Keskitalo., 2016; Cao & Wei, 2004).

Appendix B. Summary of NAS actions impacting housing finance climate risk

Emergency Management Investments:

- up to $284 million over five years for community prevention and mitigation, support innovation, knowledge and research, and creating a Centre of Excellence for Wildland Fire Innovation and Resilience
- up to $164 million over five years for free and accessible high quality, current, granulate flood hazard data and flood maps, and the Flood Hazard Identification Mapping Program
- up to $31.7 million over three years for a flood-insurance program for uninsurable homes
- up to $15.3 million over three years for free and accessible a flood risk exposure portal
- up to $48.1 million over five years to modernize the Disaster Financial Assistance Arrangements program

Infrastructure Investments:

- up to investing $489 million over 10 years in the national Disaster Mitigation and Adaptation Fund, to build resilience in communities
- topping up the Natural Infrastructure Fund to support nature-based resilience solutions
- up to $60 million over five years for updating infrastructure codes and standards for adaptation and resilience
- up to $95 million over five years for community resilience knowledge toolkits

Knowledge Investments:

- financing climate modeling and research, and sharing results through the Canadian Centre for Climate Services
- up to $70 million over five years for a national climate risk assessment to inform future adaptation

Tool and Resource Investments:

- up to $530 million in the Green Municipal Fund for community-based adaptation with the Federation of Canadian Municipalities
- up to $50 million over 5 years for indigenous and northern adaptation programming, including First Nation Adapt, Climate Change Preparedness in the North, and Indigenous Community-based Climate Monitoring

Appendix C. Summary of Pathway initiatives in MECCS - Climate Preparedness and Adaptation Strategy: Actions for 2022-2025

Pathway 1: Partnerships, Knowledge and Decision-Making - housing finance ecosystem initiatives

- investing in BC's River Forecast Centre to improve flood forecasting
- investing in the StormSurgeBC portal to enhance timely emergency warnings
- finding the Pacific Climate Impacts Consortium to help Indigenous Nations and local governments understand and adapt to climate risks
- expanding the ClimateEx project through university partnerships to develop high-resolution climate data projections
- conducting a provincial Strategic Climate Risk Assessment and reporting on the results
- conducting a Provincial Hazard, Risk and Vulnerability Assessment
- partnering with educational stakeholders to develop educational adaptation and risk awareness programs
- developing a CleanBC public awareness campaign
- investing in the Adaptation Learning Network to help develop education and training tools for employees working in adaptation

Pathway 2: Safe and Healthy Communities - housing finance ecosystem initiatives

- expanding the Community Emergency Preparedness Fund to support fund to support community and regional emergency preparedness and disaster mitigation planning
- expanding the Hazard, Risk, and Vulnerability Analysis toolkit to help communities put specific resources, recommendations, and programs in place
- supporting the BC Community Climate Funding Guide to consolidate climate funding opportunities for local governments and Indigenous communities
- supporting the First Nations Emergency Service Society's research and development of climate data and indigenous-lead climate solutions, to be consolidated in a data portal
- investing in the Community Resiliency Investment Program - FireSmart Community Funding and Supports funding stream, to be distributed by the Union of BC Municipalities and First Nations Emergency Services Society to local governments and Indigenous communities for fire resilience measures
- allocating funding for prescribed burns on Crown land, to be co-managed by indigenous partners
- developing a flood strategy through the BC Flood Resilience Plan in partnership with federal, local, and Indigenous governments
- investing in floodplain mapping

Appendix D. Interview guide for real-estate industry representatives - appraisers

General orientation

1. What services does your organization offer?
    a. Who/ what organizations typically avail of your organizations services?

2. Are climate risks a factor that are considered when valuing homes in your organization?
    a. By appraisers in BC, at large?
    b. Is there an industry standard for climate risk consideration?

3. [If yes in 2] What climate risks do appraisers consider when valuing homes?
    a. [Only ask if not already addressed in previous question] Wildfire and overland flood risks?
        i. How has this changed over the last five years, and over the course of your career in the industry?

4. How do climate risk compare to other risks considered by appraisers in home valuations?
    a. Has this changed over time?

Risk adaptation

5. How is your organization adapting or planning for risks from wildfire and floods?
    a. How has your organization's approach changed over the last five years, and over the course of your career in the industry?

6. Are you aware of development measures for protecting properties against climate change hazards? (for example: following FireSmart measures to mitigate fire damage; installing flood vents, sump pumps to mitigate flood damage)?
    a. If yes, do appraisers in your organization consider these measures when valuing homes?
    b. Do you think there is a role for appraisers to encourage / incentivize risk adaptation behavior or measures?

7. Are you aware of the recent TCFD recommendations regarding disclosure of climate risks?) In light of the recent TCFD recommendations prioritizing disclosure of climate risks, organizations will gain better understanding into how risks impact financial position. Do you anticipate this impacting your organization’s client offerings?
    a. If so, how?

Data and transparency

8. Data plays an important role in understanding and valuing climate risks.

9. Does your organization rely on data (ie: flood mapping) to incorporate wildfire or flood risks in home valuations?
    a. If so, what are your organization’s practices regarding data utilized to determine climate risks? Please answer at your discretion.
    b. Do you utilize proprietary data?

c. Do you rely on specific regional data? What level of granularity?
d. Do you rely on publicly available data, proprietary data, or subscription-based data?

10. What challenges does your organization face regarding climate risk data?
    a. Do you face any challenges accessing data for assessing climate risks?
        i. For specific regions?
        ii. For specific types of data?

11. Please describe the assessment process / logic utilized by your organization, at your discretion.
    a. To your understanding, do your clients have an understanding of the logic utilized, including financial institutions (banks)?

12. To what extent is your organization's risk assessment logic available to clients?
    a. Do clients inquire into whether climate risk factors are considered in valuations?
    b. Do clients inquire into the logic used to incorporate wildfire or flood risks?

Challenges, lessons and solutions:

13. What are the primary challenges preventing or impacting climate change risk adaptation in your organization?

14. What lessons, overall, can be drawn from the experience of your organization for the industry, more broadly?

15. What would help your business to integrate wildfire and flood prevention at the building level into your decision making?

Appendix E. Interview guide for researchers

General orientation

1. What services does your organization offer?

2. What climate events are impacting housing finance stakeholders the most?
    a. Stakeholders, include Homeowners, Builders, Insurers, Banks/ lenders, Governments?

3. How have these climate events changed over the past five years?
    a. How do you foresee this changing, moving forward?

4. How are increased risks associated with wildfire and flood events impacting the housing finance sector?
    a. Overall
    b. Stakeholders, specifically

Climate risk adaptation

5. How has the research on adaptation to wildfire and flood changed in response to increased climate risks?

6. Does your organization's research focus on adaptation measures for homes?
    a. Has there been an increased demand for research and support on adaptation measures?
        i. From individual homeowners? Communities?
        ii. How has this changed over the past five years?
        iii. How do you anticipate this will change, moving forward?
    b. Has there been an increase in measures implemented in homes?
        i. What measures?

7. How can financial barriers be addressed / homeowners or communities be incentivized?
    a. Insurance - has your research examined if / how insurance could recognize risk-reducing measures?
        i. If so, do you know if this has been implemented?

8. What other barriers impact adaptation of these measures?
    a. How can these be addressed?

Finance & insurance

9. Does your organization's research include financial institutions or insurers?
    a. If so, how are insurers or financial institutions adapting to increased risk from wildfire and flood within the scope of your research?
    b. How has this changed over the past five years?

10. From your research, do you know if insurers and/or financial lenders are denying homeowners or guilders services for projects as a result of climate-related risks/proximity to a fire or flood event?
    a. If yes, please elaborate.
    b. How has this changed in the last five years?

11. Do you know / have you heard if any bankers offer incentives for adaptation and resilience measures to protect projects from wildfire and flood, within the scope of your research?

Data and transparency

Another area that we are interested in is data and transparency of risks to homeowners.

12. Risk Factor's data and methodology is publicly available. Could you speak to the importance of transparency in data and methodology of risk determination?

13. What are the primary sources of Risk Factors data?
    a. What challenges has Risk Factor had in accessing recent and relevant and specific data?

14. Communication of risk to the public / homeowners is important in ensuring the utility of this work. What strategies does Risk factor employ to ensure this data is useful and reduces information asymmetry with homeowners / homebuyers?
    a. What are the primary challenges in communication?
    b. Is there a role for government / public organizations to play in communication and education?

Challenges, lessons and solutions

15. What challenges overall, does the residential housing and financial sector face in incorporating climate change risk adaptation?

16. What potential solutions could address those challenges?

17. What lessons can be drawn from your organizations experience?

Appendix F. Interview guide for construction industry representatives

General orientation

1. How would you describe the level of awareness around climate change risk and adaptation among your organization?
    a. How has this changed in the last five years?
    b. How do you think this will change in the next five years?

2. Which climate change impacts or risks are impacting construction reps the most to date?
    a. How do you see this changing in the next five years?

3. How does climate risk compare to other risks? (ie: Is action on climate risk a priority for your organization?)
    a. Has this changed over the last five years?

Wildfire and flood risk

4. How are increased risks associated with wildfire and flood events impacting your org?
    a. Is this comparable across construction reps?

5. To the best of your knowledge:
    a. Have there been shifts in buyer demand for climate change adaptation measures? If yes, please describe the nature of shift and where it is happening.
    b. Have you changed the design and construction of homes in response to changed demand?
        i. If so, are other builders doing this?
        ii. How has this impacted the cost of the homes demanded to be built?
    c. Have you changed when and how they obtain project insurance and financing?
    d. Have you changed to purchase contract terms, such that extensions are allowed should homebuyers be temporarily unable to secure insurance?

6. Have you been directly impacted by wildfire or flood in the past year? Your peers?
    a. How has this impacted the project(s) in terms of timeline and costs?
    b. How often were damages covered by insurance and to what extent?

Insurance and financing

7. Have you been denied insurance and/or financing for a project as a result of climate-related risks/proximity to a fire or flood event? If yes, please describe.
    a. How has this changed in the last five years?
    b. How often were they able to secure elsewhere?
    c. How did this impact project timelines or costs?

8. How clear are you on your insurance terms for wildfire and flood coverage?
    a. Do you understand how the risk of wildfire or flood impact insurance premiums and deductibles?

9. Do you know / have you heard if any insurers offer incentives for adaptation and resilience measures to protect your projects from wildfire and flood?

10. To your knowledge, have your homebuyers ever been denied insurance and/or financing as a result of climate-related risks/wildfire or flood events? If yes, please describe.
    a. How often are they able to secure elsewhere?
    b. How did this impact their ability to finalize the purchase?

Risk adaptation

11. How are you adapting or planning for risks from wildfire and floods?
    a. How has this changed over the last five years?

Challenges, lessons and solutions

12. What challenges do your members face in incorporating climate change risk adaptation?

13. What potential solutions could address those challenges?

14. What lessons, overall, can be drawn from your experience?

Appendix G. Interview guide for homeowners

General orientation

1. Could you provide a bit of background on your home and your motivation to improve its climate change resilience?
    a. In what BC region is your house situated?
    b. Where is the home located? In what sort of setting?
    c. Are you concerned about your home being directly impacted by increased risks from wildfire or flooding events?

2. What type of climate-related events (or changes) have occurred in your region in the past five years?
    a. Was your home / property impacted by these events? If yes, please describe.

3. Do you think the climate risks mentioned are currently affecting (or may affect) your property value?
    a. What about wildfire or flood risks, specifically?

Wildfire and flood risk

4. Have wildfire and flood events occurred in your region in the past five years? If yes, please describe the events.

5. Has your home been directly affected by these wildfire / flood events? Please describe the event(s) and the impacts.
    a. If there was damage, was it covered by insurance?
        i. How would you describe the process of claiming insurance coverage (smooth, transparent, lengthy or reasonable, etc.)?
        ii. If you received coverage to rebuild, were there any conditions or limitations for the rebuild process?
    b. If not covered by insurance, was that known in advance or did it come as a surprise?
    c. Did you receive compensation from other sources? (e.g. government)

6. Do you know other homeowners who were affected by climate-related events?
    a. What events?
    b. What were the impacts you witnessed or heard of?

Risk adaptation

7. What measures have you taken to adapt your home / property to climate-induced extreme weather events or other climate-related risks?
8. How did you determine the measures to implement - what information or resources did you utilize to guide your property adaptation?
    a. Is this information accessible to the public / homeowners?

9. What barriers did you face when implementing these measures?

   a. In your opinion, what are the primary barriers preventing widespread adoption of these measures by homeowners?

10. What do you think would incentivize others / the average homeowner to implement climate adaptation and resilience measures?

Insurance & finance

11. Does your insurance provider recognize any of the climate adaptation measures you've implemented to protect your property from climate risks?
    a. Do they offer any reduction in insurance premium?
    b. If not, did you investigate with other insurers?

12. Did your insurance or finance provider discuss with you potential benefits of securing your home against climate-related risks?
    a. did they offer any incentives to implement some measures?
    b. do they offer any advice on accessing other sources of financing (e.g. government grants).

13. Have you (or someone you know) had trouble securing financing for buying or constructing a new property as a result of high exposure to wildfire or flood risk?
    a. If so, were such risks specifically mentioned by the financial institution as the reason for denying financing?
    b. Were you able to secure financing from another provider?
    c. How did this impact costs?

14. Have you had trouble securing financing for home-improvement projects aimed at climate adaptation and resilience?
    a. If so, what reason was given to you for the financial institution?
    b. if you obtained financing, were you offered any advantages in recognition of reducing your property exposure to climate risks?

Challenges, lessons, and solutions

15. What lessons, overall, can be drawn from your experience as a homeowner facing risks from wildfire and flood, (or other climate risks) more broadly?

Appendix H. Interview guide for lenders

General orientation

1. What financial services does your organization offer to home builders/developers?
    a. to homebuyers and homeowners?

2. What climate events are impacting your business the most and how?
    a. How are wildfire and flood climate change events impacting your business (and / or industry)?
        i. How has this changed over the last five years, and over the course of your career in the industry?

3. How does climate risk compare to other risks facing your organization? (ie: Is action on climate risk a priority for your organization?)
    a. Has this changed over time?

Risk adaptation

4. How is your organization adapting or planning for risks from wildfire and floods?
    a. How has your organization's approach changed over the last five years, and over the course of your career in the industry?

5. Specific to your organization's portfolio, what approaches, if any, have been taken to incorporate climate change risk?

6. Has your organization denied financing to a homeowner or contractor on the basis of climate risk?

7. Regarding homeowners - has your organization has a client:
    a. Lose a property due to wildfire or flood?
    b. Default on payments / fall behind as a result of climate risk damage?

8. Regarding builders - has your organization had a client:
    a. Had a project damaged or lost due to climate risk?
    b. Fall behind on payments due to climate risk?

9. Are you aware of development measures for protecting properties against climate change hazards? (for example: following FireSmart measures to mitigate fire damage; installing flood vents, sump pumps to mitigate flood damage)?
    a. If yes, do you think there is a role for financiers to promote these practices to protect properties from climate risks?

Finance

10. Are you aware of the recent TCFD recommendations regarding disclosure of climate risks?) In light of the recent TCFD recommendations prioritizing disclosure of climate risks, organizations will gain better understanding into how risks impact financial position. Do you anticipate this impacting your organization’s client offerings?

a. If so, how?

Data and transparency

11. What are your organization's practices regarding data utilized to determine climate risks?
    a. Do you utilize proprietary data?
    b. Do you rely on specific regional data? What level of granularity?
    c. Do you rely on publicly available data, proprietary data, or subscription-based data?
    d. Are you facing any data challenges to assess climate risks for specific BC regions?

12. Please describe the risk assessment logic utilized by your organization.
    a. To your understanding, do your clients have an understanding of the logic utilized?
    b. To what extent is your organization's risk assessment logic available to clients?

13. TCFD includes information on how potential risks (a.k.a. prevent losses for the organization) are being managed. To what extent is / will your organization make this information available to clients?

Challenges, lessons, and solutions

14. What are the primary challenges preventing or impacting climate change risk adaptation in your organization?

15. What lessons, overall, can be drawn from the experience of your organization for the industry, more broadly?

16. What would help your business to integrate wildfire and flood prevention at the building level into your decision making?

Appendix I. Interview guide for insurance industry representatives

General orientation

1. What climate events are impacting your business the most and how?

2. How are wildfire and flood climate change events impacting your business (and / or industry)? How has this changed over the last five years, and over the course of your career in the industry?

3. How does climate risk compare to other risks facing your organization? (ie: Is action on climate risk a priority for your organization?)
    a. Has this changed over time?

Risk Adaptation Questions

4. How is your organization adapting or planning for risks from wildfire and floods?
    a. How has your organization's approach changed over the last five years, and over the course of your career in the industry?

5. Specific to your organization's portfolio, what approaches, if any, have been taken to incorporate climate change risk?

6. Has your organization denied financing to a homeowner or contractor on the basis of climate risk?

7. Regarding homeowners - has your organization has a client:
    a. Lose a property due to wildfire or flood
    b. Default on payments / fall behind as a result of climate risk damage

8. Regarding builders - has your organization had a client:
    a. Had a project damaged or lost due to climate risk
    b. Fall behind on payments due to climate risk

9. Are you aware of development measures for protecting properties against climate change hazards? (for example: following FireSmart measures to mitigate fire damage; installing flood vents, sump pumps to mitigate flood damage)?
    a. If yes, do you think there is a role for financiers to promote these practices to protect properties from climate risks?

Finance

10. Are you aware of the recent TCFD recommendations regarding disclosure of climate risks?) In light of the recent TCFD recommendations prioritizing disclosure of climate risks, organizations will gain better understanding into how risks impact financial position. Do you anticipate this impacting your organization’s client offerings?
    a. If so, how?

Data and transparency

11. What are your organization's practices regarding data utilized to determine climate risks?
    a. Do you utilize proprietary data?
    b. Do you rely on specific regional data? What level of granularity?
    c. Do you rely on publicly available data, proprietary data, or subscription-based data?
    d. Are you facing any data challenges to assess climate risks for specific BC regions?

12. Please describe the risk assessment logic utilized by your organization.
    a. To your understanding, do your clients have an understanding of the logic utilized?
    b. To what extent is your organization's risk assessment logic available to clients?

Challenges, lessons and solutions

13. What are the primary challenges preventing or impacting climate change risk adaptation in your organization?

14. What lessons, overall, can be drawn from the experience of your organization for the industry, more broadly?
    a. What would help your business to integrate wildfire and flood prevention at the building level into your decision making?

Appendix J. Interview guide for data providers

General orientation

1. As a starting point, could you please describe what services your organization offers and who your primary clients are?
    a. Credit unions/banks?
    b. Insurers?
    c. Appraisers?
    d. Builders/developers?
    e. Government?

2. To what extent is this data disclosed to clients?

3. What additional services/data has this partnership enabled you to provide?
    a. Is it structured as a subscription service or one-off data purchases?

4. Who have been your main clients for this data/information? (Credit unions/banks? Insurers? Appraisers? Builders/developers? Government?)

5. Has the demand for data/information from clients changed over time? If yes, please describe.

Data & transparency

6. What role do you see climate risk data playing in adaptation or planning for risks from wildfire and floods?

7. How do you see your org's work in climate change risk data evolving in the next 5 years?

8. How do you see bill C-15 impacting the financial industry?

9. Can you provide insight into the recency of the data you utilize?

10. If uncertain, how does the org. ensure the climate data utilized to assess risk is recent and relevant, as well as specific?
    a. Who do you see as potential competitors in the provision of climate change data/information?

11. As more competitors enter as demand grows, how can the integrity / standard of data be maintained across the industry?

Climate risk adaptation

12. How are your clients utilizing the information/data they purchase from you?

13. How do you think this might change in the next 5 years?

14. How do you think overall demand for this information/data will change in the next 5 years?

15. What actions, if any, have you seen your clients take in response to the data/information they've purchased from you?
    a. How do you think this might change in the next 5 years?

Challenges, lessons and solutions

16. What are the challenges you face in meeting the data demands/requests from your clients with respect to climate change risk?
    a. Are there any data/information requests you receive that you haven't been able to address?
    b. What potential solutions could address those challenges?

Appendix K. Interview guide for financial regulators

General orientation

1. What is your organization's role in BC's financial sector? What is the relationship to mortgage providers and insurers?

2. What is your organization's role with regards to risks facing these organizations?

3. What climate events are impacting financial actors that you regulate?
    a. How are wildfire and flood climate change events impacting these actors?
    b. How has this changed over the last five years, and over the course of your career in the industry?

4. How does climate risk compare to other risks facing the financial organizations within your jurisdiction? (ie: Is action on climate risk a priority for your organization?) How has this changed over time?

Risk adaptation

5. To your knowledge, are lenders (builders and mortgage) changing their practices in response to increased risk from wildfire and flood?

6. To your knowledge, have any lenders increased interest rates or denied lending to builders/developers or homebuyers, on the basis of climate-related risks?
    a. Have they denied lending on the basis of climate risk?

7. To your knowledge, do lenders factor in climate change risks when determining lending offerings? For builders or homeowners?

8. Are risks determined internally, or by third party firms?
    a. For lenders who determine risk internally (ie: without an appraiser), are you aware of the risk assessment logic utilized to determine rates?

9. Are there any key building characteristics that are factored in aside from location? (ex roof sprinklers, firesmart landscaping, other?)

Data & transparency

10. Are you aware of financial lenders practices regarding data utilized to determine climate risks for the built environment?
    a. Do they rely on specific regional data?
    b. What level of granularity?
    c. Do they rely on publicly available data, proprietary data, or subscription-based data?

11. Do you know if there are any challenges regarding access to data for these organizations?

12. What data and information gaps/challenges do lenders face when trying to assess climate change risks for specific BC regions?

Challenges, lessons and solutions

13. What are the primary challenges preventing or impacting climate change risk adaptation in financial organizations?

14. From a regulator perspective, what can be done to mitigate risks from climate - wildfire and flood, for: Insurers, Financial actors, Their clients (homeowners)?

15. Do you have any closing lessons or comments that you would like reflected in the transcript?

Appendix L. Interview guide for mortgage insurers

General orientation

1. Can you provide some information on your organization and service offerings?

2. From your perspective of your organization what climate change impacts or risks are of the most concern to homeowners? homebuilders?
    a. To mortgage providers?
    b. How is each group being impacted?
    c. How do you see this changing in the next five years?

3. How does climate risk compare to other risks facing the housing ecosystem in BC (ie: Is action on climate risk a priority for your organization?)
    a. Has this changed in the last five years?

Risk adaptation

4. One method for risk adaptation is implementing measures to reduce exposure or damage to wildfire or flood in homes, such as FireSmart measures. Does the your org. promote climate adaptation measures?

5. What steps can the org. take to promote adaptation practices?

6. Are financial incentives (subsidies) considered?

7. Is there a role for mortgage providers or insurers (non-government) to be encouraged to incentivize this behavior?

Governance

8. Can you please describe how your org. interacts with - and supports homeowners or homebuilders before, during, and after climate risk events (wildfire and flood)?
    a. What inter-jurisdictional challenges does the your org. face?
    b. How could these challenges be addressed?

9. How do you foresee the org's role in climate risk preparation and response changing / evolving over the next five years?

10. Does the org have a role to play in ensuring homeowners have access to financial support needed following climate disaster?

Insurance

11. A concern is homeowners and homebuilders in high-risk regions being unable to secure insurance. What is the org's perspective on this risk (market failure)?
    a. Does the org have a role in mitigating this risk?
    b. If so, what and how?

12. Another concern is insurers pulling out of regions - is this a concern of the org?

a. Is there a role for the org in mitigating this risk?
b. What and how?

Finance

13. A concern is homeowners and homebuilders in high-risk regions being unable to secure financing. What is the org's perspective on this risk (market failure)?
    a. Does the org have a role in mitigating this risk?
    b. If so, what and how?

14. Another concern is financiers pulling out of regions - is this a concern of the org?
    a. Is there a role for the org in mitigating this risk?
    b. What and how?

15. How do you see Bill C-15 impacting the housing and finance industry? Do you forsee offerings changing as a result?

Data and transparency

16. One concern is access to granular data (by insurers, financial institutions) for regions in Canada, including BC, to accurately determine risk. Does the org share this concern?
    a. If so, how do you foresee this challenge being addressed?
    b. Is there a role for increasing open-sourced climate risk data? (fed cooperation?)

17. What role do you see climate risk data playing in adaptation or planning for risks from wildfire and floods?

18. How do you see climate risk data and demands evolving in the next 5 years?

Challenges, lessons and solutions

19. What challenges does the org face in community adaptation to wildfire and flood risks?
    a. What potential solutions could address those challenges?

20. What actions would you like to see / do you foresee the org taking to address these challenges?

Appendix M. Interview guide for technical regulators

General orientation

1. How would you describe the level of awareness around climate change risk and adaptation among your organization?
    a. How has this changed in the last five years?
    b. How do you think this will change in the next five years?

2. Which climate change impacts or risks are impacting single family homes and construction the most to date?
    a. How do you see this changing in the next five years?

3. How does climate risk compare to other risks? (ie: Is action on climate risk a priority?)
    b. Has this changed over the last five years?

Wildfire and flood risk

4. How are increased risks associated with wildfire and flood events impacting your org?
    a. Is this comparable across construction reps?

5. Can you speak to the amount of homes and construction projects being directly impacted by extreme weather events? Per year?
    a. How has this impacted the project(s) in terms of timeline and costs?
    b. How often were damages covered by insurance and to what extent?

6. What role do regulators play in risk education?
    a. How is your organization addressing this responsibility?

Insurance and financing

7. Can you speak to the financial impacts and concerns of climate risks on the organizations you regulate?
    a. How has this changed in the last five years?
    b. How often were they able to secure elsewhere?
    c. How did this impact project timelines or costs?

8. To your knowledge, have your homebuyers ever been denied insurance and/or financing as a result of climate-related risks/wildfire or flood events? If yes, please describe.
    a. How often are they able to secure elsewhere?
    b. How did this impact their ability to finalize the purchase?

Risk adaptation

9. How are you adapting or planning for risks from wildfire and floods?
    a. How has this changed over the last five years?

10. What role does your organization have in encouraging adaptation?
    a. Education
    b. Incentives?

c. Lobbying?

Challenges, lessons and solutions

11. What challenges do your members face in incorporating climate change risk adaptation?

12. What potential solutions could address those challenges?

13. What lessons, overall, can be drawn from your experience?