Preparing Cities for Climate Emergency: A Triage-based Framework for Urgent & Equitable Climate Action Planning and Prioritization

by

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Abstract

Three interconnected crises (the climate crisis, the pandemic and inequality) are presenting unprecedented challenges for local governments. The pandemic is straining resources and time to mitigate and adapt to the effects of climate change is running out. This is leading to disproportionate burdens on racialized, marginalized, and vulnerable communities and intense pressure on local governments to formulate innovative solutions. In Section One of this paper, mixed-method research synthesis and semi-structured, open-ended interviews were utilized to explore trends, strategies and shortcomings within municipal climate action planning, prioritization, and implementation. Findings from Section One suggest that municipal climate policy and planning is haphazard, lacks standardization across municipalities, does not consider prioritization of initiatives, is not consistently leading to emissions reduction or energy savings and largely excludes considerations of equity or justice. In Section Two, an exploratory conceptual framework incorporating a medical triage perspective is proposed to streamline and standardize the climate planning & prioritization process. The triage framework adds value to the climate action planning field by utilizing an innovative, systematic method to achieve efficient, effective, and equitable policy outcomes in urgent situations. Traditional approaches to climate policy and prioritization have been insufficient in non-emergent circumstances and will not suffice in the current state of climate crisis. Section Three is a case study which utilizes the triage framework in a hypothetical scenario. The case study prioritizes climate change mitigation and adaptation initiatives for buildings in Waterloo Region. These results are compared to priorities in recent climate action plans released by Waterloo Region. An equity and justice lens underpins this research.

Foreword

Prior to entering this program, I had been working as a paramedic for three years. I came to realize that my ability to make meaningful change as a paramedic was limited since individuals are often prevented from adopting healthier behaviors due to obstacles at the systemic level. I was initially motivated to pursue this degree because I wanted to learn how people's health can be improved through interactions with the environment while simultaneously reducing the effects of the climate crisis. Throughout the program, my research interests veered towards learning how governments and policy makers influence behavior and how change can flourish or be encouraged in such circles. After completing courses with a range of distinguished members of the faculty and interacting with peers from an array of different backgrounds, I oriented my plan of study towards exploring strategies which promote effective, efficient, and just decision-making towards the climate crisis at the municipal level.

My major paper displays the knowledge and experience I developed throughout my time in the program to achieve the components of the MES degree. The research in my major paper is deeply intertwined with my learning objectives, my currents of thought and practice and the three components of my area of concentration. This research helped to achieve the learning objectives as set out in my plan of study. The first component of my area of concentrations is *Climate Crisis Mitigation*. My major paper is not only focused on the exploration and evaluation of climate crisis mitigation initiatives largely through Section One and Section Three, but also on proposing new, innovative, and interdisciplinary strategies to mitigate the climate crisis as outlined in Section Two. The second component of my area of concentration focuses on the *COVID-19 Pandemic*. The pandemic came to shape reality in many ways which potentially may never return to normal. On a positive note, COVID-19 proved that rapid, momentous, and co-

operative non-partisan action was possible from various levels of government in Canada. In my major paper, I explore the applicability of lessons from the pandemic to the climate crisis. The third component of my area of concentration is *Canadian Policy Formulation, Implementation, Evaluation & Reform.* My major paper explores the climate change policy process at the municipal level in Canada by focusing on climate action plans and prioritization in addition to the presence of equity and justice in such plans.

Although I conducted a relatively small number of interviews for my major paper, the content touched on all aspects of my area of concentration and plan of study and has contributed to my fulfillment of the MES degree. I hope that this research and the objectives achieved in my plan of study are the beginning of an experience rather then the end. I plan to move forward with these ideas in both the academic and professional realm.

Dedication

This paper is dedicated to Baby DeNuzzo. You will be born into a very tumultuous and uncertain world but hopefully by the time you will be old enough to have some understanding of what is going on, innovative, productive, and meaningful change will already be well on its way. It was challenging to feel hopeful after conducting all the research for this paper and working through over a year of the pandemic on an ambulance but as it turns out, the potential for new life can make people feel very optimistic.

Acknowledgments

I want to thank Michael DeNuzzo for his endless support, pushing me to always stand up for what I believe in and encouraging me to continue with this program throughout the numerous times I was ready to quit. I want to thank my mother, Joyce Hansen, for instilling in me the urge to help others which has guided me throughout much of my life and this paper, and for voluntarily reading and providing feedback on the whole draft (no easy feat). I want to thank my father, Dale Ritch, to whom I attribute my stubborn, argumentative nature which I would not have completed this program or research without. I want to thank all my friends and co-workers who constantly checked up on my progress in the program and always seemed genuinely interested in what I was doing.

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List of Abbreviations

CAP- Climate Action Plan

IPCC- International Panel on Climate Change

WR- Waterloo Region

CBA- Cost Benefit Analysis

GHG- Green House Gas

START- Simple Triage and Rapid Treatment

SALT- Sort, Assess, Life-saving interventions, Treatment and/or Transport

CPCAI- Climate Policy and Climate Action Initiative

ACEEE- American Council for an Energy Efficient Economy

WAP- Weatherization Assistance Programs

REIA- Racial Equity Impact Assessment

PPE- Personal Protective Equipment

NESS- National Emergency Strategic Stockpile

Introduction

Humanity is facing a disaster of momentous proportions: climate change. This human-accelerated process is associated with a range of alarming consequences including devastating weather events, large-scale extinction of plants & animals, the depletion of resources required to sustain life and loss of human life (IPCC, 2018; Hayes et al., 2018). This is expanded upon by Hayes and colleagues (2018):

> While we cannot say with certainty that any one specific extreme weather event is directly caused by climate change; we do know that because of climate change, extreme weather is more generally on the rise, making extreme weather events more frequent, intense, and complex, (p. 3).

These threats require rapid and effective government action to facilitate mitigation and adaptation on a global and local level. Under the Paris Agreement, the federal government of Canada has agreed to reduce emissions thirty percent below 2005 levels by 2030 and to net-zero by 2050 (Meyer, 2019; Environment and Climate Change Canada, 2016). This target requires commitment and action from various levels of government in Canada, but the scope of this paper focuses on climate action within municipal and regional levels of governance in Canada.

Two other major global crises are occurring, the repercussions of which cannot be ignored at the municipal level. On March 11th of 2020, when there were approximately 103 confirmed cases in Canada, the World Health Organization declared the 2019 Novel Coronavirus to be a global pandemic (Young, 2020). As of June 2021, over 1.4 million Canadians have been infected with COVID-19 (Ritchie et al., 2020). The pandemic has placed Canadian municipalities in a precarious situation regarding finances, staffing and other resources. Additionally, the pandemic has proven that rapid and consequential government action is possible when there is consensus that an emergency exists. Climate change has been acknowledged as an emergency by scientists, doctors, academics, and public officials for

decades (Ripple et al., 2017; Ripple et al., 2014; Climate Emergency Declaration, 2021; Solomon & LaRocque, 2019; Clark et al., 2021; UK Environment Agency & Department for Environment, Food & Rural Affairs, 2020). Canadian governments made prompt and momentous decisions to mitigate the initial consequences of the pandemic including border closures, lockdowns, mandatory masking, school closures, and supportive financial measures. The current challenge lies in igniting a similar emergency response to the climate crisis. This paper will provide support and guidance for perceiving and responding to the climate crisis as an emergency.

The second major global/local crisis that provides context for this research is inequality. On May 25, 2020, a Minneapolis resident, George Floyd, made a purchase at a convenience store, shortly after which the police were called (Hill et al., 2020). Seventeen minutes after the arrival of the police, Mr. Floyd was unresponsive with absent vital signs (Hill et al., 2020). For eight minutes and fifteen seconds of that time, Mr. Floyd had been pinned to the ground with the knee of a white police officer on his neck (Hill et al., 2020). Although George Floyd was not the first or last civilian death resulting from reckless and reprehensible behavior by white police officers, it set off a global reaction leading to significant protests and the growth of the Defund the Police Movement. This event reverberated in Canadian municipalities, where many vulnerable and marginalized citizens have also died as a result of violent police actions (Neustaeter, 2021). Systemic racism and inequality have been rampant for decades in Canada, but the movement that arose out of Geroge Floyd's death has made it impossible to ignore (Bensadoun, 2021; Cecco, 2020; British Columbia Teachers Federation, 2018; Sheppard, 2017). Governments and decision makers must face systemic inequality and work to eliminate it, including among municipal climate action planning and policy.

This paper developed as a response to the climate crisis which is deeply intertwined with two other crises, the pandemic and inequality, all of which have local repercussions in Canada. These three interconnected crises are presenting unprecedented challenges for citizens, communities, the environment, and local governments. The COVID-19 pandemic is straining resources, while time to mitigate the effects of climate change is running out. This is resulting in disproportionate burdens on racialized, marginalized, and vulnerable communities and pressure on local governments to formulate innovative and sustainable solutions. This paper addresses these issues.

This research paper is divided into three sections. In Section One, a literature review explores whether climate action plans have been achieving measurable progress by focusing both on Canadian and international climate action planning. This section focuses on how municipalities carry out prioritization within municipal climate action planning and policy and how concerns regarding equity and justice have been integrated into the planning process. Section Two proposes an innovative conceptual prioritization framework incorporating a medical triage perspective to guide municipal governments in the creation of improved climate action plans and policies. This section explores the history and background of triage and investigates how triage has been used outside of medicine. Section Three is a case study in which the conceptual framework from Section Two is adapted to local conditions in Waterloo Region to demonstrate its practical application. This case study focuses on the utilization of the triage framework to mitigate and adapt to the climate crisis in the building sector since a significant portion of this author's previous research focused on climate action in the buildings sector. Semi-structured, open-ended interviews were conducted with participants in the municipal climate

action planning and policy process in Waterloo Region and these interviews informed and are integrated throughout the paper.

This research paper aims to enhance the urgency, effectiveness and efficiency of the planning and implementation process associated with municipal climate action. The value of this goal is that municipal climate action will be more likely to result in meaningful and measurable progress. This research paper also aims to contribute to a sustainable and just future by establishing a framework that incorporates equity and justice considerations. The value of this goal is that climate action will no longer exclude or result in negative consequences for marginalized populations. These goals may appear contradictory but one of the aims of this paper is to demonstrate that they are not mutually exclusive. If prioritization and planning methods are established pre-emptively with appropriately trained decisionmakers and staff, the extra time and work involved in equity considerations can be reduced.

This is an exploratory paper. Its value lies in its synthesis of literature and its attempts to probe in innovative directions. The topics explored here will require further clarification and refinement in the future and are not immediately prepared to be applied in climate action planning. This research found that although there is significant discussion and literature on climate action, it has resulted in minimal measurable change. The readers should leave this paper with an appreciation for the logic and organization that the incorporation of concepts of triage can bring to the climate planning process. Utilizing evidence and data, the municipal climate action planning and prioritization process can be streamlined to result in meaningful, measurable, and equitable climate action which will be more likely to lead to significant climate mitigation and adaptation in municipalities. On a broader scale, this framework is valuable because it is not limited to the climate crisis and can potentially be utilized to aid in the management of a wide

range of emergencies including natural disasters and pandemics. Management of the climate crisis is complicated and often contradictory, but the lens of triage and equity provides significant value as climate change becomes more dire. Since humanity can no longer avoid climate change consequences, society should attempt to manage these consequences in a systematic, transparent, explicit, and logical approach providing traceability and accountability.

Section One: Background and Literature Review on Municipal Climate Action Planning & Policy

Introduction: The Role of Local Government in Climate Change

Many of the consequences of the climate crisis are experienced at the local level in the form of increasingly severe and frequent storms, floods, heatwaves, droughts, and fires (IPCC, 2018). As expressed by Porteron and colleagues (2020, p. 10), "cities, with their high populations, often being coastal, sometimes remote from water or food supplies, are particularly exposed to the increased frequency of storms, floods, droughts and heat waves." Approximately 55 percent of the world's inhabitants live in cities and in 2017, this equated to about 4.1 billion people (Ritchie & Roser, 2018).

Canadian municipalities are facing consequences from climate change. In 2016, a wildfire burned through Fort McMurray, Alberta which resulted in the destruction of thousands of homes and forced approximately 90 000 inhabitants to evacuate (Krugel, 2016). Kirchmeier-Young and colleagues (2017) found that human-caused emissions & pollution increased the likelihood of the Fort McMurray wildfire occurring by 1.5 to 6 times due to the increasing length of wildfire seasons, amplified risk of extreme fires and the rise in days that a fire can spread. The increase in hectares of forests burnt from 1990-2018 in the province of Alberta is displayed in

Figure A1 in Appendix A. In 2013, two large Canadian cities, Toronto and Calgary, experienced large-scale flooding (Henstra & Thistlethwaite, 2017). The flooding in Toronto resulted in 300 000 inhabitants losing power, caused over $940 million worth of insured property damage, and cost the city approximately $65 million to respond and aid in recovery (City of Toronto, 2013; Nelson, 2014).

The Government of Canada (2021b) warns that Canadians are likely to experience increased risk of flooding in the future due to consequences of the climate crisis including above average precipitation, more extreme precipitation, storm surges, rising sea level and earlier, faster snowmelt. In the summer of 2018, the city of Montreal experienced an extreme heat event that resulted in the deaths of sixty-six people (Chung & Mayer, 2019). In the summer of 2021, a heat dome over Western Canada has been potentially linked with 500 unexpected deaths over the approximately 230 deaths that would have typically been expected during a similar period (Cecco, 2021). Extreme heat events are particularly severe in cities due to the urban heat island effect, where heat is absorbed and maintained more easily due to the frequent presence of certain materials such as concrete and asphalt (Chung & Mayer, 2019). The Climate Atlas of Canada (2019) has found that if emissions continue to rise, "projections for 2051-2080 show that many Canadian cities will see at least four times as many +30°C days per year on average as they have in the past," (para. 8).

Cities are also responsible for emitting a large proportion of emissions. It is difficult to accurately calculate the proportion of global emissions that are emitted by cities, but researchers have estimated it to be between 37-87 percent (Grubler et al., 2012 & Marcotullio et al., 2013 in van der Bergh, 2020). Since municipalities bear the brunt of the climate crisis directly, there has

been a sense of increased urgency to intensify climate action at the local level in recent years (Tang et al., 2010; van den Bergh, 2020; Porteron et al., 2020).

Climate policy and planning at the local level is complex as expanded upon by Tang and colleagues (2010, p. 45): "local climate change action planning is a complex process incorporating geographic, political, social and economic settings and is usually affected by many factors including jurisdiction framework, decision-makers' values and experiences, information resources and awareness of alternatives." A lack of consistent, meaningful climate action combined with the continuous support of policies that contradict climate action from federal and provincial/territorial levels of government in Canada may be exacerbating local consequences of the climate crisis (Bulowski, 2021; Jost et al., 2020). Simultaneously, municipalities in Canada lack autonomy due to regulatory barriers which dictate that certain areas of policy and legislation must be passed by higher levels of government (e.g., building codes and vehicle emission standards) (Burch, 2010). Municipal resources, particularly funding & time, have always been limited but have become increasingly sporadic since the onset of another crisis, the COVID-19 pandemic. Although government funding is consistently controversial, the pandemic has presented an unprecedented challenge which may force cities to struggle to identify funding and other resources such as time and staffing in the short- and long-term. In 2021, municipalities in Ontario will be facing a projected $2.4 billion loss of income (Boisvert, 2020). Although municipalities face many challenges when it comes to reducing emissions there is great potential as stated by Armstrong (2020, p. 3): "policies in urban areas may be able to reduce emissions substantially."

In 2020, Van den Bergh questioned whether the ability for cities to mitigate the consequences of climate change are being overestimated. Van den Bergh (2020) argues this

claim is characterized by a general lack of emission reduction and empirical evidence. Armstrong points out that even when cities successfully reduce emissions, they are unlikely to see a decrease in the impacts of climate change in their area due to the global nature of climate change and the free-rider dilemma (Armstrong, 2020). Later in his dissertation, Armstrong (2020) concludes that increased control among local governments may provide a solution: "by allowing them to design policies to address their unique priorities and maximize co-benefits," (p. 94). Instead of ruling cities out completely, it may be that the actions that cities have focused on thus far in climate action planning were not significant enough or not thoroughly planned out. Cities face complex challenges in the fight against the climate crisis but with effective, efficient, and equitable evidence-driven strategies advanced by well-informed decision-makers, there is potential for significant and meaningful climate action.

In the course of interviews conducted for this project, participants discussed whether climate action planning has resulted in meaningful change in Waterloo Region (WR). All participants agreed that some meaningful change has come from CAP's. Three participants found the planning process meaningful in terms of partnership building, working on shared goals and developing a culture of sustainability among the various municipalities and actors in the region. One participant stated CAPs altered corporate culture and increased the number of people who are aware of or concerned about climate change. Participants disagreed on whether the CAPs were leading to reductions in emissions. One participant mentioned that there have been GHG reductions in WR but questioned whether these were attributed to policy decisions made at the provincial or federal level of government. A progress report found that there had been a five percent decrease in emissions in the region (Climate Action WR, 2019). One participant argued that the emission decrease was a result of coal plant closures in Ontario. Another participant

argued the coal plant closures alone would have kept emissions at a stable level but the decrease in emissions is more likely associated with WR's CAP implementation. The interviews reveal a consensus that climate action planning in WR leads to meaningful change, although the level and specific nature of that change is contentious.

Method

The primary method utilized to gather and analyze data was a form of literature review known as a mixed method research synthesis (MMRS), defined as "a literature review in which review authors combine qualitative, quantitative, and MMR primary-level studies and apply a mixed methods approach to synthesize and integrate those studies", designed "to enhance the breadth and depth of understanding complex phenomena, problems, and topics" (Heyvaert et al., 2013 in Heyvaert et al., 2017, p. 4). The initial scope focused on municipal climate policy prioritization both within Canada and internationally. Finding only a small number of relevant articles, the scope of the review was broadened to focus on Canadian climate action planning more generally. Since this literature was also relatively limited, the scope of the review was broadened again to incorporate international climate action planning literature. The review also includes a specific focus on equity and justice perspectives within climate change and climate planning. The literature review identifies trends, patterns, and gaps in an aim to illuminate the strengths and shortcomings of the international and Canadian climate policy, planning and prioritization landscape and to highlight areas that require future research

The literature review was comprised of peer-reviewed academic articles and grey literature from governments, universities, and non-profit organizations. Articles were identified through keyword searches on Google Scholar and the York University library database, OMNI throughout the fall of 2020 into June 2021. Search terms included: climate policy prioritization,

municipal/local climate action planning, municipal/local climate action planning Canada, municipal climate adaptation policies, municipal climate mitigation policies, climate justice, climate equity, climate inequity, climate justice, just sustainability. A snowballing technique was utilized throughout, where other relevant articles were identified because they had cited or had been cited by primary articles identified as relevant.

To further illuminate the Canadian municipal climate policy & prioritization realm, I conducted quantitative interviews with five climate policy stakeholders at the local level in Waterloo Region (WR). Since these interviews occurred in June and July of 2021, time limitations prevented a systemic analysis of the results, but general themes and findings were analyzed and incorporated into various sections of this paper. The participants were employed directly by municipalities in WR or work with groups that have been engaged in planning with the municipalities in the region. Most participants worked directly on current and previously released climate action plans in WR. Two participants worked directly on the 2021 Transform WR long-term CAP. Two participants worked directly on WR's 2013 CAP. One participant was recommended by another participant as being a vocal proponent of climate action in the region and did not work directly on any of the climate action plans.

The interview format was semi-structured and open-ended. The questions were written in an exploratory nature to determine what policy processes/tools to aid decision-making are currently used and to identify any existing barriers in the municipal climate policy process. The interview questions provided to participants can be reviewed in Appendix D. This interview also explored whether there was an alignment of priorities among participants and compared results to the findings from the literature review. The goal of these interviews was to identify, clarify and investigate municipal climate planning strategies and to inform future climate policy

formulation, implementation, and decision-making. The interviews were conducted and recorded over Zoom and all participants provided verbal consent after reading through a consent form.

The literature review and the interviews informed the conceptualization of the triage framework presented in Section Two. The triage framework was designed based on strengths and shortcomings identified in the literature review and feedback from the interviews.

Climate Action Planning at the Municipal Level in Canada

Many municipalities have acknowledged the significance of the climate crisis through the formulation of climate action plans (CAPs). In Canada, "climate action plans, or local action plans, are endorsed by council and set out the actions required to reduce emissions and meet a GHG reduction target," (PCP, 2019, p. 6). These plans often outline or serve as the foundation for policies and initiatives aimed at reducing emissions and energy usage, "local climate change action plans are critical for providing a fundamental inventory for GHG emissions, setting a long-term emission reduction target, making appropriate action policies, coordinating cross-boundary issues and implementing decisions," (Tang et al., 2010, pp. 41-42). Tang and colleagues (2010) further expand upon the importance and relevance of such plans, "a local climate change action plan will provide a feasible, bottom-up means to establish strategic goals to lower emissions, identify emission sources and amounts, make appropriate policies and establish mechanisms for co-ordination, monitoring, measuring and reporting performance," (p. 42). Many Canadian municipalities have participated in the formulation of CAPs.

Guyadeen and colleagues (2019) highlight the inconsistent nature of climate planning in Canada, "climate change planning is highly uneven in Canada given the general absence of statutory obligations," (p. 123). Only one province in Canada, Nova Scotia, requires municipalities to formulate CAPs and some provinces require climate change goals and policies

to be integrated into municipal official plans. (Guyadeen et al., 2019). Guyadeen and colleagues (2019) outline how climate action planning in Canadian municipalities has been assisted by the Partners for Climate Protection Program established in 1994 which provides resources, networking, case studies and events related to municipal climate planning and has assisted over 400 municipalities, set over 460 targets, and assisted in the implementation of over 160 climate action plans (Partners for Climate Protection, 2021). Transforming climate action planning into implementable, meaningful, and measurable progress has faced numerous challenges in Canada and internationally.

Literature regarding evaluation of climate action planning in Canada exists but is not robust. Guyadeen and colleagues (2019) evaluated climate change plans in sixty-three Canadian municipalities and found that the implementation, monitoring and evaluation components of plans required improvement and that municipalities were not significantly incorporating diverse stakeholders into the planning process. In a national survey in 2019, sixty-five municipalities reported engaging in a total of 420 measures within climate action plans, of which seventy-five percent were reported to be completed or in implementation (PCP, 2019). The municipalities that responded to this voluntary survey represented only seventeen percent of the membership of the organization that conducted the survey so the figure may not be representative of most Canadian municipalities (PCP, 2019).

A significant portion of the Canadian research on CAPs focuses on climate action in general rather than climate action plans specifically. A study on municipalities in British Columbia found that sufficient capacity exists to mitigate and adapt to climate change but noted a lack of effective facilitation of existing resources that would require the re-conceptualization of

path dependencies, policy formulation processes, and organizational culture to address (Burch, 2010). This is expanded upon by Burch (2010),

> The current municipal structure and function has embedded in it a host of barriers to action that have influenced the successful pursuit of climate change action. Structural, operational, cultural, and contextual factors (for instance) can serve to enable or inhibit the translation of capacity into action. Many of these factors are not independent phenomena, but rather are the interwoven products of the underlying development path (p. 288).

Other barriers to climate action in British Columbia reported by elected officials and government employees included "a lack of senior government support, resources, authority, and staff capacity," (Rhodes et al., 2021, p. 60).

A longitudinal study in British Columbia on eleven communities considered leaders in climate action found that drivers of local climate action included governance leadership on multiple levels, presence of extreme weather in a community, funding, skills & availability of resources through government and partnering organizations (Dale et al., 2019). Jost and colleagues (2020) associated numerous climate action drivers with three municipalities in Vancouver that had been identified as having implemented or are currently implementing noteworthy levels of climate action including local context, financial opportunities, various levels of government integration, mitigation-adaptation incorporation, and cooperation with external agencies or organizations. Rhodes and colleagues (2021) conducted surveys on regional climate action planning in portions of British Columbia and found that almost all participating communities were experiencing hazardous impacts due to changing weather patterns, that all municipalities were supportive of climate action, and most were engaged in climate action, both adaptation and mitigation related. Literature on CAPs in Canada is limited, and largely focuses on drivers and barriers to climate action within communities, municipalities, and regions in one province, British Columbia.

Municipal Climate Action Planning Abroad

Literature regarding evaluation of climate action planning in the United States and Europe is more robust than in Canada and in Europe. Some municipalities in Europe are legally required to create climate action plans as a response to climate change impacts (Reckien, 2015 in Guyadeen et al., 2019). In 2012, Millard-Bell conducted research on whether climate plans led to measurable reductions in emissions in California and found that "climate plans are largely codifying outcomes that would have been achieved in any case," more correlated with citizens environmental preferences (p. 1). Other research supports the lack of correlation between the formulation of climate action plans and measurable results (Stone et al., 2012; Bassett & Shandas, 2010; Deetjen et al., 2018). Basset and Shandas (2010) expand on this, "many of the plans do not really constitute action plans, as they do not identify actions, designate actors, or lay out timetables. Some do not even aspire to present technically sophisticated analyses," (p. 442). Stone and colleagues (2012) analyzed municipal and state level climate action plans in fifty regions and concluded that the plans "may fail to adequately protect human health and welfare from rapidly rising temperatures," (p. 263). Deetjen and colleagues (2018) analyzed the climate action plans of twenty-nine large American cities, finding that the highest emitting cities were the most likely to have inadequate and inconsistent climate action plans. The authors concluded the likelihood of meaningful change resulting from the climate plans was low (Deetjen et al., 2018).

Pietrapertosa and colleagues (2020) expand on some of the shortcomings of current climate policy processes from a European perspective, "the definition and implementation of energy-climate policies is hampered by the lack of easy-to-use tools to support the decision-making process, and by the scarce concerns and motivation of stakeholders, including citizens,"

(p. 11). Not all the research surrounding CAPs is negative. Basset & Shandas found that participants in the planning process expressed satisfaction with plans because they initiated discussion on community climate action and provided a pathway to local emission reduction. The consensus on CAPs is that although they have high potential for meaningful change, little harm or benefit has resulted from the formulation of current climate action plans (Tang et al., 2010; PCP, 2019; Stone et al., 2012; Bassett & Shandas, 2010; Deetjen et al., 2018; Millard-Bell, 2012).

Like the Canadian literature, significant research has been conducted on factors associated with successful drivers of climate action within the United States. Yeganeh and colleagues (2020) performed a meta-analysis of research on how local conditions affect climate change policy adoption and found that public support was the most impactful variable. They found that "a 1% increase in public support is associated with a 0.91% increase in local government engagement in policy adoption" (Yeganeh et al., 2020, p. 13). Other impactful variables were population size, population density, fiscal capacity, level of education, and political orientation, while manufacturing dependence was the most negatively impactful on climate policy adoption (Yeganeh et al., 2020). Policies would generally receive more support when they resulted in local benefits (Yeganeh et al., 2020). Yeganeh and colleagues (2020) also found a lack of correlation between higher level government leadership and local policy adoption although government leadership has been found to be correlated with adaptation of local policies in previous research (Schipper & Pelling, 2006). Azevedo and Leal (2020) found that there is a lack of statistically significant findings within the literature regarding the effects of local energy actions on emissions reduction required for a thorough, accurate and legitimate assessment on actions to mitigate climate change locally. Azevedo and Leal (2020) refer to any factors that

have the potential to reduce emissions as factors of change, although in their context they are specifically referring to changes within local energy systems.

This literature review finds that potential exists for meaningful and implementable progress because of municipal CAPs but that improvements to the process are needed because current CAPs have not led to significant change. The drivers and barriers to climate action revealed in the literature can provide insight on how to make CAPs more effective. Since research is almost non-existent on municipal CAPs outside of British Columbia in Canada, future research efforts could be directed to this area.

Prioritization Within Municipal Climate Policy

Policy prioritization is one component of the climate policy process. For the purposes of this paper, prioritization is defined as the valuation and hierarchal ordering of climate action initiatives, or the goals/targets/actions outlined in municipal climate plans. Climate policy prioritization can aid governments in producing an urgent yet effective response to the climate crisis (Boussalis et al., 2019; Westin et al., 2018). Prioritization is particularly valuable in situations characterized by scarce resources where not all climate policies or initiatives can be implemented. Table A1, displayed in Appendix A summarizes established frameworks and tools designed or adapted to guide policy prioritization, gathered from international academic and gray literature since Canada does not have significant literature on these processes.

The frameworks/tools as outlined in Table A1 have emerged in various contexts and there appears to be relatively little emphasis on prioritization in “developed” countries. However, since no country is exempt from limitations on resources, particularly time, funding and staffing, these tools should not be limited by geography or Gross Domestic Product. Most of the tools

utilize a multi-criteria analysis in which various criteria are weighted and ordered based on stakeholder/group input and consensus. Only three of the tools were exclusively designed for climate policy prioritization while the other tools are adapted and applied from other areas such as management and business. The frameworks/tools outlined in Table A1 largely exclude explicit considerations of urgency, justice, and equity. Many of these frameworks/tools also require significant levels of training and involve many different steps, as displayed in Figures A2 through A4 in Appendix A, which is not conducive to effective utilization in emergency or crisis situations.

In the interviews, participants were questioned regarding the presence and characteristics of prioritization in the CAP's in WR. Most participants were not familiar with the examples of established prioritization frameworks provided in Table A1. One participant had participated in SWOT and PEST analyses and another participant participated in a SWOT analysis during informal group discussions. Most participants refer to an initial set of priorities being determined by external consultants/groups of experts. One participant mentioned that over 100 subject matter experts in WR and abroad were consulted for the 2021 CAP in WR.

Some participants discussed their experiences narrowing down the expert/consultant-recommended strategies that would be incorporated into the final plans. One participant mentioned political concerns as being the main determinant for prioritization, but another participant disagreed with this. The same participant mentioned that plan priorities were directly correlated with the highest areas of emissions (e.g., most emissions come from transportation sector, so this was the highest priority in the 2021 plan) and that a *back casting* approach was utilized in which the desired end state was determined at the outset of the planning process and planners worked backwards to incorporate priorities that would achieve the end state. One other

participant also mentioned utilizing a *back casting* approach. Another participant mentioned concepts of ownership and reduction potential as being key determinants.

Most participants agreed that the strategies that had been incorporated and prioritized in the plans were appropriate, although numerous participants stated that some priorities had been excluded (e.g., food/diet). One participant stated that although food/diet are large contributors to climate change, they are difficult to address at the municipal level. The experiences of interview participants reveal low levels of knowledge or familiarity with established climate policy prioritization frameworks. There is a burgeoning body of academic literature on climate policy prioritization as outlined below but it appears that these theories have not emerged as influential in the CAP process in WR.

There is a lack of consensus among the literature as to which criteria are most appropriate to utilize when conducting climate policy prioritization. Pietrapertosa and colleagues (2014) suggest that cost-effectiveness, energy & emissions reduction potential, economic feasibility and return on investment should form the pillars of prioritization framework and that these tools be "user-friendly, open-source and easily transferable to energy planners, policymakers, and local administrators, after a short hands-on training," (p. 2). Cost Benefit Analyses (CBA) are a popular assessment framework utilized by governments in decision making to weigh impacts and costs. Ortega and colleagues (2014) argue that prioritization frameworks should be integrated into CBAs to greater determine impacts and relevance, "the assumption of a finite budget, in time and/or human and monetary resources, necessitates some prioritization of which impacts to bring within the CBA," (p. 7946). In his dissertation, Lutsey (2008) formulates a prioritization framework integrating cost of technology, energy saving benefits over lifetime and emissions reductions. In their 2018 paper, Westin and colleagues developed a framework to aid in

prioritization in Sweden, allowing for easier adoption by municipalities which quantifies results in the form of emissions reduction potential rather than a Multi-Criteria Decision Analysis which must take numerous factors into consideration.

Boussalis and colleagues (2019) analyzed close to 3000 press releases between 2010 and 2016 from eighty-two American cities to determine how municipal governments prioritized climate change issues when communicating with residents. Prioritization varied based largely on residents' political affiliations, "more liberal cities have a higher tendency to discuss climate actions and in several instances the effects are sizable" (Boussalis et al., 2019, p. 14). Boussalis and colleagues also found that when a high climate risk or sense of vulnerability is present, cities are more likely to prioritize climate resiliency. Chapman and colleagues (2018) argue that considering co-benefits, such as social equity and energy justice when making climate mitigation and prioritization decisions can reveal positive impacts that would not emerge in traditional approaches focusing exclusively on economic performance and emissions reduction. "Through the incorporation of social considerations and of energy justice ideals, energy policy decision making can be influenced to engender not only a more efficient, but also a fairer energy system transition toward renewable energy alternatives" (p. 196). Chapman and colleagues suggest that quantification of social equity may increase the likelihood of consideration of equity within the policy and decision-making realm.

Economic or cost concerns and emissions or energy reduction potential dominate much of the literature concerning municipal climate policy prioritization, but more recent literature suggests that considering other factors such as equity and justice may produce additional benefits in climate mitigation and adaptation. This literature review has contributed to the selection of the three criteria that will be utilized in the framework outlined in Section Two and has displayed

that climate policy prioritization is not commonly used in Canadian municipalities but that it has potential to be useful. Municipalities faced with climate change-induced severe weather events, scarce resources because of the COVID-19 pandemic and demands to increase equity may find that climate policy prioritization can facilitate the selection of the most effective, efficient, and just policies for implementation when it is impossible to enact all desired policies.

Concepts of Equity and Justice Within Municipal Climate Policy & Planning

In 1987 the United Nations released the Brundtland Report which outlined three pillars of sustainability: equity, ecology, and economy (World Commission on Environment and Development, 1987). Fast forward to three decades later when 196 countries negotiated, collaborated, and adopted the Paris Agreement in 2016 and "despite strong references to justice, human rights, and equity in the Paris Agreement's preamble, the concept of equity is largely absent from its substantive components," (Klinsky et al., 201 Krueger 6, p. 1; United Nations, n.d.).

A similar trend displaying a lack of substantive equity content and action has been observed in municipal CAPs (Dobai, Reimer, Dreyer, 2020; Krueger & Gibbs, 2007). Resistance to incorporating equity and justice concerns into climate change policy and research is evident, based on the rationale that equity concerns would decrease climate research quality, distract researchers, and result in a trade-off between environmental and equity concerns in which the latter would be prioritized (Klinsky et al., 2016). Klinksy and colleagues (2016) counter these arguments, maintaining that "by excluding equity we risk ignoring, or willfully omitting, the implications of decision-making on those who are most vulnerable and are most likely to face severe costs of any action (or inaction)," (pp. 2-3) and for some communities e.g., the global community, "there is not a trade-off between equity and climate action: climate action is

necessary for survival, which is surely included in the realm of equity," (pp. 2-3). Klinksy and colleagues also point out that "without including equity in the analysis of policy decisions, the actual implications of trade-offs for diverse individuals and groups cannot even be identified," (pp. 2-3). Only recently has it become common for conversations around climate change to include concerns around climate justice and equity in climate action planning (Dobai, Reimer, & Dreyer, 2020).

Various authors and governments tend to utilize an array of terms in the climate change justice and equity literature, so it is useful to distinguish between some common concepts as displayed in Table A2 in Appendix A. In this paper, the term climate justice designates a goal state that society should be working towards while equity designates both a means to achieving the goal of justice, while also serving as a goal that can only be realized when justice is achieved on a societal and systemic level (Mobilize Green, 2021; Manzo, 2021). In latter sections of this paper, equity is the term used most frequently but it is used to represent a pathway to a society characterized by climate justice and sustainability justice as defined in Table A2. A brief overview of climate justice and equity is provided below.

Climate Justice & Equity at the Local Level

White-Newsome (2016) finds that climate justice arose out of the broader environmental justice movement that emerged in the 1970's as a to response environmental racism. Climate justice demands the development of policies and interventions focused on human & moral dimensions of the climate crisis (Shepard & Corbin-Mark, 2009; White-Newsome, 2016). Climate justice calls for a re-examination of how consequences of the climate crisis such as pollution, energy costs, and resource extraction are disproportionately experienced by racialized and indigenous communities, women, and populations with low socioeconomic status (Shepard

& Corbin-Mark, 2009; Perkins, 2019). Various principles of climate justice are outlined by Perkins in greater detail in Table A3 in Appendix A.

According to one definition of equity in the context of local climate action planning, "creating equity means ensuring the fair distribution of negative and positive impacts of climate action across different groups of a city's population," (Porteron et al., 2020, p. 18). This definition differentiates inclusivity from equity, defined as the "practice of including relevant stakeholders in the policy-making and urban governance process, particularly disadvantaged groups, in order to create equity and ensure a fair policy process with successful outcomes," (Porteron et al., 2020, p. 18). For the purposes of this paper these concepts are both incorporated under the larger umbrella of equity.

In 2009, Shepard & Corbin-Mark pointed out that vulnerable communities face greater risks from the climate crisis because they are "the first to experience extreme heat events, respiratory illness, vector-borne infectious diseases, food insecurity, and natural disasters, (p.163)." One example of the manifestation of climate injustice is energy burden, where lower income households pay a larger proportion of their income for energy costs (Ribeiro et al, 2020). "Compared with white households, Hispanic households' energy burdens were 24% greater on average, while Black households' energy burdens were 64% greater on average," (Drehobl and Ross 2016 in Ribeiro et al, 2020, p. 60). The COVID-19 pandemic has crystallized many of these disparities, by disproportionately resulting in higher morbidity and mortality rates in poor and racialized communities (Patel et al., 2020; Kim & Bostwick, 2020). Understanding what the climate justice movement entails is essential, but it is also important to outline how upholding principles of climate justice will manifest in the climate action planning and policy environment.

Climate policies often directly or indirectly exclude or neglect the concerns of vulnerable communities as expressed by Ribeiro and colleagues (2020), "historically, people of color and those with low incomes have been denied access to the resources that would allow them to address these vulnerabilities or move to less vulnerable locations," (p. 60). White-Newsome (2016) argues that for climate justice to be achieved, "robust policies, accountability, and an engaged grassroots community to properly address the impacts of climate change" will be required (p.13). Canadian ecological economist Ellie Perkins (2019, p. 184) argues that climate justice can be achieved through "collective governance systems that prevent privatization and thus maintain livelihoods for entire communities." There are other benefits of the integration of climate justice and equity into climate policy as expanded upon by Klinsky and colleagues (2016):

> Failing to account for the equity implications of policy actions required for rapid decarbonization leaves climate policy efforts vulnerable to attack from such pro-status quo actors as fossil fuel companies, who exploit equity concerns to generate political opposition to action (p.2).

Equity & Climate Justice in Climate Action Planning

Literature and research regarding the incorporation of equity and climate justice into climate action planning is growing. Dobai, Reimer & Dreyer (2020) recommend the concepts surrounding sustainability justice become "a central aspect of the CAP, rather than an added consideration," (p. 2). In a survey of the CAPs of twenty-eight American cities, Schrock, Bassett and Green (2015) found that "only a minority of cities in our sample made equity a prominent theme in their climate and sustainability plans," (p. 286). Angelo, MacFarlane and Sirigotis (2020) analyzed climate action plans of 170 cities/counties in California to identify patterns and trends in how equity was integrated or excluded from these plans. The authors found that plans incorporating equity had been released more recently and were more likely to emerge from cities

with a population of over 124,000 residents, with more racial diversity, larger proportions of registered democrats & residents having more years of education (Angelo, MacFarlane & Sirigotis, 2020). The authors also found that equity was present more often in plans in cities with lower social inequality (Angelo, MacFarlane, & Sirigotis, 2020).

During the interviews, participants were questioned on how equity and justice concerns had been integrated into WR's CAPs. Three participants stated that equity/justice were not considered in the 2013 plan. One participant stated the 2013 plan focused exclusively on measurable emission reduction. One participant mentioned that the 2013 plan resulted in unintended consequences for some marginalized communities which initiated the conversation for the 2021 plan to focus substantially more on equity/justice.

Two participants who were involved with the 2021 plan stated that justice and equity were key considerations throughout the most recent planning process. Equity and justice-based initiatives in the planning process included inclusive community consultations of over 1600 participants, consultations with equity-seeking interest groups (e.g., housing and homelessness, diversity), paid review and focus groups with knowledge holding BIPOC community members and the utilization of an equity-focused advisory consultant group that orchestrated workshops. One participant mentioned that further feedback regarding equity was obtained at the end of the planning process before the plan was released. One participant mentioned that the 2021 plan was conceptualized as a vision for an equitable society. Although the sample size for the interview is too small to make any strong conclusions, it appears that equity and justice concerns have become substantially more influential within WR's most recent CAP as compared to 2013.

Research in academic literature has compiled and proposed a range of strategies to greater integrate equity into CAPs. Angelo, MacFarlane and Sirigotis (2020) identified eleven

social or equity-inclusive solutions that appeared in the CAPs as displayed in Figure A5 in Appendix A. They found that most of the climate change plans in California included social solutions such as public transit, participatory processes and public information and open/recreational green space. They also found that the plans that incorporated explicit considerations of equity were more likely to include the solutions more directly linked to social equity such as high density and affordable housing, pollution and public health, jobs and job training and food production and access.

Angelo and colleagues utilize Wachsmuth and Angelo's 2018 categorization which differentiates these types of solutions as the former being 'green' policy interventions which focus on community quality of life and the latter as 'gray', focusing on systemic policy interventions. Of the plans with equity, sixty-five percent considered affordable housing whereas thirty-six percent of the plans without equity considerations did (Angelo et al., 2020). Angelo and colleagues surmise that there is a reciprocal relationship present where gray solutions lead to increased conversations about equity and provide opportunities "to introduce more systemic social planning agendas, such as affordable housing, into urban sustainability planning" (p. 10). The authors conclude that the increasing prevalence of equity in California's climate action plans is a positive sign but express concern that it may be incorporated at more of a token or boilerplate component instead of significantly reducing local inequity.

Quantitative measures of social equity in climate action planning have also emerged in the literature within recent years. Chapman and Pambudi (2018) state that social equity can be measured from a quantitative perspective by observing the distribution of burdens and benefits of energy policy outcomes and ensuring they are distributed more evenly among households of various income levels. Chapman and Pambudi (2018) also consider the measure of meaningful

participation which “is assessed by observing the change in the future energy system based on end user's participation and energy,” (p. 1015). In a household survey conducted in Japan concerning social equity related to energy, Chapman & Pambudi (2018) found that participants were concerned about safety of energy technologies and the authors suggest that future research include safety as an additional social equity factor (e.g., safety of nuclear power technologies). Angelo, MacFarlane and Sirigotis (2020) make recommendations for future research on equity and CAPS, calling for “in-depth case studies in select cities, to better assess the effects of CAPs, regardless of their language, in addressing actually existing social inequalities,” (p. 11) and suggest this can be conducted through, “interviews with key policymakers about the plans’ development and implementation,” (p. 11).

Dobai, Reimer & Dreyer (2020) make six recommendations regarding integrating a sustainability justice lens into climate action plans in municipalities: frame the plan with sustainability justice, recognize and contend with previous injustices, engage with equity-seeking groups throughout the planning process, ensure stakeholder inclusivity & diversity, focus on equitable distribution of burdens & benefits of plans and integrate reflection & learning time into the planning process. The consideration of equity and justice in municipal climate action planning is growing but still has significant ground to cover to ensure that climate action is inclusive, considers diverse populations and voices, and equally distributes the benefits and burdens of policies across all communities. Integration of equity concerns into municipal climate action planning and prioritization can increase the efficiency and effectiveness of such processes while also ensuring that no populations are unfairly disadvantaged when such policies are enacted. The triage framework proposed in the next section attempts to incorporate equity more significantly into climate action planning and prioritization.

Conclusion

The climate crisis is severely affecting cities, but significant potential exists for cities to engage in meaningful climate action by utilizing evidence-driven strategies advanced by well-informed decisionmakers**.** Municipalities are utilizing CAPs as a tool to mitigate and adapt to climate change but planning and implementation thus far has been largely inadequate due to slow progress, a lack of standardized, reliable, and validated planning frameworks and limited achievement of goals. Research on CAPs in Canada is limited, focusing mostly on drivers and barriers to climate action within communities, municipalities, and regions in British Columbia. International literature on climate action plans proposes that there is high potential for CAPs to lead to meaningful change but thus far, little harm or benefit has resulted from CAPs and improvements are required.

Prioritization can aid CAP formulation and implementation, particularly in municipalities with significant demands and scarce resources, but most existing prioritization models exclude considerations of urgency, justice, or equity and are complex to learn and implement. Considerations of equity and justice have largely been excluded from climate action planning, yet more recently they are emerging as priorities for municipalities. Climate action planning and prioritization could benefit from a streamlined, evidence-based decision-making framework designed for urgent and emergent situations characterized by scarce resources which integrates equity in addition to more traditional criteria. The triage framework proposed in Section Two is a response to the shortcomings in existing climate action planning and prioritization.

Section Two: Theoretical Model

Introduction: The Urgency of the Climate Crisis

Consensus exists among scientists that the earth's mean temperature is increasing, and that this trend is largely attributed to human action (Oreske, 2004; Doran & Zimmerman, 2009; Oreske, 2007; Schneider, 2011; IPCC, 2018). Various surveys conducted in 2006, 2009 & 2020 found that just over half of surveyed Americans and approximately sixty percent of Canadians agreed with the scientific consensus (Doran & Zimmerman; 2009; Oreske, 2007; Canseco, 2020). Drastic intervention is crucial to minimize the unfathomable consequences, some of which are already evident. The global community must face this challenge united, as Gills & Morgan (2019) point out: "What happens in one area of the globe has far reaching, but as yet insufficiently understood, effects upon and consequences for even far distant regions," (p. 1).

In 2015, the formulation of the Paris Agreement took place, with many countries participating in the setting of emission reduction targets to prevent global temperature rise above 1.5 ℃ (Ripple et al., 2020). Canada committed to reduce emissions thirty percent below 2005 levels by 2030, reaching net-zero by 2050 (Meyer, 2019; Environment and Climate Change Canada, 2016). Some scientists argue that it is already too late to meet the Paris Agreement target of remaining below a 1.5 ℃ increase or that this goal is not sufficient to prevent serious detrimental consequences (Gills & Morgan, 2020). As Gills & Morgan (2020) point out, "even 1.5 degrees warming implies setting in motion numerous cumulative effects in the global climate system and on the natural environments and ecosystems that constitute the global web of life," (p. 3). If countries cannot reduce emissions and temperature increase beyond 2℃, consequences will be catastrophic (Gills & Morgan, 2020). For example, at an increase of 1.5 ℃, seventy to ninety percent of the planet's coral reefs will be lost, but at 2℃, the loss is over ninety-nine

percent (IPCC, 2018). Although the Paris Agreement was signed in 2016, global emissions are still on the rise. The highest level of annual carbon dioxide emissions released was in 2017-2018; and cumulative carbon dioxide concentrations in the atmosphere are currently at the highest level ever recorded; in the summer of 2021, portions of Western Canada and The United States experienced record breaking temperatures up to 49.6 ℃, soon after followed by unrelenting wildfires (Gills & Morgan, 2019; BBC News, 2021). Existing global and national level commitments to reduce emissions are not sufficient, yet the planet and its inhabitants will be unable to tolerate delayed action.

Steffen and colleagues have modelled one potential outcome of the climate crisis. This irreversible scenario, known as *Hothouse Earth,* involves extreme increases in temperature leading to societal chaos, and possibly, an uninhabitable earth (Steffen et al., 2018). As temperatures increase, *tipping points* and *feedback loops* become more frequent and more likely. A tipping point can be defined as an irreversible change in state (Gills & Morgan, 2020). A feedback loop is a "cyclical chain reaction that repeats again and again," and "can either amplify or diminish the effects of climate forcings," (drivers of our climate e.g. GHG emissions) (The Climate Reality Project, 2020, paras. 5-6). Many of the changes associated with climate change act as a set of dominos; when the first is knocked over, the rest soon follow. Increasing temperatures are causing over ninety percent of glaciers to melt so that less ice is available to reflect the sun's heat, resulting in greater temperature increases (Gills & Morgan, 2020). Melting glaciers leads to rising water levels which threatens habitats and food security, leading to increases in levels of migration. Forest fires are now the primary source of deforestation on the planet (Gills & Morgan, 2020). Many uncertainties surround these processes, but the interaction

of numerous tipping points and feedback loops will accelerate the physical changes on earth, bringing us closer to the *Hothouse Earth* scenario (Steffen et al., 2018; Gills & Morgan, 2020).

The climate crisis has already resulted in scarcity of resources, particularly time and the need for action to avoid catastrophic consequences is more urgent than ever before. As stated with high confidence in the IPCC's 2018 Summary for Policymakers, "the challenges from delayed actions to reduce greenhouse gas emissions include the risk of cost escalation, lock-in of carbon-emitting infrastructure, stranded assets, and reduced flexibility in future response options in the medium to long term," (p. 18). Many complex political, structural, economic, sociological, and psychological barriers hinder progress within Canadian municipalities (Robinson & Gore, 2005; Burch, 2010; Oulahen et al., 2018). Since some consequences will be faced by future generations rather than those living now, it is convenient to prioritize other issues over the climate crisis (Rode & Tortosa, 2021). Unfortunately, many consequences are already emerging, as discussed below, and decision-makers will likely be forced to choose among policies due to resource scarcity. Ideally, they will enact the most effective and efficient policies. The principles and practices of triage, originally developed for emergency medical situations, may be particularly helpful in the prioritization of strategies, initiatives, and policies to enhance governance, decision-making, and climate action in emergency situations.

Climate Crisis as Emergency

The Emergency Governance Initiative (2020) defines an emergency as "a situation that poses an immediate and significant risk to health, life, property, or the environment," requiring maximized resources and re-directing efforts to prevent increasing severity (p. 1). Scientists have repeatedly attempted to warn the world of the urgent and emergent nature of climate change in global congregations and letters, including the 1979 First World Climate Conference, the 1992

Rio Summit, the 1992 World Scientist Warning to Humanity supported by over 1700 independent scientists, the 1997 Kyoto Protocol, and the 2016 Paris Agreement (Ripple et al., 2017; Ripple et al., 2014). In recent years, cities worldwide have begun to officially declare that the climate crisis is an emergency.

As of January 2021, climate emergencies were declared by 1864 local governments across thirty-three countries (Climate Emergency Declaration, 2021). Medical professionals have also responded by publicly acknowledging the emergent nature of the climate crisis as many of the consequences of climate change are developing into health-related emergencies (Solomon & LaRocque, 2019). The climate crisis is resulting in increased pressure on the healthcare system from an upsurge in burn patients due to increasing wildfires, greater prevalence of insect-borne diseases and increasing air pollution due to fossil-fuel-released particulates (Solomon & LaRocque, 2019). A recent report from the Canadian Institute for Climate Choices found that without immediate action, the climate crisis could lead to a public health crisis which will affect the most vulnerable sections of society (Clark et al., 2021). This crisis could cost the Canadian government billions of dollars due to productivity losses and deaths from increasing heat, Lyme disease, and greater concentrations of ground-level ozone which contributes to air pollution (Clark et al., 2021).

The climate crisis is also having a detrimental effect on mental health. A 2020 study from the United Kingdom found that people who had experienced personal consequences resulting from extreme weather events were fifty percent more likely to struggle with mental health issues such as depression (UK Environment Agency & Department for Environment, Food & Rural Affairs, 2020). This effect was still present two years later in one quarter of people who had

experienced floods (UK Environment Agency & Department for Environment, Food & Rural Affairs, 2020).

The climate crisis is a unique type of emergency which will require innovative strategies and solutions to prevent it from becoming more severe. Addressing the climate crisis through an emergency management perspective provides insights as to why it is such a challenging emergency to manage. Schneider (2011) conceptualizes the climate crisis as a "multifaceted, multi-event, prolonged, high probability, high-impact global disaster," (p. 56). Rode & Tortosa (2021) categorize emergencies by type and designate the climate crisis as a *complex global emergency* characterized by uncertainty, long-term challenges, and complicated political features (Rode & Tortosa, 2021).

Complex global emergencies have "limited direct experience-ability" of the emergency, meaning the individual, community, or regional experience may not accurately represent the scope of the emergency, resulting in a reduction of people's perceptions of danger (Rode & Tortosa, 2021, p.12). For example, twenty of the highest emitting countries in the world have exceptionally low vulnerability to climate crisis consequences, whereas eleven moderate/low emitting countries are highly vulnerable to such consequences (Althor, Watson & Fuller, 2016). Therefore, the high emitting countries are less likely to experience the scope or perceive the danger of the consequences of the climate crisis even though they are most greatly contributing to it. Any beneficial effects of the actions to tackle complex global emergencies are more likely to pay off in the long-term, so it is harder for individuals or groups to see the benefit of such actions, particularly when it is requested that sacrifices be made now for benefits later (Rode & Tortosa, 2021).

Schneider (2011) expands on the above characteristics: “It is happening over an extended time frame, in slow motion compared with every other natural disaster within our memory and is deceptively un-urgent at its onset while potentially more damaging than anything known,” (p. 56). Navigating the complex nature of the climate crisis to develop insights on strategies and solutions can be challenging. Analyzing and extracting lessons from a different complex global emergency may provide further insight on enhancing the effectiveness, efficiency, and equity of strategies to result in meaningful climate action.

Lessons from the Pandemic

Rode & Tortosa (2021) provide another example of a complex global emergency; the 2019 Novel Coronavirus Pandemic (COVID-19). It has become apparent since early 2020 that rapid and momentous government action in an emergency is possible, as evidenced by the response to the COVID-19 pandemic. The shared characterization of the pandemic and climate crisis as complex global emergencies illuminates similarities between these events in which strategies for coping with one can also be applied or adapted to the other. The pandemic is also characterized by “limited direct experience-ability,” since many people complying with pandemic restrictions (e.g., mask wearing, working from home, lockdowns, etc.) may never have had personal experiences with the COVID-19 virus (Rode & Tortosa, 2021, p. 12). The benefits of complying with such measures may not be experienced for some time, increasing the challenge associated with making sacrifices now for benefits later (Rode & Tortosa, 2021). The shared characterization of the pandemic and climate crisis as complex global emergencies also illuminates errors and oversights regarding the management of the pandemic, from which lessons can be learned to improve management of the climate crisis.

In 2006, Canadian health officials released *The Canadian Pandemic Influenza Plan for the Health Sector,* as a response to the SARS virus outbreak in 2003 (Tomlinson & Roberston, 2020/2021). This report was co-authored by Theresa Tam, the current Chief Public Health Officer of Canada (Tomlinson & Roberston, 2020/2021). This report envisioned a hypothetical flu virus outbreak based on previous pandemics and made recommendations for the federal government to stockpile personal protective equipment (PPE) and other medical supplies (Tomlinson & Roberston, 2020/2021). In 2010, shortly after the H1N1 swine flu scare, an audit was performed to take inventory of the National Emergency Strategic Stockpile (NESS), revealing that "public-health officials across the country weren't certain what exactly the stockpile contained," and "the audit flagged a particular problem with shoddy record-keeping, saying it was unclear how much of the stockpile was up to date, and how much of the goods had expired," (Tomlinson & Robertson, 2020/2021, paras. 41-43). These issues were never addressed prior to the COVID-19 pandemic (Tomlinson & Robertson, 2020/2021).

There is likely a plethora of reasons explaining why the federal government did not heed the warnings that resulted from the investigations they had commissioned, and it is not within the scope of this paper to explore these. Looking back, it is disconcerting that even with efforts of pandemic preparation and identification of shortcomings, 26, 336 lives were lost during the COVID-19 pandemic as of July 5th, 2021, because these plans and shortcomings were ignored (Ritchie et al., 2020/2021).

Turning to the climate crisis, research, and literature regarding management of the crisis is robust. As with the pandemic, efforts at climate crisis preparation and identification of shortcomings within governance have been documented. Local governments have an opportunity to minimize harm, decrease lives lost and reduce the likelihood of greater failure regarding the

climate crisis. The following portions of the paper illuminate how principles and practices within emergency triage can enhance local-level decision making in the complex global emergency that has yet to be significantly acted upon, the climate crisis.

Triage

Background

The word triage originates from the French word trier meaning *to sort* (Kennedy, 1996). Traditionally, triage refers to the "sorting of patients for treatment priority in emergency departments (EDs) and in multi-casualty incidents, disasters, and battlefield settings" (Iserson & Moskop, 2007a, p. 275). The first use of triage occurred in the late 1700's and early 1800's by the chief surgeon of Napoleon's Army (Jenkins et al., 2008). Triage was further honed and developed throughout the American Revolution, World War 1, World War 2, and the Korean War (Jenkins et al., 2008). The use of triage eventually spread beyond conflict situations to multi/mass-casualty events and hospital settings, particularly emergency rooms, and intensive care units (Kennedy, 1996). Triage is far from ideal, as it inevitably results in exclusions, but when resources are scarce it acts as an invaluable guide to ensure rational, reasoned, and ethical decision making (Jones et al., 2014; Kennedy, 1996; Jenkins et al, 2008; Iserson & Moskp, 2007a; Iserson & Moskop, 2007b).

At its most basic level, triage attempts to establish morally and ethically sound guiding principles for prioritization of patients in any situation in which the need or time for treatment surpasses available resources. As expanded upon by Jones and colleagues (2014), "the use of an objective triage tool helps to provide a systematic approach to a very stressful and emotionally challenging triage process," (p. 417). There have been a variety of triage models developed over the years, but most contemporary models categorize patients based on their requirements for care

from highest to lowest priority with four or five similar categories designated by colors: emergent/immediate as red, urgent/delayed as yellow, nonurgent/minimal as green, death and/or expectant as black (Kennedy et al., 1996; Iserson & Moskop, 2007a; Lerner et al., 2008). The system is designed to be embedded into the mind of the professional performing triage (triage officer) so that delays in decisions are minimized (Kennedy, 1996). Components of triage differ depending on the context triage is utilized in (Kennedy, 1996).

A mass/multi casualty incident is "an overwhelming event, which generates more patients at a time than locally available resources can manage using routine procedures" and can result from a variety of events including but not limited to natural or human-caused disasters, motor vehicle collisions or intentional killing sprees (Lomaglio et al., 2019, p.1). This type of incident requires a unique triage process that differs from hospital or military conflict triage. This incident requires rapid decision-making which tends to be less informed, and "the emphasis shifts from ensuring the best possible outcome for each individual patient to ensuring the best possible outcome for the greatest number of patients," (Lerner et al., 2008, p. 25). Components of mass-casualty triage will largely inform the triage framework for climate crisis policy & planning. One of the greatest challenges in dealing with multi-casualty incidents is the potential limitation of resources, like the shortage of financial resources, staff and time faced by local governments planning effective climate action (Jenkins et al., 2008).

Numerous models of multi-casualty triage have been developed over the years. Prior to 2008, Jenkins and colleagues (2008) found that seven mass-casualty triage algorithms existed but noted these tools were not evidence-based, had not been tested in mass-casualty settings and were characterized by the "lack of a standardized mass-casualty triage system that is well validated, reliable, and uniformly accepted," (p. 3). In 2008, Lerner and colleagues attempted to

combat that problem by reviewing & evaluating existing triage algorithms and developing a standardized national triage guideline intended to be utilized across The United States called SALT (Sort, Assess, Life-saving interventions, Treatment and/or Transport) (Lerner et al., 2008). This model aimed to "decrease confusion, ensure timely and accurate care in the field, and improve destination decision making," (Lerner, 2008, p. 31). In 2018, Bazyar, Farrokhi & Khankeh conducted an international literature review of triage systems, identified 20 different triage systems, and found there is still no widespread consensus on which triage algorithm is the most effective. Bazyar, Farrokhi & Khankeh (2018) conclude that since it is difficult to conduct good quality, randomized, and controlled research during real-world disasters to truly determine the ideal method of triage, a triage algorithm is most effective when it is easy to use but also avoids errors.

The importance of accurate, reliable, and valid triage methods is crucial due to the risk of overtriage and undertriage. Undertriage occurs when patients have significant injuries that would benefit from immediate care but are neglected or their care is delayed (Jones et al., 2014). Overtriage occurs when immediate care and resources are directed to patients whose care could be delayed which "can distract the attention of providers from others who may need it, can consume scarce resources unnecessarily, and may delay transport unnecessarily for patients at a triage level below the overtriaged patients," (Cone et al., 2009, p. 538). Overtriage is preferable in situations such as hospital triage, where you would rather classify a patient as being in a more acute position than they are, but in multi-casualty triage it can be dangerous to overuse scarce resources (Cone et al., 2009). The risk of undertriage and overtriage must be kept in mind when planning triage algorithms to increase overall accuracy and effectiveness of the triage process. Characteristics of multi-casualty triage are similar in nature to the contemporary situation local

governments find themselves in while trying to cope with planning effective, efficient, and equitable climate policy. Although triage is traditionally used in a medical context, there have been previous adaptations of triage principles to other contexts, which help to inform this triage-based framework.

Principles of Triage Outside the Medical/Military/Disaster Context

Triage is traditionally a concept used within medical and conflict situations but there are numerous instances of the concept being used in other fields. Some of the earliest examples emerge from American papers published in the 1980's. Marcuse (1982; 1985) and Daniels & Lapping (1987) apply triage in the context of cities, arguing that triage should be utilized to exclude portions of cities that are considered in decline from city-supported services since it is not efficient for the cities to continue to support urban areas when the city cannot meet the needs of those areas. Hess & Greer (1986) take an educational perspective, arguing that students are being triaged into high or low performing schools based on their level of "preparedness". In a paper published in 1990, Stoffle and Evans expand on the concept of *cultural triage.* Stoffle & Evans found that when indigenous communities in the United States were consulted in environmental assessments for future development projects, they often had two responses. The indigenous populations responded with holistic conservation, not wanting any of their land to be utilized or through cultural triage, a term "selected because it seems to convey the emotional cost inherent in choosing among cultural resources, all of which are equally valuable in traditional terms when they are forced to give up components of their culture" (Stoffle & Evans, 1990, p. 95).

Numerous articles and books outline triage usage in species conservation (Towns & Williams,1993; Bottrill et al., 2008; Lawler, 2009; Arponen; 2012; Schneider, Hauer & Boutin,

2010; Gilbert et al., 2020), landscape healthcare (Hobbs & Kristjanson, 2003) and in adaptation strategies for landscape preservation in Natural World Heritage Sites (Perry, 2015; Perry, 2019). Perry, 2015 (in Perry, 2019) summarizes the value of triage from an ecological or conservation perspective, "triage guides allocation of conservation resources such that scarce resources are allocated to maximize persistence of features that will disappear without conservation action," (p. 9). Attempts to integrate triage with policy in an urban, educational, or cultural context have not gained popularity over the decades but the use of triage in an ecological context has grown.

Some scholars and researchers have been exploring the moral, ethical, and practical suitability of applying or adapting triage to the climate crisis (Sachs, 2014; Mckinnon, 2011; Hsu, 2020; Gattie, 2020; Victor, 2011). Sachs theorizes that since the earth's atmosphere can only absorb a finite level of emissions, this ability should be conceptualized as a scarce resource necessitating governance through international agreements (2014). Triage should be used to determine how this scarce resource will be allocated globally (Sachs, 2014). Mckinnon agrees that atmospheric capacity is a scarce resource, but views triage as a strategy to create order in the post-climate crisis inaction doomsday scenario like *Hothouse Earth* described previously. Mckinnon states, "principles of triage are an application or interpretation of a background theory of justice in unusual, often temporary, nonideal circumstances" and concludes that although principles of triage are not synonymous with principles of justice, they are justified, and not only in terms of efficiency (Mckinnon, 2011, p. 110).

In the book *Preparing for a Changing Climate,* Victor argues that although many countries are integrating climate crisis adaptation strategies into policy and governance, "some triage will be needed where adaptation is impossible or prohibitively expensive", particularly in developing countries (2011, p.166). Victor (2011) views triage as a last resort to be utilized once

the earth has undergone irreversible damage. Rather than utilizing triage principles to establish order and justice in a *Hothouse Earth* scenario, Victor outlines geographic triage in which certain countries and ecosystems are prioritized while others are completely abandoned (2011; Steffen et al, 2018). Gattie (2020) recommends using principles of triage to establish an international system where all nations pool resources and direct them to regions facing the greatest threats. Gattie argues that the current nationally determined contributions to reduce emissions under the Paris Agreement are insufficient to keep global temperature increases under 2°C, pointing out that many countries emissions are still on the rise (2020). Gattie proposes a regional technical triage or greatest needs approach where the international community collaborates to focus initiatives on countries where emissions continue to rise and to assist those nations facing the greatest threats from climate change (2020).

Hsu (2020) also proposes a globally collaborative approach which alternatively focuses on using triage concepts to cope with the shortages in natural resources resulting from climate change through the establishment of a resource trust as a last resort supplier of essential resources in times of scarcity. Hsu (2020) argues that governments should establish funding to acquire the rights to natural resources required for human life (e.g., water) to establish these trusts now to avoid future conflicts particularly spurred on by economic inequality if the climate crisis does inevitably result in a scarcity of essential resources. Based on the research thus far, no evidence has emerged of a framework based on principles of triage to aid in the planning and implementation of climate policies and initiatives among local or regional governments.

Triage and Climate Crisis Policy

This section will provide the rationale for using triage as the basis of a climate action prioritization framework. Iserson and Moskop (2007a) have determined that the use of triage in a medical context requires the existence of three conditions.

1. **Healthcare resource scarcity** which can be from minor to severe depending on the nature of the multi-casualty incident. If there are enough resources or if there are absolutely no resources, then triage will not be required.
2. **Presence of a health care worker designated as a triage officer,** who briefly examines each patient to determine needs**,** through face-to-face assessment also known as microallocation. This process is unique to triage since most essential decisions regarding healthcare resources are made through administrators or legislation which is distanced from the actual patients through macroallocation.
3. **Utilization of "an established system or plan, usually based on an algorithm or a set of criteria**" (p. 275) to decide how patients will be prioritized and treated. This rule is also unique to triage within the healthcare system as it "distinguishes triage from purely ad hoc or arbitrary decisions about distribution of health care resources" (p. 275).

According to Iserson and Moskop (2007a), when the above three conditions are met, triage in its primary form is occurring. Iserson & Moskop (2007a) also state that most of the time triage is used within healthcare, but it is never explicitly stated in any literature that the concept cannot be used outside of healthcare. Theoretically, if the above three conditions are met in the field of climate crisis policy and planning or in any other field, than triage can be utilized within this decision-making process to ensure the greatest good for the greatest number of people, similar to the application within multi-casualty incidents.

Iserson and Moskop's (2007a) three conditions can be applied to climate crisis policy planning as follows:

1. ***Local government*** **resource scarcity.** Local governments do not have enough time, capacity, or funding to enact all climate policies and plans that would be beneficial and this scarcity has become more pronounced since the onset of the pandemic.
2. ***Stakeholders and/or decisionmakers*** **designated as** ***policy*** **triage officers briefly** ***yet thoroughly*** **examine each** ***policy*** **to determine if an acceptable degree of** ***emission/energy reduction, cost-efficiency, and equality are present.*** The role of policy triage officer could be fulfilled by a wide variety of professionals employed by local governments and/or highly engaged stakeholders that would be trained in the principals and procedures of the triage process, framework, and algorithm. Ideally, this is conducted by numerous people within a group, but this can be performed by one triage officer when resources are limited.
3. **Use of "an established system or plan, usually based on an algorithm or a set of criteria**" (p. 275) which does not currently exist but what this paper attempts to establish based on multi-casualty incident triage.

Kennedy and colleagues outline several additional points that provide a more comprehensive understanding of triage. In the next section these concepts will be adapted to the realm of climate policy planning.

1. **"One of the goals of triage should be to <u>diagnose critical injuries requiring lifesaving treatment in the shortest possible time</u>. To this end patients are categorized into groups to determine their priority for treatment…"** (Kennedy et al., 1996, p. 140;

Frykberg & Tepas, 1988). Minimizing time spent on decision making is essential to increase time spent providing lifesaving care.

2. **Patients are not solely prioritized by the level of severity of their injuries or medical condition. Patients are sorted under the assumption <u>that those prioritized have the greatest potential to benefit from the treatment received</u>** (Kennedy et al., 1996). This occurs when the likelihood of preservation of life is deemed low or when the need for resources for one instance is deemed too high as in the multi-casualty scenario that has been the focus thus far (Iserson & Moskop, 2007b). The goal is not to have the best outcome for each patient but to have the best outcome for the greatest number of patients.
3. **"Triage should be a tool by which a seemingly unmanageable, overwhelming situation can be organized."** (Kennedy et al., 1996, p. 140).
4. **Triage is not only a process to ensure individuals lives are saved but to prevent systems from being overburdened (Kennedy et al., 1996).** As Kennedy and colleagues (1996) point out, control of the scene is necessary to avoid bystanders/victims transporting themselves or other patients to hospitals. Although self-transport by victims helps reduce the workload of the triage officer, it worsens the burden for the hospital system at large as there is no rationale behind who is transported to which hospital.
5. **Triage is a dynamic process** (Kennedy et al., 1996) As triage is underway, patients must be continuously reassessed, and their level of severity may be reassigned. As expanded upon by Bazyar, Farrokhi & Khankeh (2018, p. 492), "the fact that triage categories should not be considered permanent is of particular importance. After initial sorting, patients may not remain in that particular category during the incident." Patients should be continuously re-evaluated as much as resources permit.

6. **"Correct triage is crucial and has a profound effect on the management of disaster victims. Therefore, it is reasonable to assume that triage should be conducted by personnel with appropriate experience" (Kennedy et al., 1996, p. 141).** Since multi-casualty incidents are typically rare, there may be extended periods of time in between actual use of triage. Since these incidents can have such serious consequences if triage is conducted incorrectly, it is important to regularly perform refresher trainings. This concept is expanded upon by Canatan (2020, p. 81), "having experienced experts provide training, conducting drills, and enacting scenarios are suggested to develop healthcare professionals' ethical decision-making and ethics-based triage application skills during triage training."
7. **The goal of triage is to achieve the best outcomes (preserving human life and ensuring systems continue to function effectively) based on the limited resources available (Iserson & Moskop, 2007b).** Outcomes may vary depending on the specific type of triage. For example, as Lerner et al. points out (2008, p. 25) when comparing hospital triage to a multi-casualty incident, "the emphasis shifts from ensuring the best possible outcome for each individual patient to ensuring the best possible outcome for the greatest number of patients," but in a war, the goal is to return soldiers back to the battlefield (Iserson & Moskop, 2007b).

The following concepts utilized in triage literature have been adapted to provide the theoretical background for conceptualization of an efficient, rapid model of decision-making framework to be utilized during the climate crisis.

1. **One goal of triage should be to *identify critical policies which will minimize harm from the climate crisis*. To this end *policies* are categorized into groups to determine**

their priority for *implementation*, (Kennedy et al., 1996, p. 140; Frykberg & Tepas, 1988). Minimizing time spent on decision making is essential to increase time implementing, monitoring, and evaluating climate action initiatives. Governance and policy decision making processes are notoriously slow and political, requiring numerous rounds of revisions, review, and approval until they reach implementation. Canadian municipal policy frequently succumbs to path dependencies (as discussed in Section One) upholding the traditional patterns of decision-making often antithetical to sustainability and climate action (Burch, 2010). If local governments can establish a pre-emptive framework for prioritization of climate policy which inherently avoids path dependencies while simultaneously supporting equity, barriers to decision-making and inequities can be reduced. This is particularly relevant since time continues to become a scarcer resource.

2. ***Policies*** **are not solely prioritized by** ***their cost, convenience, or political appeal*****.** ***Policies*** **are prioritized based on their potential** ***to minimize harm to humans and the environment*** (Kennedy et al., 1996). Although there are a variety of policy options related to the climate crisis, the ones that will be planned for implementation should minimize harm to the greatest extent. These policies should be evidence-based strategies supported by robust data and research. Much of the research on effective strategies and solutions to the climate crisis has already been completed or is currently underway by the IPCC and other scientific consensus groups.
3. **"Triage should be a tool by which a seemingly unmanageable, overwhelming situation can be organized."** (Kennedy et al., 1996, p. 140). The climate crisis is perceived by many as alarming and upsetting. Individuals and decision-makers may become overburdened due to the vast array of actions and potential consequences

associated with the climate crisis. A triage-based framework will ensure that the issues facing decision makers and citizens are prioritized and manageable, reducing the perception of being overwhelmed.

4. **Triage is not only a process to ensure *harm to the individuals and the environment is minimized* but to prevent systems from being overburdened (Kennedy et al., 1996).** Other departments within local governments will function more efficiently when a triage framework is established. For example, in the City of Toronto the Environment and Energy Division is largely responsible for reporting on annual sustainability initiatives within the city, but all city Divisions contribute emissions and may be operating their own initiatives to reduce emissions in the city (Environment & Energy Division, 2018). If the main city division in charge of climate crisis policy and initiatives is operating more efficiently due to utilization of the triage framework, other divisions whose work crosses over with climate crisis policy should also adopt the triage framework and operate more efficiently. This may also reduce multiple divisions working on the same initiatives or to identify when there are gaps that no divisions are working on.

   Additionally, this framework should encourage greater co-operation between all levels of governance. Each individual city's or region's climate action initiatives are limited by the policies of the governments at greater regional or national levels (van den Bergh, 2020; Burch, 2010). Ideally, this framework will clarify roles within different levels of government and minimize over-involvement or unnecessary crossover from higher levels of government.

5. **Triage is a dynamic process** (Kennedy et al., 1996). Policy goals and progress should be continuously monitored. Internal and external bodies, ideally integrating diverse

stakeholders from the community, must be assigned to constantly monitor and evaluate progress at least once annually and ideally more often to ensure that resources are continuously being allotted to the most effective policy options based on the most up to date scientific consensus (Schneider, 2011).

6. **Accurate *policy* triage is essential, having a profound effect on the management of *the climate crisis and the wellbeing of individuals and the environment*. *Policy* triage should be undertaken by decision-makers with appropriate experience (Kennedy et al., 1996).**
7. **The goal of triage is to achieve the best outcomes based on the limited resources available (Iserson & Moskop, 2007b).** The goal of this triage-based framework is to minimize harm to individuals and the environment that are already occurring or may occur soon. Local governments can add additional goals or establish their own goals based on local conditions. It is essential that goals be clearly stated and that a majority consensus be present amongst decisionmakers and stakeholders to avoid a *Hothouse Earth* scenario where the only debate is between prioritizing food, water, and life.

Triage minimizes time spent on decision-making, utilizes evidence-based strategies supported by data & research, prevents decisionmakers from becoming overwhelmed, and enhances collaboration between various levels of government.

The triage based decision-making framework is intended to be utilized in *crisis or emergency* situations in which *resource scarcity* is present and *prioritization* of policies is required while local governments are *planning and implementing climate action initiatives*. Since the climate crisis is an emergency as outlined earlier in this paper, it inherently meets the contextual criteria of this framework. The framework is intended to be used in a planning

capacity but can be utilized in an operational capacity if required. As discussed previously, municipal climate action plans often result in no measurable or significant changes and continuing to distinguish planning from implementation may further reinforce this shortcoming.

Other contexts or events in which this framework is useful include those in which there is potential for high impact consequences, instability, uncertainty, and those which require urgency to reduce harm and risks. Typically, government policies are benefit-oriented (i.e., some or all citizens benefit from new or increased services, the environment benefits from stricter environment legislation, corporations' benefit from less regulation, the government benefits financially from increased taxes or decreases in services, etc.). Policies focused on harm or risk reduction exist, but they are less common and may be controversial (e.g., injection sites for drug users). In crisis or emergency situations, the emphasis is on achieving the best possible outcome which is geared more towards a harm reduction approach rather than maximizing benefits. Traditional approaches to local governance, policy and decision-making are not sufficient in crisis or emergency situations but a triage-based framework can aid local governments to prioritize, plan and implement climate action initiatives in situations where resource scarcity is a serious concern.

Climate Policy and Climate Action Initiative Framework (CPCAI)

Triage Algorithm

The triage algorithm SALT outlined in *Triage Background* will be utilized as the foundational algorithm for the CPCAI framework. Although another algorithm, START, is most widely used in the US, and is used in Canada, SALT is the only algorithm that was developed through the review and evaluation of existing algorithms to standardize the triage process through evidence-based research (Canatan, 2020; Bazyar, Farrokhi & Khankeh, 2018; Lerner et al., 2008). SALT

has been evaluated in numerous studies and although not without imperfections, has been found to be relatively efficient and reliable, “The SALT mass casualty triage system can be applied quickly in the field and appears to be safe, as measured by a low undertriage rate,” (Cone et al., 2009). Figure 1 displays the original SALT algorithm and Figure 2 displays the algorithm that has been adapted to represent the CPCAI framework. The remainder of this section of the paper will expand upon the steps of the algorithm.

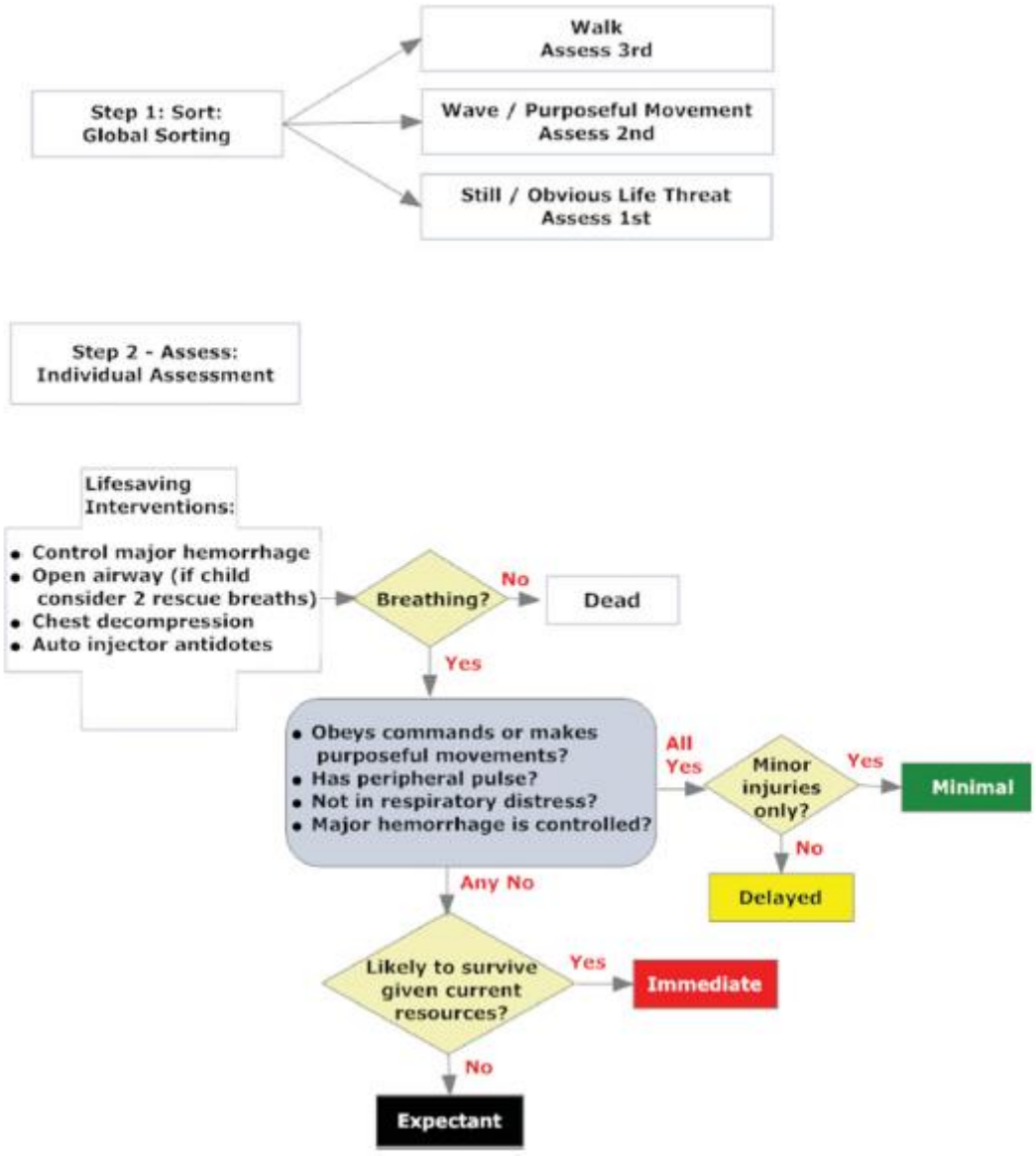

Figure 1: SALT Triage Algorithm (Jones et al., 2014)

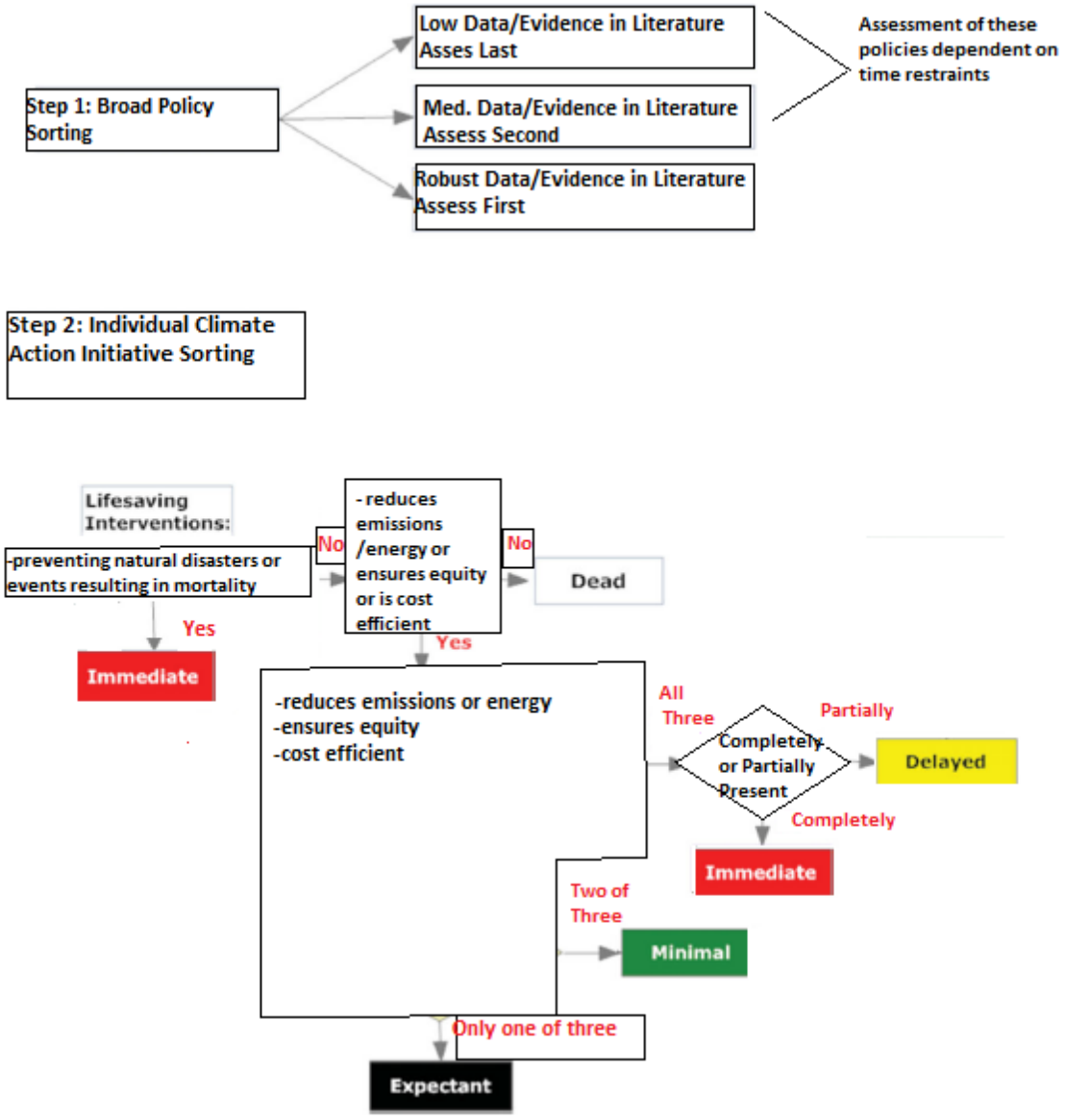

Figure 2: Climate Policy & Climate Action Initiative (CPCAI) Decision-making Algorithm (adapted from Lerner et al., 2008; Jones et al., 2014)

Step 1: Global Sorting/Broad Policy Sorting

In SALT's multi-casualty triage model, the first step is global sorting of patients which is conducted through the verbalizing of commands by the triage officer. First, it is determined which patients can walk, assuming these are minimally injured patients who can be assessed last (Lerner et al., 2008). The second step is to identify those who can wave or make intentional movements but cannot walk and those will be assessed second (Lerner et al., 2008). The third step is to identify those who are not moving or cannot move and assess these patients first (Lerner et al., 2008).

In the CPCAI algorithm, Step One has been adapted into Broad Policy Sorting. This step will decrease the volume of policies and initiatives that local governments must consider. Local governments can group policies and initiatives into three groups based on the level of data and evidence present in academic and grey literature: Robust, Medium, and Low. Considering that time and staff resources may be limited, policies and initiatives with robust data and evidence showing that they have led to or are highly likely to lead to measurable progress should be considered first (Armstrong, 2020). Policies and initiatives with low or medium data and evidence in the literature can be assessed later if resources allow. If policies or initiatives are new and innovative or are characterized by a lack of data or evidence for another reason, they can still be considered in the framework based on having a high likelihood of reduction potential, cost effectiveness or supporting equity. Ideally, this high likelihood will be supported by more than one reliable source.

Policies that have worked in experiments or in a specific place may not translate to another as expanded upon by Porteron and colleagues (2018), "different cities will implement the same action which results in different impacts. These differences are due to all the contextual

factors which define the conditions in which the action is implemented and how the action is implemented" (p. 22). In an exploration of the broad impacts of climate action in various cities, Porteron and colleagues label these influential variables as contingencies and recommend identifying these to avoid utilizing resources to enact policies or initiatives that may not lead to meaningful change.

Step 2: Individual Assessment/Individual Climate Action Initiative Sorting

Life Saving Interventions

The SALT algorithm allows for life saving interventions to be performed prior to the actual triage process and these interventions were chosen because "they can be applied rapidly and can have a profound impact on survival," (Lerner et al., 2008, p. 31). These interventions may change the category that someone ends up being triaged in, for example moving them from expectant to one of the other stages. In SALT triage, these interventions should be performed rapidly. In the CPCAI algorithm, the lifesaving intervention step serves a different purpose. This step prioritizes lifesaving policies or initiatives, resulting in their immediate planning and implementation. Life Saving Interventions will be enacted immediately if they are likely to prevent natural disasters or events resulting in mortality. For example, if using the algorithm to plan for a flood, initiatives to reduce mortality such as altering land-use policies to avoid building in flood-prone areas should be prioritized. These initiatives or policies will generally be from the climate adaptation side and will often focus on resilience, preparedness, and preventative measures. Further examples will be provided in Section Three.

Allocating Triage Classification

In SALT triage, patients are sorted into five triage categories: Minimal, Delayed, Immediate, Expectant and Death. When patients have had any relevant, lifesaving interventions

performed and are still not breathing, they are classified as dead. Since their resource requirement is too high, no resources are directed towards them. When patients (1) follow commands, (2) have pulses in their extremities, (3) are not having difficulty breathing and (4) are not having any major, uncontrolled bleeding they will be designated as requiring *minimal* treatment (minorly injured) or *delayed* treatment (more than minor injuries) (Lerner et al., 2008). When patients are lacking one of those four characteristics discussed in the previous sentence they are classified as requiring *immediate* treatment (will probably survive considering resources available) or death *expectant* (resources will be directed away from these patients) (Lerner et al., 2008). The need for the expectant classification varies as expanded upon by Lerner and colleagues (2008, p. 31), "the expectant category is intended to be resource based and the definition could and should change depending on the magnitude of the incident, available resources, and the provider's level of training and comfort with using the category" and "patients categorized as expectant should be readily identified, reevaluated frequently as resources become available, and have their triage categorization changed as appropriate."

In CPCAI triage, policies are sorted into the same five designations. Three criteria are considered to determine how policy and initiatives should be prioritized. These three criteria are: reduces emissions/energy, promotes, or ensures equity, and cost efficiency. These criteria are further expanded upon below. If a policy or intervention does not meet any of those three criteria it is categorized as *dead* and will not be considered. If a policy or intervention meets only one of the three criteria, it is categorized as *expectant* and will not be considered. If a local government has sufficient resources, it can re-consider policies classified as expectant later. If a policy or intervention meets two of the three criteria it is categorized as *minimal* and can be considered after higher prioritized policies have already been considered, planned, or implemented. If a

policy or intervention meets all three criteria, but only at low or medium levels it is categorized as *delayed* and is considered the second highest prioritized policy/intervention. If it meets all three criteria at high levels it is categorized as *immediate* and should be planned or implemented as soon as possible.

Triage Framework Components

Three components form the criteria of the framework for this research: emission/energy reduction, cost efficiency, and equity. Since the goals of this framework are to prevent decisionmakers from being overwhelmed and minimize time spent on decision-making, the criteria should be relatively familiar, rational, and straightforward.

1. Emission/Energy Reduction

Hoornweg and colleagues (2020) and Hughes (2017) argue that cities have high potential to reduce emissions. Policies enacted in Swedish and German cities between 1967 and 2005 that focused on city infrastructure, public transit, and lifestyle-influencing policies such as congestion pricing or higher prices for parking drastically reduced their emissions (Hoornweg et al., 2020). The presence/absence of emission or energy reduction is utilized in the CPCAI algorithm to prioritize policies.

Municipal CAPs often already incorporate numerous commitments based on emission or energy reduction. Hughes (2017) provides some rationale behind GHG emissions as a valuable measure of climate mitigation effectiveness, "GHG emissions form the basis of city pledges" and "changes in GHG emissions are a politically useful metric: this is the claim decision makers want to make publicly after investing city resources into mitigating climate change," (p. 10). GHG inventories are utilized to identify and report on sources of emissions, allowing cities to focus policies and initiatives on high emitting areas and monitor progress over time (Hoornweg

et al., 2020). Many Canadian and international cities have already established GHG inventories, and some provide regular updates (Hoornweg et al., 2020; Hughes, 2017). To require emissions/energy reduction as one of the criteria for this framework maintains the status quo already established by most municipalities and will not require any substantive change to current strategies/initiatives.

Although focusing on emission and energy reduction is valuable, an overemphasis on these areas can be detrimental, as expanded upon by Hughes (2017), "judging effectiveness solely on the basis of GHG emissions can be misleading" (p. 10). For example, Westin and colleagues (2018) found that significant emissions are reduced when cities provide infrastructure that is supportive of the transition from gas-powered to electric vehicles but manufacturing these vehicles can increase other detrimental effects on the environment including acidification and eutrophication. Westin and colleagues found that an overall reduction of cars on the road was more beneficial to the environment then expanding production and consumption of electric vehicles. Therefore, municipalities should focus on policies which support alternatives to owning and operating a car rather than investing in electric vehicle infrastructure. The authors recommend integrating a cost benefit analysis (CBA) into policy evaluations to determine whether policies with less emission reduction should be implemented based on increased affordability (Westin et al., 2018). This finding demonstrates that a holistic approach to policy prioritization that considers more than just emission reductions is necessary to fully comprehend the pros and cons of policies.

2. Cost Efficiency

Cost efficient policies prioritize initiatives that are considered affordable or minimize costs, that may have net positive costs in the long term and/or that establish independent or self-

funding mechanisms. Determining the cost efficiency of climate policies and initiatives is a complex process. It is often pointed out that although some initiatives have large upfront costs, they may be financially beneficial in the long run as explained by Sudmant and colleagues (2016):

> Firstly, ambitious urban climate actions can be seen as an investment opportunity rather than a cost. The investment needs are significant, and the payback periods are relatively long (at least for commercial investors), but with medium or high energy prices the investments would more than pay for themselves through the direct savings that they would generate (p.686).

Sudmant and colleagues (2016) calculated the costs associated with a collection of eleven low carbon measures in various scenarios of climate mitigation actions within cities. Sudmant and colleagues (2016) found that "the average global investment needs would be approximately $1 trillion per year between 2015 and 2050, which is equivalent to 1.3% of global GDP in 2014," and that the "average payback period weighted by investment value is 16 years and the net present value of the stream of costs and benefits associated with these investments between 2015 and 2050 is $16.6 trillion," (p. 684). Gouldson and colleagues (2018) compared economic case studies conducted in five cities globally and found that by investing $3.2 billion or 0.4-0.9 percent of a city's gross domestic product (GDP) in low carbon measures over the next decade could reduce emissions by fifteen to twenty-four percent over the same period (as compared to business as usual). Gouldson and colleagues (2018) also found that these would be worthwhile investments, "savings generated in the form of reduced energy bills would be equivalent to between 1.7% and 9.5% of annual city-scale GDP, and the average payback period of investments would be approximately 2 years at commercial interest rates," (p. 93).

It is important to consider that the previous estimates do not valuate the additional co-benefits that can arise from emission mitigation measures such as decreased pollution and

reduced traffic (Sudmant et al., 2016). For the purposes of the CPCAI algorithm, no significant monetary or mathematical calculations are required. Decision-makers only need to determine if these policies or initiatives are cost-effective or there is a high likelihood of cost-efficiency based on evidence that already exists in the literature. If no data or evidence exists in the literature, decision-makers can utilize tools that are likely already familiar within the municipal realm such as a cost-benefit analysis or a marginal abatement cost curves which provide "a visualization of the rank order cost-effectiveness and total possible emissions reductions of alternative strategies in a Climate Action Plan" (Kendall et al., 2020, p. 1). Integrating cost efficiency with emission reductions and equity aids in policy prioritization and planning with scarce resources.

3. Equity

Equitable policies prioritize equal distribution of benefits & burdens of climate policy while ensuring inclusion of racialized, marginalized, and vulnerable communities in the planning process. Many consequences of the climate crisis such as pollution, energy costs, and resource extraction are disproportionately experienced by racialized and indigenous communities, women, and populations with low socioeconomic status as discussed in Section One (Shepard & Corbin-Mark, 2009; White-Newsome, 2016; Perkins, 2019).

As discussed earlier in the paper, triage is utilized to minimize harm and ensuring equity in this context means minimizing harm equally to all populations. To ignore equity in these circumstances would directly continue the pattern of systemic exclusion that is leaving so many individuals open to disproportionate harm from climate change in the first place. Incorporating equity may appear to be at odds with the speed and efficiency of the triage framework, but if methods to ensure equity are determined pre-emptively and decision makers are trained appropriately, this should not add significant time to the overall process. Additionally, policies

that ensure equity can have benefits extending beyond the climate crisis, "local investments to mitigate and adapt to climate change, if targeted correctly, have the potential to serve as tools of social and racial justice by tackling longstanding disparities and inequities," (Schrock, Bassett, & Green, 2015, p. 282). It is essential to incorporate diverse viewpoints from the full range of individuals who are affected by climate change to ensure that the policies and initiatives that are planned and implemented will be equally beneficial to all communities, which requires "robust policies, accountability, and an engaged grassroots community to properly address the impacts of climate change," (White-Newsome, 2016, p.13).

Some policies and initiatives will incorporate equity explicitly or inherently within their design. Gillingham, Newell & Palmer (2006) outline how Weatherization Assistance Programs (WAP's) are utilized by the federal U.S. government to "primarily help low-income households pay energy bills through the finance and implementation of residential energy conservation investments that result in corresponding energy savings," (p. 180). WAP's have been found to be associated with emission reduction, cost-efficiency and help to ensure equity by focusing specifically on low-income populations (Gillingham, Newell & Palmer, 2006). Many policies and initiatives will not have incorporated an equity component explicitly and whether equity is present may have to be determined through additional frameworks. There are numerous frameworks or scorecards that have been developed to be used by municipalities to assess equity in climate policy or other policy areas. These can be utilized as part of the algorithm to assess the equity side of climate action planning. Multiple examples are provided below but other frameworks exist which can also be utilized.

The American Council for an Energy Efficient Economy (ACEEE) publishes annual scorecards containing metrics evaluating the energy efficiency of American cities. Components

of the scorecard related to equity are listed in Table B1 in Appendix B. These components are utilized to evaluate energy-related initiatives but can also apply to other areas of climate action planning. Cities can obtain 1.5 points towards their total score for energy efficiency by achieving three equity-related objectives as displayed in Table B2 in Appendix B; increased public engagement with marginalized populations, formal decision-making roles for marginalized individuals and adoption of structural equity procedures (Ribeiro et al, 2020).

Another framework local government could utilize to assess equity is to perform a Racial Equity Impact Assessment (REIA). REIA systemically determines how proposed policies or actions will affect racialized populations to minimize adverse consequences to racialized populations which may otherwise be overlooked and to combat institutional or systemic racism (Keleher, 2009). From a climate perspective, this tool would evaluate community engagement, gentrification & displacement, energy cost burden, economic prosperity, housing, health risks, environmental risk based on geographic location and urban heat island effects for racialized communities (ACEEE Webinar, 2021). The sample questions it entails are expanded upon in Figure B1 in Appendix B. A step-by-step Urban Equity Impact Assessment is outlined in Figure B2 in Appendix B which can be used to analyze how policies address equity (Reckien et al., 2018).

Provided below are some examples of initiatives directed towards integrating equity into the climate action planning process (Ribeiro et al, 2020; ACEEE Webinar, 2021; Clean Air Partnerships Webinar, 2021):

- An *Equity Advisory Group* designed to contribute recommendations for a climate and energy plan

- A *Green Zones Initiative* in which progress is tracked on improving economic and health outcomes in low-income and marginalized communities that have faced high levels of environmental pollution
- A financially compensated environmental justice committee
- Avoiding general meetings in which participants lack equal footing
- Individual risk assessments across various low-income and marginalized communities to identify how risks vary across communities

Incorporating considerations of emission reduction and equity alongside cost efficiency will ensure that local governments are not investing in or planning initiatives which are simply the most affordable or that pay back on investments the most quickly. The triage framework focuses on initiatives which lead to measurable, significant, and cost-efficient change but that are also fair, just, and equitable for all individuals and communities.

Weighting/Hierarchy of Framework Components

Each component of the framework is weighted equally. This could be changed depending on the needs of the party utilizing the framework but ideally it should not as the inclusion of equity as a criterion weighted equally to more traditional criteria is a central tenet of this paper which results in a balanced framework. The hierarchy of the weighting of components is listed as follows and is visually represented in Diagram 1. This hierarchy follows triage principles by disregarding all other concerns aside from these three components (e.g., political concerns are not considered).

1. High Emission Reduction Potential (HR), High Equity (HE), Low Cost ($)
2. Medium Emission Reduction Potential, Medium Equity, Medium Cost

3. HR, HE, High/Medium $$ or Medium/Low HR, HE, Low $, or HR, Medium/Low Equity, Low $ (one component lacks either partially or fully, but the others are upheld)
4. All other scenarios except for 5
5. Low Equity, High Cost ($$$), Low Emission Reduction Potential

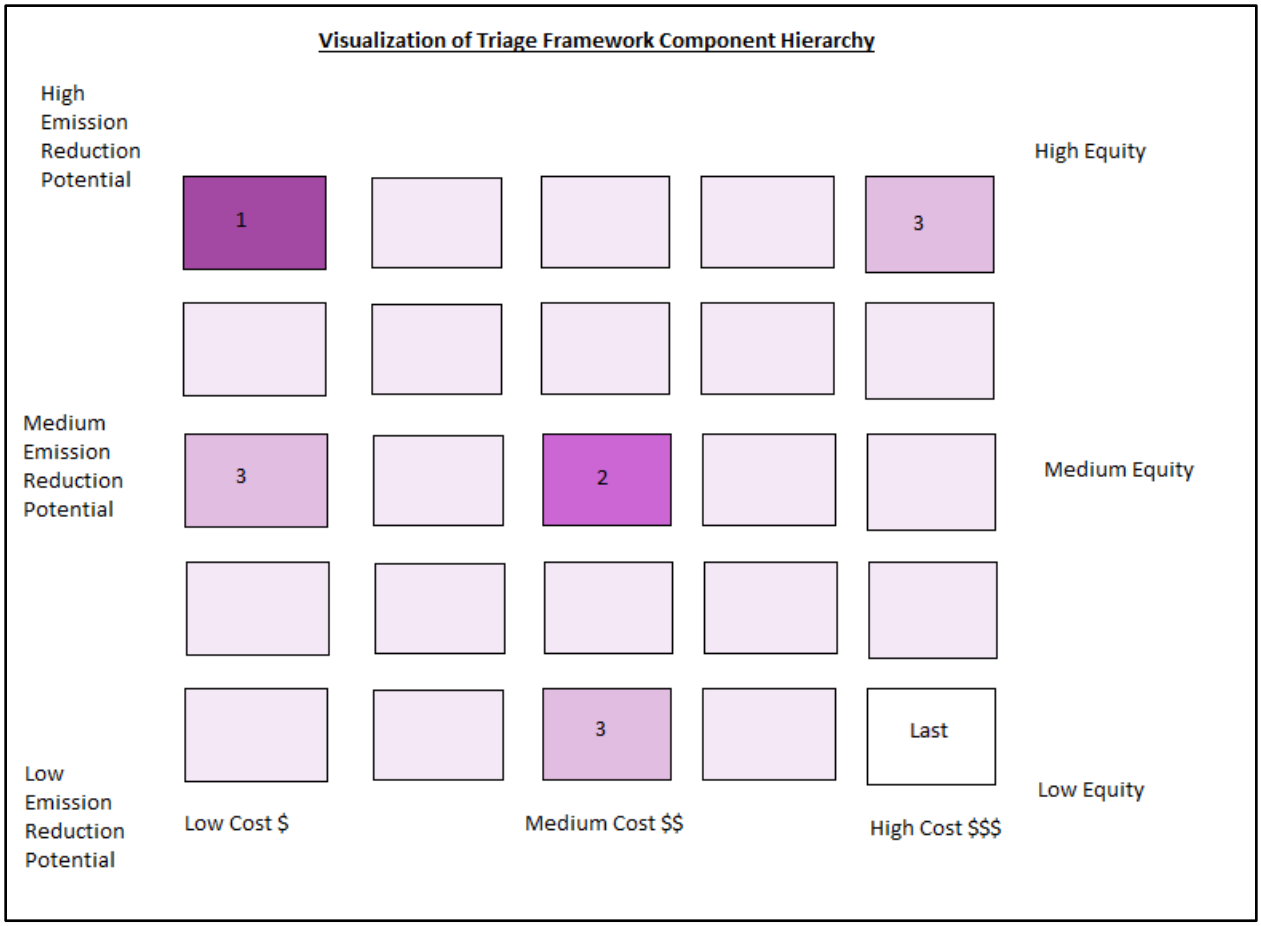

Diagram 1: The hierarchy in the balancing of the three components is indicated in this diagram.

Conclusion

The climate crisis is a unique type of emergency requiring innovative yet urgent strategies and solutions. The Canadian response to the COVID-19 pandemic proved that rapid, momentous, and consequential government action in an emergency is possible. The triage

framework proposed in this Section is a response to the shortcomings identified in climate action planning and prioritization discussed in Section One.

Traditional approaches to local governance, policy and decision-making are not sufficient in crisis or emergency situations but a triage-based framework can aid local governments to prioritize, plan and implement climate action initiatives in situations where resource scarcity is a serious concern. The CPCAI algorithm provides a framework for municipal climate action planning and policy prioritization, where no similar or sufficient prioritization frameworks incorporating urgency and equity currently exist. Weighting considerations of equity equal to more traditional criteria (emission/energy reduction and cost efficiency) will ensure that local governments plan initiatives which lead to measurable, significant, and cost-efficient change while also being fair, just, and equitable for all individuals and communities. Utilizing evidence and data as encouraged by the CPCAI algorithm, the municipal climate action planning and prioritization process can be streamlined to result in meaningful, measurable, and equitable climate action which will be more likely to lead to significant climate mitigation and adaptation in municipalities. Section Three will outline a case study that utilizes the framework and algorithm from Section Two in a real-life scenario.

Section Three: Waterloo Region Case Study

The intention of this case study is to provide an example of how the framework/algorithm presented in Section Two can be utilized within municipalities. The hypothesis is that through the consideration of lifesaving interventions and by weighting equity equally to emission/energy reduction and cost considerations, the resulting prioritized policies and initiatives will be different than the ones that are currently being prioritized. Emphasizing urgency in decision making and acknowledging the climate crisis as an emergency may also contribute to this change in prioritization.

Introduction: Climate Action & Vulnerability in Waterloo Region

Waterloo Region is situated in the Greater Golden Horseshoe of Southwestern Ontario, Canada. Waterloo Region (WR) is comprised of three cities and four townships. In 2019, the region held a total population of 617 870 residents (Region of Waterloo, 2020).

In 2013, WR published a climate action plan (CAP) that established a short-term framework to reduce emissions by 2020. The report emphasizes the importance of climate action at the local level, "for local municipalities, tackling Greenhouse Gas emission reductions is no longer only an environmental concern, but a financial and a health care imperative that impacts the development and maintenance of prosperous, sustainable communities," (Climate Action WR, 2013). The 2013 CAP aimed to reduce six percent of emissions by 2020, and the region also set a long-term goal to reduce emissions 80% by 2050 (below 2010 levels). In 2019, Climate Action WR received a grant from the Federation of Canadian Municipalities to aid in the development of a long-term climate action strategy, a short-term strategy for 2020-2030 and an updated emissions inventory in 2021/2022 to monitor progress (Chong & Burton, 2020;

Tremmel, 2020; ClimateAction WR, 2021). In 2019, Waterloo Region released a council-approved Community Climate Adaptation Plan. An interim report found that between 2010 to 2015, Waterloo Regions emissions decreased by 5.2%, putting it well on its way to achieving its short-term reduction goal of 6% by 2020 (Climate Action WR, 2019).

Although Waterloo Region is engaging in climate action, it is simultaneously experiencing the consequences of the climate crisis. In 2013, 2017 and 2018 the region suffered from major rainstorms, windstorms, floods, and record-breaking temperatures which caused significant damage and required extensive repairs to utilities infrastructure, homes, and businesses (Climate Action WR, 2013; Region of Waterloo, 2019). In 2018, climate modelling displayed the potential for the climate crisis to lead to more severe weather in Waterloo Region by 2050 including annual temperature increases of two to three degrees and three times the number of days reaching extreme heat (Wandel et al., 2010; Cadel et al., 2015). In WRs Community Climate Adaptation Plan, it is argued that residents are at risk due to the "health impacts of extreme heat, long-term mould-related issues from increased flooding, and increased hazardous walking conditions due to increased freezing rain" (Region of Waterloo, 2019, p. 27-28).

There are numerous vulnerable and racialized communities in the region. Those experiencing homelessness are at greater risk of facing the consequences of the climate crisis from more frequent and severe heat waves and precipitation (Wandel et al., 2010; De Gómez, 2010). WR had set a goal of ending homelessness by 2020, but did not reach this goal (Bueckert, 2019). Homelessness has increased over the last decade and emergency shelters are operating overcapacity (Bueckert, 2019; Thompson, 2020). A 2020 survey found that 181 people were experiencing homelessness and not accessing shelter beds at night (Bueckert, 2019; Thompson,

2020). WR is also struggling with systemic racism as reported by Rodney (2020), “in 2017, Kitchener-Waterloo ranked third highest in the nation for rates of reported hate crimes per 100,000 people,” (para. 3) is “one of the highest metropolitan areas with a disproportionate amount random police stops of visible minorities” (para. 3) and, “about 90 per cent of Kitchener’s public service is white,” (para. 15).

On May 26th, 2021, after public and technical consultation, the long-term climate action strategy entitled Transform WR was released and will be considered by various municipal councils over the next month (Engage Region of Waterloo, 2021). This plan aims to reduce emissions in the region eighty percent by 2050 and thirty percent by 2030 based on 2010 levels (ClimateAction WR, 2021). The plan emphasizes six major changes focusing on active transportation/public transport, zero emission vehicles, eliminating heating/cooling through fossil fuels, reducing waste, localizing food production, and increasing equity and prosperity in the region (ClimateAction WR, 2021). This climate action plan places equity in the top six priorities of the report and claims an external agency was utilized to assist in equity concerns, making the region stand out from many other municipal and regional climate action plans that often exclude equity concerns as discussed in Section One (ClimateAction WR, 2021). Stakeholders and decisionmakers in Waterloo region are motivated to act towards reducing and adapting to the impacts of the climate crisis, assist vulnerable populations and have released numerous climate action plans, the most recent of which appears to consider equity. The region is an ideal one to perform a prioritization case study and test the framework and algorithm outlined in Section Two.

Case Study: Building Mitigation & Adaptation in Waterloo Region

Background

Municipalities frequently divide initiatives in their climate action plans by source of emission (e.g., buildings, energy, transportation, waste, etc.)**.** The triage framework can be utilized in any of these areas. For this case study, buildings will be utilized due to their high mitigation and adaptation potential, large portions of which are regulated by municipal-level governments. Buildings contribute significant levels of emissions as displayed in Figure C1 in Appendix C, "in Canada, using energy to heat and cool buildings accounted for about 12 percent of national greenhouse gas emissions in 2014 or 17 percent, if emissions from generating the electricity used in buildings is also included," (Environment and Climate Change Canada, 2016). In Ontario, twenty-two percent of total emissions come from buildings, and in urban centres like Toronto, contributions are closer to fifty percent (Buchanan, 2017). In WR in 2015, forty-five percent of emissions originated from energy use in residential, industrial, commercial, and institutional buildings as displayed in Figure C2 in Appendix C (ClimateAction WR, 2021). Most of the energy used to heat or cool buildings is wasted due to inefficient infrastructure and emissions are projected to rise without drastic intervention (Environment and Climate Change Canada, 2016).

Many major Canadian cities, including those in WR are expanding rapidly, requiring more energy to construct and operate buildings. Severe weather events increasing in duration, frequency and intensity as discussed in Section One and Two also pose challenges to the building sector. It is essential that cities focus on enhancing building resilience (Wamsler & Brink, 2014). Additionally, the potential for energy and emission reduction is high if building construction and operation become more efficient and can lead to reduced long-term costs. The

International Panel on Climate Change's (IPCC) *Buildings* report highlights the possibilities for energy and cost-savings with appropriate policies, "recent advances in technology, design practices and know-how, coupled with behavioral changes, can achieve a two to ten-fold reduction in energy requirements of individual new buildings and a two to fourfold reduction for individual existing buildings largely cost-effectively or sometimes even at net negative costs," (Lucon et al., 2014, p. 675). A recent literature review by Urge-Vorsatz (2020) shares a similar consensus, "it is possible to achieve net or nearly-zero energy building outcomes across the world in most building types and climates with systems, technologies, and skills that already exist, and at costs that are in the range of conventional buildings," (p. 227). Buildings pose barriers and challenges to climate action n WR but also hold significant potential for measurable and impactful change.

Step One: Broad Policy Sorting

Refer to Figure 3 in Section Two to follow the triage algorithm for the next sections of the paper. Step One is designed to decrease the volume of policies and initiatives that will be considered by grouping them into three categories based on the level of data and evidence present in academic & grey literature: Robust, Medium, and Low. Policies and initiatives supported by robust evaluative data and evidence showing that they have led to or are highly likely to lead to specific, measurable changes should be prioritized (Armstrong, 2020). Policies and initiatives with low or medium data and evidence in the literature can be assessed later if resources allow. Step One should only include policies or initiatives that are highly relevant to local conditions (e.g., weather, climate, and pertaining to a municipalities authority over laws, by-laws, and legislation). This is particularly important for adaptation initiatives/policies, which

vary in relevance in the building sector depending on regional climates and projected climatic changes (Stagrum et al., 2020)

Method

The list of best building practices, initiatives, and policies to mitigate and adapt to the effects of the climate crisis was compiled from numerous documents including peer-reviewed journal articles and literature from well-established government and non-governmental organizations (NGO's). These documents were identified through keyword searches on Google, Google Scholar and York University's library catalogue, OMNI. Initial keywords included: buildings, climate change, climate crisis, climate mitigation, climate adaptation, policy instruments, energy efficiency, Evaluation of Municipal Building Policy, Municipal Building Policy and Climate Change, Municipal Public Policy and Buildings. Most of these searches took place in 2020 for other related, preliminary research papers. Additional searches were conducted in May to July of 2021 to ensure the most up-to-date sources were utilized for this research paper. Initial searches often yielded comparative articles or reviews evaluating numerous building policy instruments related to climate change.

Once an initial list of initiatives and policies was established, additional keyword searches had to be performed in June to July of 2021 to identify additional articles that specifically focused on individual policies/initiatives. These documents were identified through keyword searches on Google Scholar and the OMNI catalogue with various versions of the name of the policy/initiative. Canadian and international articles were utilized. Most articles were published between 2010-2021 but older articles from 1988, 2000, 2002, 2005 and 2006 were also included. Throughout both keyword searches, a snowballing technique was utilized where other

relevant articles were identified because they had cited or had been cited by primary articles identified as relevant.

There is no definitive guideline on the amount of evidence required for each category as this depends on the total amount of data present for different topics. Although this list is intended to be comprehensive, it is possible that initiatives or policies were unintentionally excluded since this research was conducted solely by the author. This list is compiled with the intention of being utilized in a municipality in a Western, developed nation. This framework can also be utilized in developing countries, which should integrate additional initiatives.

Climate Change Mitigation Initiatives/Policies

Climate change mitigation focuses on reducing or preventing atmospheric greenhouse gas emissions to lessen the severity of climate change impacts (European Environment Agency, 2020). Within sustainable buildings literature, researchers have sorted mitigation policy instruments into similar categories with slight variations. Berardi (2013) divides sustainable building policy instruments into four sub-categories: *regulatory & control mechanisms, economic or market-based instruments, fiscal instruments & incentives, and information & voluntary actions.* Labandiera and colleagues (2020) focus more broadly on energy efficiency policies and divide those into three categories, combining economic and fiscal instruments into one category based off Markandya and colleagues (2015) categorizations*: standards, economic instruments, and information instruments*. Enker & Morrison (2020) base their categories on guidance from the European Union, making similar distinctions to Labandiera and colleagues with the addition of *enhancement of industry delivery capacities* as a fourth category. This research paper complements previous categorizations and utilizes four categories to clearly display the wide range of initiatives and policies that can be implemented for mitigation.

Retrofits was added as a fourth category to display the breadth of initiatives available under the retrofitting umbrella that can be under-emphasized when retrofits are listed as one sub-category. The categories are: (1) Economic Instruments/Financial Incentives, (2) Information/Education/Voluntary Actions, (3) Legislation/Standards or Regulatory & Control Mechanisms for Buildings and (4) Retrofitting/ Renovations for Residential/Commercial/Municipally Owned Buildings. The initiatives/policies within each of these categories and the sources supporting them are outlined in the following four tables. In Table 5, these initiatives/policies are sorted by robust, medium, or low levels of evidence.

Results

As displayed in Tables 1 through 5, there are twenty-one initiatives/policies among the four categories of building mitigation policy instruments. The sources of literature evaluating these initiatives/policies ranges from zero to ten. The mean number of articles per initiative is three and the median is three. Literature with evidence against the initiative is not included in the calculations for Step One but will be considered in Step Two. Based on the amount of literature related to these initiatives/policies, robust evidence is considered five to ten articles, medium is two to four articles and low is those with zero or one article. There are four initiatives/policies considered robust, twelve considered medium and five considered low as displayed in Table 5.

Table 1: Economic Instruments/Financial incentives (e.g., Loans, Rebates, Grants, Tax Exemptions, Taxes, Subsidies etc.) (Labandiera et al., 2020; ICLEI, 2020, p. 8; Augustus de Melo, Jannuzzi, & Tripodi, 2013; Rana et al., 2021)

Initiatives/Policies	**Evidence Supporting Initiatives in Literature**	**Evidence Against Initiatives in Literature**
To support construction of green buildings/homes e.g., directed towards developers for compact developments,	Rybeck, 2004; Ghodrati et al., 2012	

towards homebuyers for purchase of green homes		
For retrofits/renovations e.g. Property Assessed Clean Energy (PACE) financing	UNECE, 2020, pp. 55-56; Berardi, 2013, p. 144; Capps, 2019; Gillich, 2013	
For renewable on-site energy e.g., solar panels, solar heat pumps	UNECE, 2020, p. 55; ACEEE, 2020c; NYC, 2019a; Burger et al., 2008	
Trading schemes e.g., building emission caps, building carbon trading scheme, renewable energy credits, white certificates etc.	Capps, 2019; Urban Green Council, 2020a (just proposing building carbon trading scheme but no empirical evidence provided); Arimura & Abe, 2019	
Energy Service Agreements/Energy Service Companies (ESCO)	UNECE, 2020, 55-56; NYC, 2019b; Goldman, Hopper & Osburn, 2005	
Municipal retail sales surcharge	PCEF, n.d. (no empirical evidence-program currently in progress)	
Subsidies for efficient appliances	Rana et al., 2021; Houde & Aldy, 2014; Gillingham, Newell & Palmer, 2006	Gillingham, Newell & Palmer, 2006
Tax exemptions	Gold & Nadel, 2011	Villca-Pozo & Gonzales-Bustos, 2019

Table 2: Information Instruments/Education on Energy Conservation & Sustainability/Voluntary Actions (Labandiera et al., 2020; ICLEI, 2020; Berardi, 2013)

Initiatives/Policies	**Evidence Supporting Initiatives in Literature**	**Evidence Against Initiatives in Literature**
Improving awareness of building occupants/behavioral change/lifestyle change /information campaigns	Harvey, 2013, p. 283; Lucon et al., 2014; Persson, & Grönkvist, 2015; Ayres, Raseman, & Shih, 2013; Boza-Kiss et al., 2013; UNECE, 2020; Augustus de Melo, Jannuzzi, &Tripodi, 2013; Gillingham, Keyes & Palmer, 2018	

Home energy audits	van den Brom, Meijer, & Visscher, 2019, p. 262; Considine & Sapci, 2016	Palmer et al., 2012
Leadership programs	Berardi, 2013, p. 145; Augustus de Melo, Jannuzzi, &Tripodi, 2013	

Table 3: Legislation/Standards or Regulatory & Control Mechanisms for Buildings (Labandiera et al., 2020; Berardi, 2013)

Initiatives/Policies	**Evidence supporting initiatives in literature**
Mandatory energy audits/Inspections/Benchmarking/Commissioning	UNECE, 2020; Augustus de Melo, Jannuzzi, &Tripodi, 2013; Rana et al., 2021; Harvey, 2013
Minimum energy performance standards/ Mandatory labelling/Eco-labelling (e.g., for appliances or computers, Passive House Standard; EnerGuide labelling, carbon disclosure)	Harvey, 2013, p. 287; Augustus de Melo, Jannuzzi, &Tripodi, 2013; UNECE, 2020; Stern, 2006; Filippidou, Nieboer, & Visscher, 2016; Berardi, 2011 in Berardi, 2013, p. 145; Hastings, 2004 in Salon et al., 2010; Gillingham, Newell & Palmer, 2006; Brounen & Kok, 2011; Boza-Kiss et al., 2013
Building codes mandating retrofits or surpassing provincially mandated building codes within the municipality for construction of new energy efficient buildings, net-zero buildings, renewable energy on site etc.	UNECE, 2020; Enker & Morrison, 2020, p. 791; Pitt, 2010; Meier and Nordman 1988; Urge-Vorsatz et al., 2020; Lucon et al., 2014; Jacobsen & Kotchen, 2010; Augustus de Melo, Jannuzzi, &Tripodi, 2013; Harvey, 2013; Berardi, 2013
Energy monitoring/Smart metering	UNECE, 2020
Banning/Phasing out Older Technologies	UNECE, 2020
Public procurement policies for buildings	Augustus de Melo, Jannuzzi, &Tripodi, 2013

Table 4: Examples of Residential/Commercial/Municipally owned Building Retrofits or Renovations that Municipalities could Prioritize or Invest in (Gillingham, Newell & Palmer; 2006; ICLEI, 2020)

Initiatives/Policies	**Evidence supporting initiatives in Literature**	**Evidence Against Initiatives in Literature**
HVAC/insulation/building envelope improvements (e.g., Reduce annual air cooling/heating	Filippidou, Nieboer, & Visscher, 2019, p. 32; Dall'O', Galante, & Pasetti, 2012; Lucon	van den Brom, Meijer, & Visscher, 2019, p. 254

costs and emissions, building automation system, heat pumps etc.)	et al., 2014; Webber, Gouldson & Kerr, 2015	
Green features integrated into buildings (e.g., roof, wall, etc.)	Banting, 2005; Peng & Jim, 2015; Çelik et al., 2010; Niu et al., 2010; Santamouris et al, 2007	Carter, T., & Keeler, A., 2008
Alternative fuel sources	Lucon et al., 2014; UNECE, 2020	
Efficient lighting/daylighting	UNECE, 2020; Lucon et al., 2014; Mahlia et al., 2005; Di Stefano, 2000	

Table 5: Broad Policy Sorting Categories

Robust Evidence (5-10)	**Medium Evidence (2-4)**	**Low Evidence (0-1)**
Improving awareness of building occupants/behavioral change/lifestyle change /information campaigns (8)	To support construction of green buildings/homes e.g., directed towards developers for compact developments, towards homebuyers for purchase of green homes (2)	Public procurement policies for buildings (1)
Minimum energy performance standards/ Mandatory labelling/Eco-labelling (10)	Efficient lighting/daylighting (4)	Banning/Phasing out Older Technologies (1)
Building codes mandating retrofits or surpassing provincially mandated building codes within the municipality (10)	Alternative fuel sources (2)	Energy monitoring/Smart metering (1)
Green features integrated into buildings (5)	HVAC/insulation/building envelope improvements (e.g., Reduce annual air cooling/heating costs and emissions, building automation system, heat pumps etc.) (4)	Tax exemptions (1)
	Mandatory energy audits/Inspections/Benchmarking/ Commissioning (4)	Municipal retail sales surcharge (0)

	Leadership programs (2)	
	Home energy audits (2)	
	Subsidies for efficient appliances (3)	
	Energy Service Agreements/Energy Service Companies (ESCO) (3)	
	Trading schemes e.g., building emission caps, building carbon trading scheme, renewable energy credits, white certificates etc. (2)	
	For renewable on-site energy e.g., solar panels, solar heat pumps (4)	
	For retrofits/renovations e.g. Property Assessed Clean Energy (PACE) financing (4)	

Step 2: Individual Climate Action Initiative Sorting

A. Life-Saving Interventions: Climate Change Adaptation Initiatives/Policies

Climate change adaptation refers to the "adjustment of human and natural systems to climatic actual or expected events, in order to minimize damage or maximize benefit," (Ledda et al., 2020, p. 1). Many climate action plans are dedicated to or incorporate adaptation measures. In contrast to the significant amount of literature evaluating the predictive and empirical effects of municipal climate mitigation policies and initiatives on emissions, energy and costs, there is a lack of similar literature regarding the effectiveness of adaptation policies and measures (Stagrum et al., 2020). This dilemma is expanded upon by Stagrum and colleagues (2020), "there is a notably small body of literature on climate impacts on and adaptation measures for buildings," most of which is found to focus on increasing temperatures and neglect focus on colder, rainier, or windier climates (p. 13). Olazabal and colleagues (2019) clarify how problematic this lack of impact literature is, "the development of policies on its own, while indicative of adaptation policy progress, may not actually lead to vulnerability or risk reduction"

(p. 278). Due to the lack of evaluative literature on adaptation policies/initiatives, adaptation initiatives will be prioritized when they have a high likelihood of being lifesaving interventions which prevent natural disasters or other events resulting in mortality.

The categories in Table 6 were adapted from the IPCC's 2014 *Summary for Policymakers on Climate Change: Impacts, Adaptation and Vulnerability*. The framework categorizes four adaptation-related initiatives/policies as immediate: structural and physical adaptation initiatives (e.g., reducing overheating, flood-proofing at risk buildings, and incorporating escape routes or second floors into buildings/homes in case of flood or other severe weather risks), disaster risk management (e.g., enhancing building resilience), and hazard and vulnerability focused land-use policies (e.g., avoiding building in flood-prone or severe weather prone areas, utilizing future climate projections in construction) (IPCC, 2014).

Table 6: Initiatives/Policies Related to Climate Change Adaptation (Hazard Reduction, Vulnerability Reduction, Response Preparedness, Recovery Preparedness) (Wamsler & Brink, 2014)

Initiatives/Policies (Categories designated by IPCC, 2014)	**Evidence supporting initiatives in Literature**	**Evidence Against**
Structural & Physical e.g., building envelope, green infrastructure to cope with changes to weather, building codes, cooling green roofs and facades, increasing foliage, reducing overheating, waterproofing/flood-proofing at risk buildings/homes, including escape routes or second floors	De Munck et al., 2018; Virk et al., 2015; Zinzi, 2016; Halawa et al., 2014; Makantasi and Mavrogianni, 2016; Wamsler & Brink, 2014	Fosas et al., 2018
Disaster Risk Management e.g., Increasing/Enhancing building resilience, building codes & practices	Ascione et al., 2017	
Land-use policies considering hazards and vulnerabilities e.g., Avoiding building or	Wamsler & Brink, 2014; Lyles, Berke & Overstreet, 2017	

development in areas prone to floods or close to sea level, land use zoning, consideration/incorporation of future climate projections when constructing new buildings		
Social e.g., Education, information, behavioral, engagement of the public, increasing risk awareness, public campaigns, citizen advisory committee, local knowledge-based adaptation (Mimura et al., 2014; Henstra, 2012)		
Institutional e.g., Economic instruments, laws, and regulations (IPCC, 2014)		

B. Criteria for Climate Mitigation Policy/Initiative Prioritization

The four initiatives/policies found to have robust evidence in Step One will be evaluated for the first two criteria in the CPCAI algorithm first (emission/energy reduction and cost-effectiveness) and the evaluation regarding the third criterion, equity, will follow. These four initiatives/policies apply to and have been utilized by municipal governments previously.

1. Minimum Energy Performance Standards/Mandatory or Voluntary Labelling/Eco-Labelling

Urge-Vorsatz, Koeppel, and Mirasgedis (2011) conducted a review of sixty policy evaluations across thirty countries/regions and found that one of the most effective policy instruments to reduce building emissions was voluntary labelling, "the most cost-effective instruments, all achieving energy savings at negative costs for society, were appliance standards, demand-side management programmes and mandatory labelling," (p. 458). Enker and Morrison (2020) found that appliance standards were associated with high levels of emission reduction. Augustus de Melo, Jannuzzi and Tripodi (2013) evaluated cost-effectiveness in the Brazilian buildings sector and found that one of the most impactful policy options were minimum energy

standards for appliances such as air conditioning units, fridges, and lights. Enker and Morrison found that minimum building performance standards, "provide substantive economic benefits in terms of positive benefit/cost ratios and substantially positive outcomes in terms of net present value. These outcomes are achieved in parallel with cost effective greenhouse abatement: negative costs per unit CO2 abated," (p. 802).

The United States Environmental Protection Agency found that the use of ENERGY STAR labelling in the United States was associated with both significant emission and energy reduction, in addition to reductions in energy costs and bills. The passive housing concept has been associated with a space heating energy reduction of approximately twenty percent, including in colder climates (Hastings, 2004). Harvey (2013) found that "residential buildings can be constructed virtually anywhere that meet the Passive House standard for heating loads (≤15 kWh/m2 year) at an extra cost of 0-10% compared to current, minimally code-compliant buildings," (p. 303). Brounen and Kok (2011) found that homes labelled as energy efficiency were more likely to sell for a higher price than conventional homes. Boza-Kiss and colleagues (2013) found that "product energy performance standards (MEPS) and their combination with product labels (S&L programs) perform significantly better in terms of environmental effectiveness than any other instrument, while they also rate high on cost-effectiveness," (pp. 164, 172). Boza-Kiss and colleagues (2013) found standards and labels to be the most energy saving in the long term and cost effective among an analysis of eight building policy instruments including building codes. Labelling and minimum energy performance standards have been found to reduce emissions and conserve energy while displaying cost-efficiency.

2. <u>Building codes mandating retrofits or surpassing provincially mandated building codes within the municipality</u>

Urge-Vorsatz, Koeppel, and Mirasgedis (2011) conducted a review of sixty policy evaluations across thirty countries/regions and found that one of the most effective policy instruments to reduce building emissions were building codes. A 2007 IPCC report found that building codes were a highly effective policy instrument (Levine et al., 2007). Augustus de Melo, Jannuzzi and Tripodi (2013) found that one of the most impactful and cost-effective building policy options in Brazil were building codes, specifically those pertaining to renewable technologies. Berardi (2013) found that building codes in newly constructed residences displayed thirty percent reductions in energy usage. Enker and Morrison (2020) found that building codes were associated with high emission reduction levels. In older research, increasingly stringent building codes were found to result in a forty percent decrease in space heating energy needs as compared to standard dwellings (Meier and Nordman, 1988). The United Nations Economic Commission of Europe (2020) found that "countries with comprehensive and stringent building standards in place have higher penetration rates of energy-efficient technologies," (p. xi). Harvey (2013) found that "commercial buildings of most types and in most climates can be constructed with an energy intensity of no more than 50– 75 kWh/m2 year at an extra cost of −2% to 5% compared to current, minimally code-compliant buildings," and that this results in "a factor of 2–4 smaller energy intensity than under the most stringent national-level building codes in effect as of 2012 and up to a factor of 5 reduction," (p. 304). Jacobsen and Kotchen (2010) compared electricity and natural gas consumption of residences in Florida before and after stricter building energy codes were enacted and found a four percent decrease in electricity usage, a six percent decrease in natural gas consumption with a payback period of approximately six years. Progressive and innovative municipal building codes have been found to reduce emissions and conserve energy while maintaining cost-efficiency.

3. Green features integrated into buildings

Numerous studies have evaluated the benefits associated with green roofs. In 2005, Banting and colleagues estimated initial financial benefits of green roof installation to be $313 million with annual benefits of $37 million. Rana and colleagues (2021) found that eco-roofs are associated with reduced energy usage in buildings. Peng and Jim (2015) found that "large-scale green-roof installation can substantially reduce energy consumption, upstream emission and atmospheric concentration of CO2" (p. 554). Peng and Jim (2015) found that based on construction costs, cost-benefit ratios, and payback periods, "the long-term benefits of both green-roof types can exceed their construction costs," (p. 559). De Munck and colleagues (2018) and Virk and colleagues (2015) found that building and street greening reduced energy usage. Santamouris and colleagues found green roofs reduced cooling loads in a building by six to forty-nine percent. Carter and Keeler (2008) found that green roof construction in one geographical region was less cost effective than a traditional roof but acknowledged that this could change as the costs of green roofing materials and construction decrease in the future. Integrating green features, particularly green roofs, into buildings has been found to reduce emissions/energy and be cost-effective in some, but not all cases.

4. Improving awareness of building occupants/behavioral change/lifestyle change/information campaigns

Boza-Kiss and colleagues (2013) found that information and awareness raising instruments were generally associated with low costs and moderate environmental effectiveness (measured as total energy saved each year). In a review of various energy efficiency initiatives and policies, Gillingham, Keyes & Palmer (2018) found information instruments to be one of the most cost-effective instruments but lacked in energy saving potential compared to other instruments. Harvey (2013) considers behavior to be essential in achieving energy reductions,

"behavior of the building occupants can alter the energy use of identical buildings by a factor of 2 or more," (p. 283) and "a change in thermostat setting from 23◦–24◦C to 27◦–28◦C during the cooling season can decrease cooling energy use by a factor of 2–3," (p. 283). Persson and Grönkvist (2015) observed that information and publicity may have contributed to behavioral change in consumers: the presence of a Passive House Center in Western Sweden was correlated with a higher number of passive houses in this area. Ayres, Raseman, & Shih, (2013) found that when utility companies informed and compared consumers home electricity and natural gas usage with other consumers, energy usage was reduced by up to 2.1% for as long as one year. Focusing on awareness, information campaigns and behavioral change has been shown to be cost effective and to reduce energy usage in some, but not all cases.

Each of the four initiatives/policies with robust data show evidence of emission/energy reduction and cost-efficiency. The determination of whether these initiatives/policies ensure equity is outline in the next section.

Equity

The literature evaluating and investigating the initiatives/policies that emerged from Step One with robust levels of evidence did not explicitly incorporate considerations of equity. This warrants their evaluation through a framework already established to evaluate equity or requires further, highly specific literature searches on equity and the initiative.

Minimum Energy Performance Standards/Mandatory or Voluntary Labelling/Eco-Labelling and Building codes mandating retrofits or surpassing provincially mandated building codes within the municipality

For these policies/initiatives, no literature, data, or evidence was revealed during the research phase that explicitly assessed equity and no additional literature could be located. Since these

instruments reduced emissions/energy and were found to be cost efficient, it is still possible that they be categorized as immediate and prioritized, but only when integrated with an equity assessment framework to ensure decision-makers incorporate serious considerations regarding equity, avoid leaving out marginalized groups or implement policies which may have unintended, unequitable consequences for certain populations. Section Two outlines numerous examples of such frameworks in Appendix B. If additional equity evaluation frameworks are not utilized, these policies/initiatives would be categorized as delayed and will not be the highest prioritized policies.

Green features integrated into buildings

Hunter and colleagues (2019) report that within the literature there is "too little evidence to enable us to draw firm conclusions regarding the impact of urban green space interventions on a range of equity indicators, for example those from disadvantaged backgrounds, migrants, the elderly, children, and those with disabilities" (p. 240). Hunter and colleagues included green infrastructure as one category of urban green space interventions. Sanchez and Reames (2019) conducted a socio-spatial analysis of green roof equity in Detroit as a mitigative strategy for the urban heat island effect. Sanchez and Reames found that most low-income residents were not incorporated into Detroit's Urban Green Neighborhood Plans and that most green roofs were in the higher-income areas of the city. Semeraro and colleagues (2021) analyze how ecosystem services can provide human benefits and find that green roofs reveal "the capacity to produce a stratified use of the urban space passing from the mono-functional use of specific urban space into integrating different functionalities that are capable of increasing ecological and social human well-being," (p. 8). Although Semeraro and colleagues do not focus specifically on equity they outline potential green roof projects to combat water scarcity which incorporate water

storage and water re-use facilities. La Rosa and Pappalardo (2020) conduct a comparative spatial analysis that looked at how various locations of green roofs as sustainable urban drainage system affected different social groups and found that by ensuring the equal distribution of green roofs across an urban area helped drainage occur more efficiently than by concentrating the roofs in specific locations. Assessing the equity of the integration of green features, largely green roofs is limited by the lack of literature on this topic, but it can be pre-emptively concluded that although green roofs and their benefits are not currently being equally distributed, they have the potential to be used to increase equity in the future specifically regarding water drainage, in the reduction of urban heat islands, to decrease water scarcity and to improve human wellbeing. Since this policy/initiative ensures emission/energy reduction, is cost efficient and has the potential to ensure equity, it is categorized as immediate and should be highly prioritized.

Improving awareness of building occupants/behavioral change/lifestyle change/information campaigns

There appears to be a burgeoning field of research on energy poverty, energy justice, behavioral economics, energy efficiency and behavioral change which is largely conceptual and not supported by significant empirical or modelled data (Della Valle &Sareen; 2020; Caballero & Della Valle, 2020; Zhu, 2020). Caballero and Della Valle (2020) theorize that energy poverty can result from inefficient energy behavior "characterized by an inability to afford the basic energy services necessary to guarantee a decent standard of living," (p. 1). Caballero and Della Valle conducted a study on two groups of residents living in socially funded housing that had recently been retrofitted. Both groups were given feedback on their energy use through smart metering devices, while the experimental group was also allowed to access feedback on the energy use of their neighbors (Cabellero & Della Valle, 2020). No significant behavioral changes

were noted in this study, but the authors point out that this could act as evidence that governments should focus on other types of energy efficiency mechanisms (Caballero & Della Valle, 2020). Although the empirical evidence to reasonably argue that information, awareness, and behavioral campaigns can ensure equity, the conceptual and theoretical literature hypothesizes that personalizing such campaigns rather than taking a one-size fits all approach to such strategies will likely be beneficial for a variety of communities and marginalized populations (Della Valle & Sareen; 2020; Caballero & Della Valle, 2020; Zhu, 2020). There is high potential for this initiative to ensure equity in the future. Since this policy/initiative ensures emission/energy reduction, is cost efficient and has the potential to ensure equity, it is categorized as immediate and should be highly prioritized.

Comparison of Currently Prioritized Initiatives/Policies vs. CPCAI Prioritized Initiatives/Policies

Waterloo Regions Most Recent Long-Term Climate Action Strategy "Milestones" for Buildings (ClimateAction WR, 2021):

- Switching to electric heat pumps or other similar equipment in buildings (twenty percent by 2030 and eighty five percent by 2050)
- Utilizing water heaters that use less energy and carbon in buildings (twenty percent by 2030 and eighty-five percent by 2050)
- Eliminate fuel oil and propane used for heating in buildings by 2025

Initiatives/Policies Prioritized by CPCAI Algorithm:

- Green features integrated into buildings (physical greening e.g., roofs)
- Improving awareness of building occupants/behavioral change/lifestyle change/information campaigns

- Minimum Energy Performance Standards/Mandatory or Voluntary Labelling/Eco-Labelling
- Building codes mandating retrofits or surpassing provincially mandated building codes within the municipality
- Structural and physical adaptation initiatives (e.g., reducing overheating, flood-proofing at risk buildings, and incorporating escape routes or second floors into buildings/homes in case of flood or other severe weather risks),
- Disaster risk management (e.g., enhancing building resilience)
- Hazard and vulnerability focused land-use policies (e.g., avoiding building in flood-prone or severe weather prone areas, utilizing future climate projections in construction)

Case Study Discussion

The case study identified four mitigation-based and four adaptation-based policies/initiatives that are considered immediate after undergoing the CPCAI algorithm. It is recommended that these eight policies/initiatives be prioritized by decision-makers based on their emission/energy reduction, cost efficiency, equity, or lifesaving capabilities. The analysis conducted here indicates that when equity or lifesaving ability is considered equally to emission/energy reduction and cost efficiency, priorities are different than those currently being prioritized in WR's long-term CAP. As revealed in the interviews, prioritization of policies in Waterloo Region is often conducted by external consultants or experts and narrowed down by staff working directly on the CAP utilizing a range of strategies ranging from political preferences to highest level of emissions. The triage framework provides a systematic, grounded, objective, evidence-supported, and data-driven process to support policy prioritization. Since this

framework and algorithm are in their early stages of development, the process requires further refinement and adaptation to specific local conditions but demonstrates opportunity for improved climate planning and prioritization processes by providing a systemic, ethical, and equitable rationale to support prioritization.

One major shortcoming of this model is that it assumes when more evidence exists for a specific policy or initiative, that policy/initiative is more likely to be effective. There may be numerous external variables affecting why an initiative was studied more (e.g., it might be a more convenient sample, it may have been more popular politically, etc.). This framework will be improved in the future through further testing but currently provides a foundation for conceptualizing future directions for municipal climate planning and prioritization that rely on evidence rather than political or decision-maker preference.

This case study revealed significant gaps in the literature which future research could focus on. First, there is a lack of literature that quantitatively or qualitatively evaluates building mitigation measures and a significant lack of literature evaluating adaptive building measures. Second, much of the literature on building mitigation and adaptation does not consider equity, although there is some highly innovative research and conceptualizing beginning to emerge regarding how policies and initiatives affect and are affected by equity and justice concerns.

Part Three Conclusion

Stakeholders and decisionmakers in Waterloo region are motivated to act towards reducing and adapting to the impacts of the climate crisis, assist vulnerable populations and have released numerous climate action plans, the most recent of which attempts to integrate equity. The region is an ideal one to perform a prioritization case study and test the framework and algorithm outlined in Section Two of this research paper. The analysis performed in the case

study indicated that by considering lifesaving interventions and weighting equity equally to emission reduction and cost considerations, the policies and initiatives that would be prioritized in climate planning, policy and implementation are different than the ones that are currently being prioritized.

Conclusion

This major paper promotes a future for climate action planning foregrounded by sustainability and justice concerns through the establishment of a framework enhancing the effectiveness, efficiency and equity of municipal climate action planning and policy. Decades of unrestricted emissions and growth have resulted in a climate crisis that threatens every corner of the globe and all its inhabitants. The COVID-19 pandemic and the ignored systemic and institutional racism are crises occurring independently of climate change but also are deeply intertwined with serious repercussions for the climate crisis that can no longer be ignored.

Section One explained that cities face complex challenges in the fight against the climate crisis which has been exacerbated by substandard climate action planning that has largely excluded considerations of justice and equity. Fortunately, with effective, efficient, and equitable evidence-driven strategies advanced by well-informed decisionmakers, there is potential for significant and meaningful climate action. Section Two argued that climate change is increasingly gaining acceptance as a full-scale emergency similar in nature to the pandemic. The experience of the COVID-19 pandemic in Canada demonstrates that when the inevitability of dire consequences is acknowledged, governments can commit to rapid action resulting in momentous changes. Section Two conceptualized an exploratory triage-based framework to be utilized by governments and decision-makers to prioritize initiatives and policies more effectively, efficiently, and justly within climate action planning. Section Three outlines a case

study in Waterloo Region utilizing the triage framework and algorithm for building mitigation and adaptation. The case study concluded that when equity is considered equally to emission/energy reduction and cost efficiency, the prioritized policies and initiatives are different than the current ones Waterloo Region has prioritized.

The policy process at various levels of government in Canada is typically lengthy, complex, and stubborn, "each stage not only reflects the larger socio economic and political context but also refers back to the preceding stage(s), directing feedback that reinforms the direction and evolution of each stage of the policy process (Hessing et al., 2005, p. 254). In normal circumstances it may be impossible or highly unlikely to establish a prioritization process for climate policy that surpasses or does not consider political context, prior policy precedent and path dependency. The situation local governments and communities find themselves in post-pandemic and during the climate crisis is undoubtedly an emergency requiring immediate action. During the early stages of the response to the COVID-19 pandemic, various levels of governments made urgent yet rational decisions that circumvented traditional policy processes and the political context. At that time almost nothing was known regarding the impact the pandemic would have. There is an advantage regarding the climate crisis because although much remains unknown, there is an idea of what is happening and how it is likely to progress.

Utilizing evidence and data, the municipal climate action planning and prioritization process can be streamlined to result in meaningful, measurable, and equitable climate action which will be more likely to lead to significant climate action in municipalities. Management of the climate crisis is complicated and often contradictory, but the lens of triage and equity provides significant value as climate change becomes more dire. Since humanity can no longer completely avoid climate change consequences, society should attempt to manage these

consequences in a systematic, transparent, explicit, and logical approach ensuring traceability and accountability. When the local and global emphasis on COVID-19 begins to decline, it is possible that a window will emerge with great potential for policy change. Now is the time to establish a framework to guide the path forward and ensure that the future is fair, sustainable, and livable for all.

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Appendix A

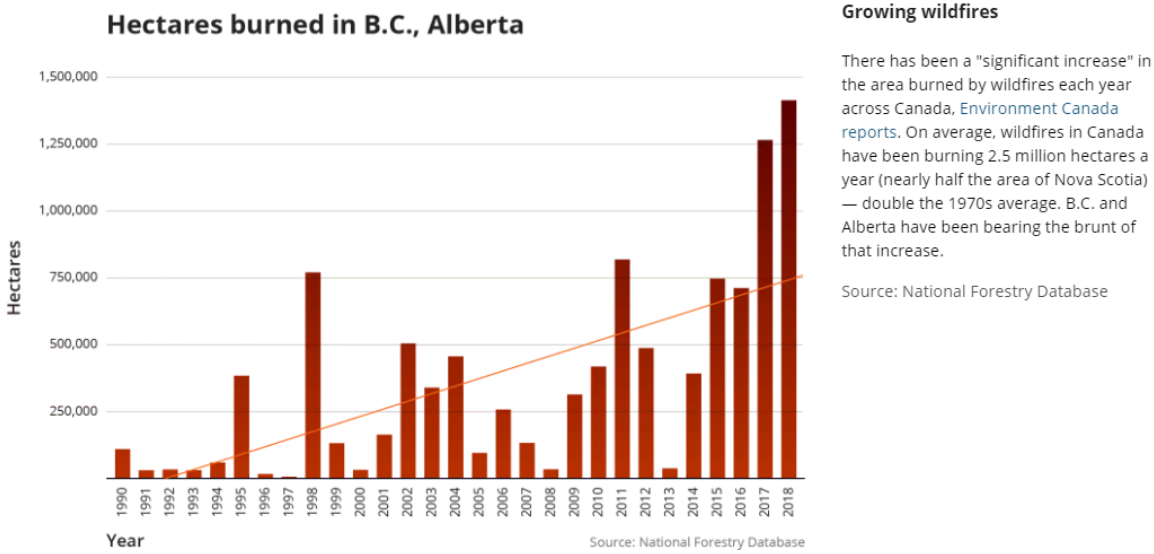


Figure A1: Increasing Prevalence of Wildfires (National Forestry Database in Chung & Mayer, 2019)

Table A1: Summary of Existing Prioritization Frameworks

Name	Area of Focus	Type of Analysis	Time	Pro's	Con's	Application Examples/Case Studies
PrioritEE (Interreg Mediterranean, n.d.)	Energy efficiency measures in public buildings	-a toolbox w/ numerous components to aid in decision making -see appendix 1, figure 1 (Pietrapertosa et al., 2014)	-high	-increases capability to enact energy efficiency initiatives -supports local action plans aimed at reducing energy consumption -developed by scientific partners and received feedback from local users and was refined based on that (Pietrapertosa et al., 2014) -free access on website	-requires a lot of work (many different steps and a lot of data required)	-municipalities Italy, Portugal, Spain, Greece, Croatia (Pietrapertosa et al., 2020)
CLIMACT Prio (Cities Alliance, 2016)	Mitigation & adaptation options	Multi-criteria Analysis Evaluation	At least two days	-qualitative & quantitative -compromise & collaboration -incorporates various -stakeholders (e.g., scientists, decision-makers, policy)	-debatable valuation of non-market variables -too subjective? -requires a lot of data -difficult to co-ordinate various stakeholders	-mostly used in academic context but also in policy context (IHS, 2015)

Name	Area of Focus	Type of Analysis	Time	Pro's	Con's	Application Examples/Case Studies
SWOT Analy-sis (Bawo le et al., 2016)	Multi-discipline (used in business, policy etc.)	Strengths, weaknesses, opportunities, threats	-minimal	-simple & cost-effective; does not require training -considers quantitative & qualitative (Nordmeyer, 2019)	-no weighting of component -one-dimensional -too subjective (Nordmeyer, 2019)	Roll-out of Electronic Government Services in Indonesia (non-climate policy related) -SWOT analysis showed that rolling out these services would lead to beneficial financial opportunities (Karyono & Agustina, 2019) - Austria Sinfonia Smart Cities "Guidelines to build an energy baseline scenario, Good practices tool for stakeholders' involvement, and Smart City plans SWOT analysis were prepared," (UNECE, 2020, 45)
Multi-voting techni-que (Bawo le et al., 2016)	Multi-discipline strategy in various group settings	-conducting a group vote to select highest priorities	-minimal	-can narrow selection with a substantive list of options	-limits discussion -not sufficient independently -must be combined with other tools	n/a

Name	Area of Focus	Type of Analysis	Time	Pro's	Con's	Application Examples/Case Studies
MCA4 climate project prioritization tool (Bawole et al, 2016)	-develpng countries mitigation & adaptation strategies (Scrieciu et al., 2011)	-hierarchal criteria tree (See steps in appendix 1, figure 2) -multi-criteria analysis	-high	-multidimensional -transparent -encourages diverse opinions & involves a range of stakeholders -considers non-monetary values	-high level of participation required from stakeholders	-Mumbai, Yemen, South Africa (Scrieciu et al., 2011) -Ghana's climate adaptation initiatives (Bawole et al., 2016)
CBM Prioritization (Bawole et al, 2016)	Multi-Discipline	Criteria-based Matrix/ Multi-criteria analysis (See appendix 1, figure 3)	-takes significant time	-can reduce bias & subjectivity -can quantify qualitative factors -can aid consensus among stakeholders	-success dependent on knowledge level of stakeholders -does not consider qualitative factors, all factors will be converted to quantitative assessment	-Ghana's climate mitigation initiatives
PEST Analysis (Bawole et al., 2016)	Business/ Project Managmnt	Political, Economic, Social, and technological analysis	-minimal	-provides business perspective -promotes system thinking -easy to use & flexible -anticipates future trends	-substantial local knowledge required - long-term issues; needs to be adapted for changes that occur	-incentivizing private sector investments in Ghana (Bawole et al., 2016)

Name	Area of Focus	Type of Analysis	Time	Pro's	Con's	Application Examples/Case Studies
Urban Adaptation Support Tool Step 4.3 (Climate ADAPT, n.d.)	Adaptatn initiatives in cities -multi-step process with one step focused on prioritizatn	Multi-criteria analysis w/ stakeholders -5 categories (no-regrets, low-regrets, win-win, flexible, adaptive mngmnt and multi-benefit)	-n/a	-n/a	-n/a	-n/a
OECD-DAC (Bawole et al., 2016) (OECD, 2020)	- evaluation of internatnl develpmnt co-operation (OECD, 2020)	Six evaluation criteria (relevance, effectiveness, efficiency, sustainability, impact, coherence) guided by principles (OECD, 2020)	-minimal (little training required)	-can be easily modified to include or exclude relevant/irrelevant factors (Bawole et al., 2016) -criteria have been evaluated/validated and are accepted globally (Bawole et al., 2016; OECD, 2020)	-participants must hold expertise in topic being evaluated	-Ghana's REDD+ projects (Incentivization program to reduce emissions from deforestation) (Bawole et al., 2016)

Name	Area of Focus	Type of Analysis	Time	Pro's	Con's	Application Examples/Case Studies
CBA	Economic	-measures and balances impact and costs	-high levels of time required	-already broadly accepted as legitimate tool in government/policy circles	-leaves out significant non-monetary factors -high time and cost involvement for thorough CBA (Ortega et al., 2014)	-many examples; used in policy & governance frequently

Table A2: Clarification of Terms Associated with Climate Justice & Equity

- **Environmental Justice:** "people of color are forced, through their lack of access to decision-making and policy-making processes, to live with a disproportionate share of environmental 'bads'-and thus to suffer the related public health problems and quality-of-life burdens," (Agyeman, Bullard & Evans, 2002, pp. 81-82)
- **Sustainability**: "to improve the quality of life while living within the carrying capacity of ecosystems," (International Union for the Conservation of Nature, 1991)
- **Climate Justice:** "a moral and political framework that focuses on the root causes of climate change while creating systemic change that places fairness, social justice and equity at the forefront of all climate-related activism and policy," (Perkins & Sers, 2019; Saad, 2017 in Dobai, Reimer & Dreyer, 2020, p. 5)
- **Environmental Equity:** "no single group or community faces disadvantages in dealing with environmental hazards, disasters, or pollution," (Mobilize Green, 2021, para. 2) and "Equity is the outcome of environmental justice. An equitable society is one in which justice has been served," (Mobilize Green, 2021, para. 7)
- **Climate Equity**: "equity in climate change should work as an operational principle, rather than being just a desirable outcome," (Manzo, 2021, para. 16)
- **Just Sustainability/Sustainability Justice:** According to Agyeman, Bullard & Evans (2003), "'the need to ensure a better quality of life for all, now and into the future, in a just and equitable manner, whilst living within the limits of supporting ecosystems" (p. 5). Dobai, Reimer & Dreyer (2020) point out that the concept of just sustainabilities links the environmental sustainability and environmental justice movement and is "focused on equity and justice, within the supporting limits of our ecosystems," (p. 5)

Table A3: Principles of Climate Justice (Perkins, 2019)

- Distributional Justice: Fairness in distribution of material goods
- Procedural Justice: Fairness in political access
- Intergenerational Justice: Ensuring future generations have the same/better opportunities than those living today
- Interspecies Justice: Ensuring welfare & existence of all species
- Intersectional Justice: Enacting measures that address or prevent populations from becoming vulnerable and marginalized
- Restorative Justice: molding institutions to counteract inequality and self-compensate for unequitable situations

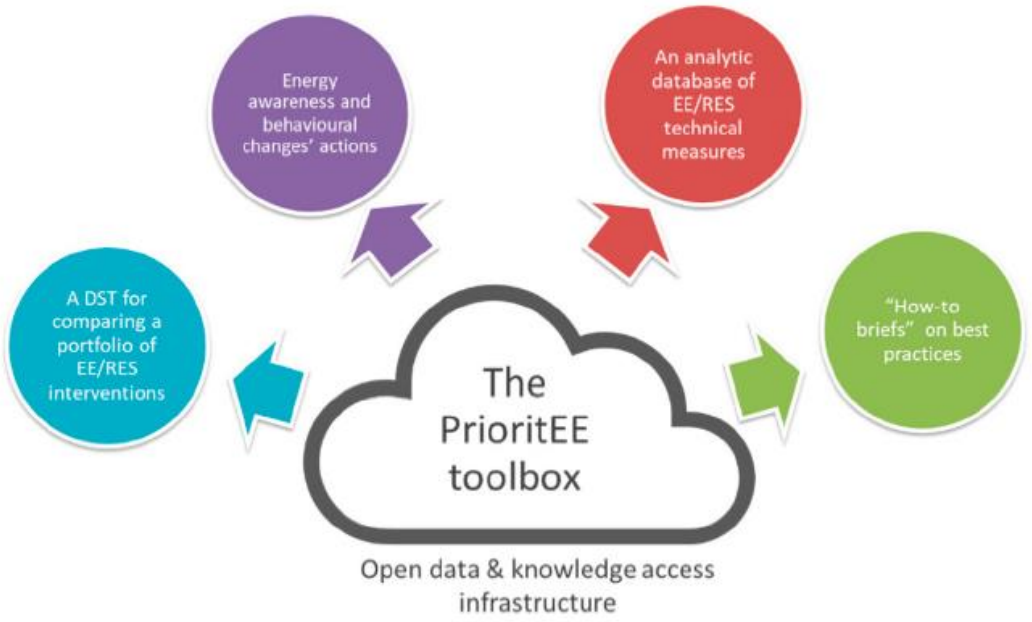


Figure A2: Main Components of PrioritEE toolbox (Pietrapertosa et al., 2014)

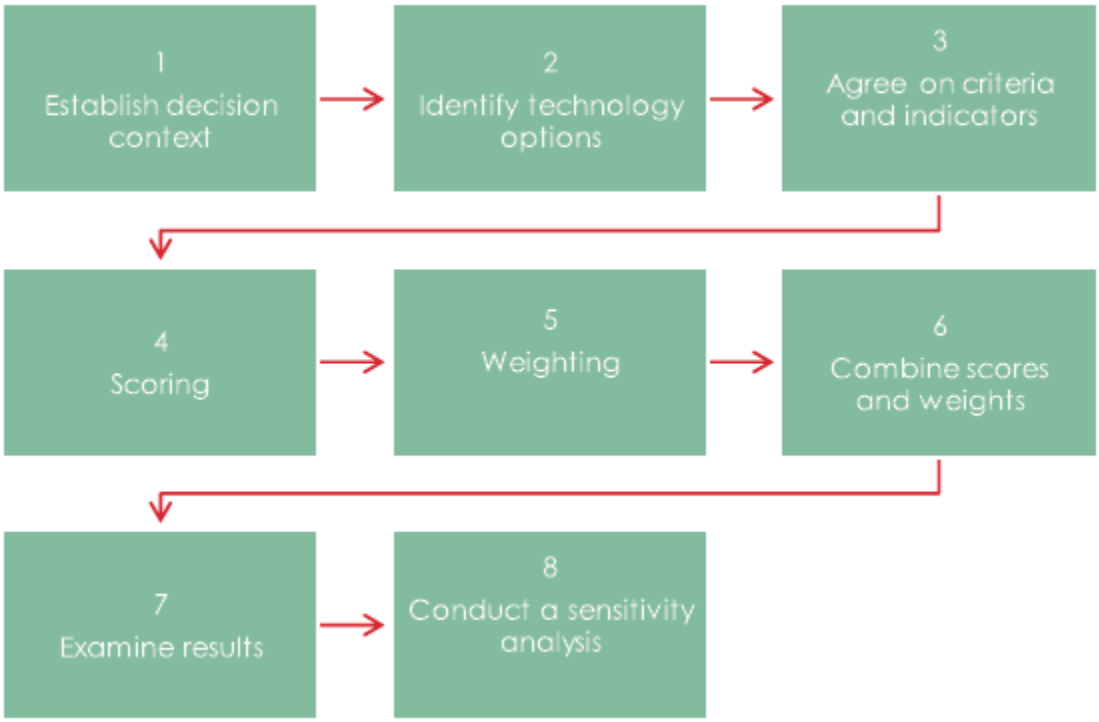


Figure A3: Steps in MCA4 Climate (UNDP, 2016)

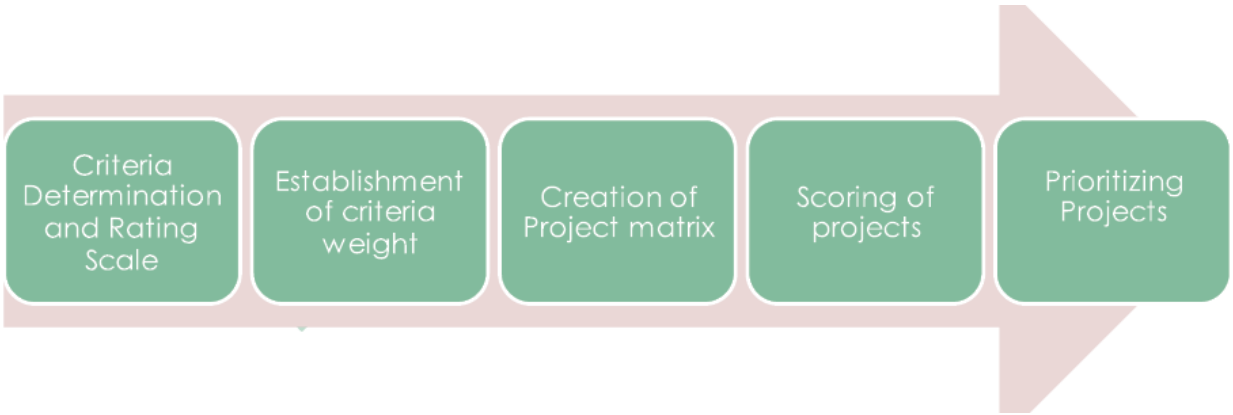


Figure A4: Steps in CBM Prioritization (UNDP, 2016)

Figure A5: California's Social Solutions to Climate Change (Angelo, MacFarlane, & Sirigotis, 2020).

Appendix B

Table 1. Approaches to equity and their relationship to clean energy

Component of equity	Link to energy efficiency and renewable energy activities
Procedural equity	Offer inclusive, accessible, authentic engagement and representation in the process of developing or implementing sustainability programs and policies.
Distributional equity	Design sustainability programs and policies to achieve fair distribution of benefits and burdens across all segments of a community, prioritizing those with highest need.
Structural equity	Institutionalize accountability so that decisions are made with a recognition of the historical, cultural, and institutional dynamics and structures that have routinely advantaged privileged groups in society while creating chronic, cumulative disadvantage for subordinated groups.
Transgenerational equity	Consider generational impacts and avoid placing unfair burdens on future generations.

Table B1: Example of Equity Assessment Components (Ribeiro et al, 2020)

Table 16. Scoring for equity-driven clean energy initiative planning, implementation, and evaluation

Equity-driven community engagement	Score
City has structured its public engagement strategies to increase engagement with marginalized groups.	0.5
Equity-driven decision making	
City has given marginalized residents formal roles in decision-making processes for clean energy initiatives.	0.5
Accountability for social equity	
City has adopted structural equity procedures.	0.5

Table B2: Example of Equity Assessment (Ribeiro et al, 2020)

Below are sample questions to use to anticipate, assess and prevent potential adverse consequences of proposed actions on different racial groups.

1. IDENTIFYING STAKEHOLDERS

Which racial/ethnic groups may be most affected by and concerned with the issues related to this proposal?

2. ENGAGING STAKEHOLDERS

Have stakeholders from different racial/ethnic groups—especially those most adversely affected—been informed, meaningfully involved and authentically represented in the development of this proposal? Who's missing and how can they be engaged?

3. IDENTIFYING AND DOCUMENTING RACIAL INEQUITIES

Which racial/ethnic groups are currently most advantaged and most disadvantaged by the issues this proposal seeks to address? How are they affected differently? What quantitative and qualitative evidence of inequality exists? What evidence is missing or needed?

4. EXAMINING THE CAUSES

What factors may be producing and perpetuating racial inequities associated with this issue? How did the inequities arise? Are they expanding or narrowing? Does the proposal address root causes? If not, how could it?

5. CLARIFYING THE PURPOSE

What does the proposal seek to accomplish? Will it reduce disparities or discrimination?

6. CONSIDERING ADVERSE IMPACTS

What adverse impacts or unintended consequences could result from this policy? Which racial/ethnic groups could be negatively affected? How could adverse impacts be prevented or minimized?

7. ADVANCING EQUITABLE IMPACTS

What positive impacts on equality and inclusion, if any, could result from this proposal? Which racial/ethnic groups could benefit? Are there further ways to maximize equitable opportunities and impacts?

8. EXAMINING ALTERNATIVES OR IMPROVEMENTS

Are there better ways to reduce racial disparities and advance racial equity? What provisions could be changed or added to ensure positive impacts on racial equity and inclusion?

9. ENSURING VIABILITY AND SUSTAINABILITY

Is the proposal realistic, adequately funded, with mechanisms to ensure successful implementation and enforcement. Are there provisions to ensure ongoing data collection, public reporting, stakeholder participation and public accountability?

10. IDENTIFYING SUCCESS INDICATORS

What are the success indicators and progress benchmarks? How will impacts be documented and evaluated? How will the level, diversity and quality of ongoing stakeholder engagement be assessed?

Figure B1: Racial Equity Impact Assessment Questions (Keleher, 2009)

The Urban Equity Impact Assessment (EquIA-urban) tool: A step-by-step guide
This guide summarizes important questions that need to be considered when defining the dimensions and parameters of climate change policies in order to understand their likely impact on urban equity. Following this guide and discussing these questions will minimize the risk that a policy measure will have unintended, inequitable consequences following its implementation.

1) **Process: How are the parameters of urban equity set?**
   What is the decision-making process in framing the initiative?
   How is it established and at what scale of decision-making?
   Who is included/excluded in the decision-making process?
   Who defines the goals, targets, and content of the initiative?

2) **Goal: Why equity? What is the explicit/implicit goal?**
   Is the goal to maximize urban equity, to improve equity, or to do no harm? Or are equity impacts not under consideration?

3) **Target: Who counts as a subject of equity?**
   At which scale(s) is equity considered: individual, household, community, city, value chain, or regional? Consider multiple scales to prevent negative side-effects for others.
   How are the needs of current and future urban generations taken into account?
   How are the needs of nonhuman species or urban ecosystems taken into account?

4) **Content: What counts as a matter of urban equity?**
   4a) Distributive equity
      Has the distribution of benefits, costs, and risks across urban residents been considered?
      What is the intended basis for the distribution of benefits: e.g., equal shares, net social welfare, merit, needs?
      What is the intended cost-benefit distribution, and what will its impacts be?
   4b) Procedural/participatory equity
      Who is participating in decision-making, and who is left out?
      Which underrepresented groups are recognized? Can they voice their interests and be heard?
   4c) Contextual equity (incorporating capabilities, access, power)
      Do decisions reflect the interests of the under-represented groups?
      Do under-represented individuals have access to the resources (e.g., land, capital) necessary to secure benefits of the initiative?
      What new capabilities are being developed (e.g., economic opportunities)?
      What local institutions provide "safety nets"?
      Are the causes of inequity identified? Are they addressed?

Figure B2: Urban Equity Impact Assessment (adapted from McDermott et al., 2011 in Reckien et al., 2018)

Appendix C

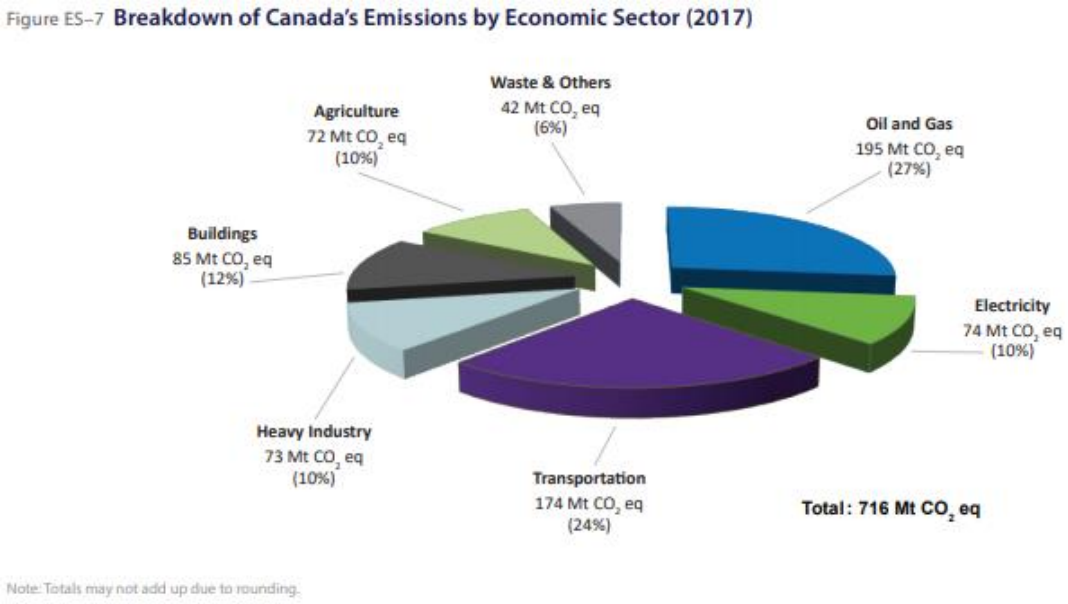


Figure C1: Canada's Emissions by Sector (Environment and Climate Change Canada, 2019)

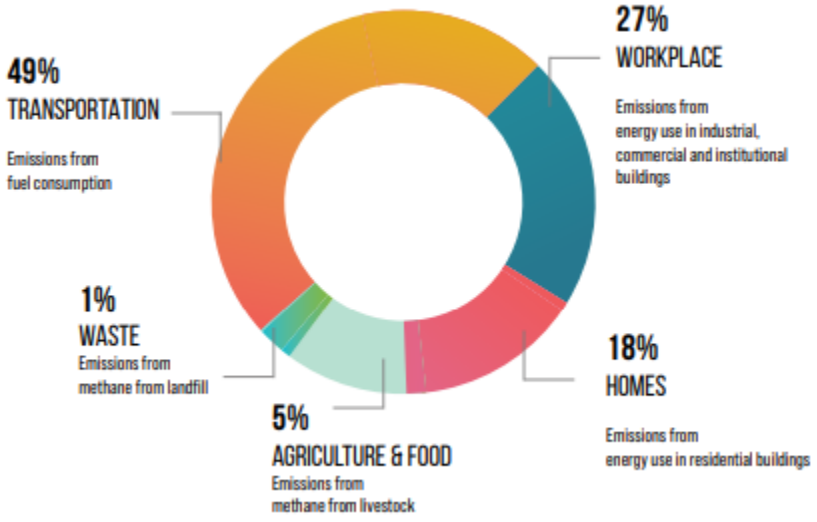


Figure C2: Waterloo Regions Emissions by Sector (ClimateAction WR, 2021)

Appendix D

Participant Selection & Tentative Interview Questions

Jenna Ritch

Masters Candidate 2019-2021

Faculty of Urban and Environmental Change

Tentative Interview Questions *

**Questions are subject to change and progress as research develops*

Section 1: Introductory Questions

1) Please provide a brief description of your current or previous role within Waterloo Region (any specific identifying titles will be kept confidential and excluded from the research and will be used for sampling purposes only)
2) Please identify how your role is/was related to climate policy/planning within Waterloo Region
    - Were you involved in a specific climate action plan formulation process (e.g., Transform WR 2021, 2013 Climate Action Plan for 2020, Progress Report 2010-2015, plans currently underway, other initiatives, etc.)

Section 2: Municipal Climate Planning and Prioritization Process

In this context, prioritization can be defined as the valuation and hierarchal ordering of climate action initiatives or the goals/targets/actions outlined in municipal climate plans.

3) To your knowledge, were there any frameworks, strategies, or guidelines that were utilized to **prioritize** initiatives/targets/goals/actions within Waterloo Region's climate action plan?
    - If yes, were any of the following utilized: PrioritEE, CLIMACT Prio, SWOT Analysis, Multi-voting technique, MCA4, CBM (Criteria-based matrix), PEST analysis, Urban adaptation support tool, OECD DAC, CBA, or any others not listed here
    - Any limitations or barriers to prioritization?
    - If no, was it ever considered or discussed in the planning process?
4) Based on your professional experience, what initiatives do you consider to be priorities in Waterloo Region?
    - Specifically, can you list priorities regarding buildings
    - Do these align with the priorities of present/past climate action plans released by the Region or with other regions?
    - If you have noted discrepancies or changes among priorities, why do you think these exist?

5) To your knowledge, are there any frameworks, strategies or guidelines that were used or are currently being used to guide the formulation, implementation, and evaluation of climate policy within Waterloo Region? *
    - If yes, did any of these frameworks face barriers or limitations? Please expand

**Question 5 may or may not be asked depending on the response provided for Question 3. Question 5 designed to probe planning process more broadly if participant is not providing robust response regarding prioritization process.*

Section 2A: Equity & Justice in Municipal Climate Planning & Prioritization

6) Are you aware of any specific considerations in the climate policy/planning process for climate justice and/or equity?
    - For example, were there specific considerations regarding vulnerable, marginalized, or racialized communities (probe further if required by listing examples of specific considerations such as targeted consultations, committees, surveys, etc.)
7) In your professional opinion, would climate action plan priorities (or climate action plans more generally) change if climate justice & equity were weighted equally with other considerations such as emissions reduction and cost efficiency?

Section 3: Plan Implementation: Actions & Achievements*

*may skip if running low on time

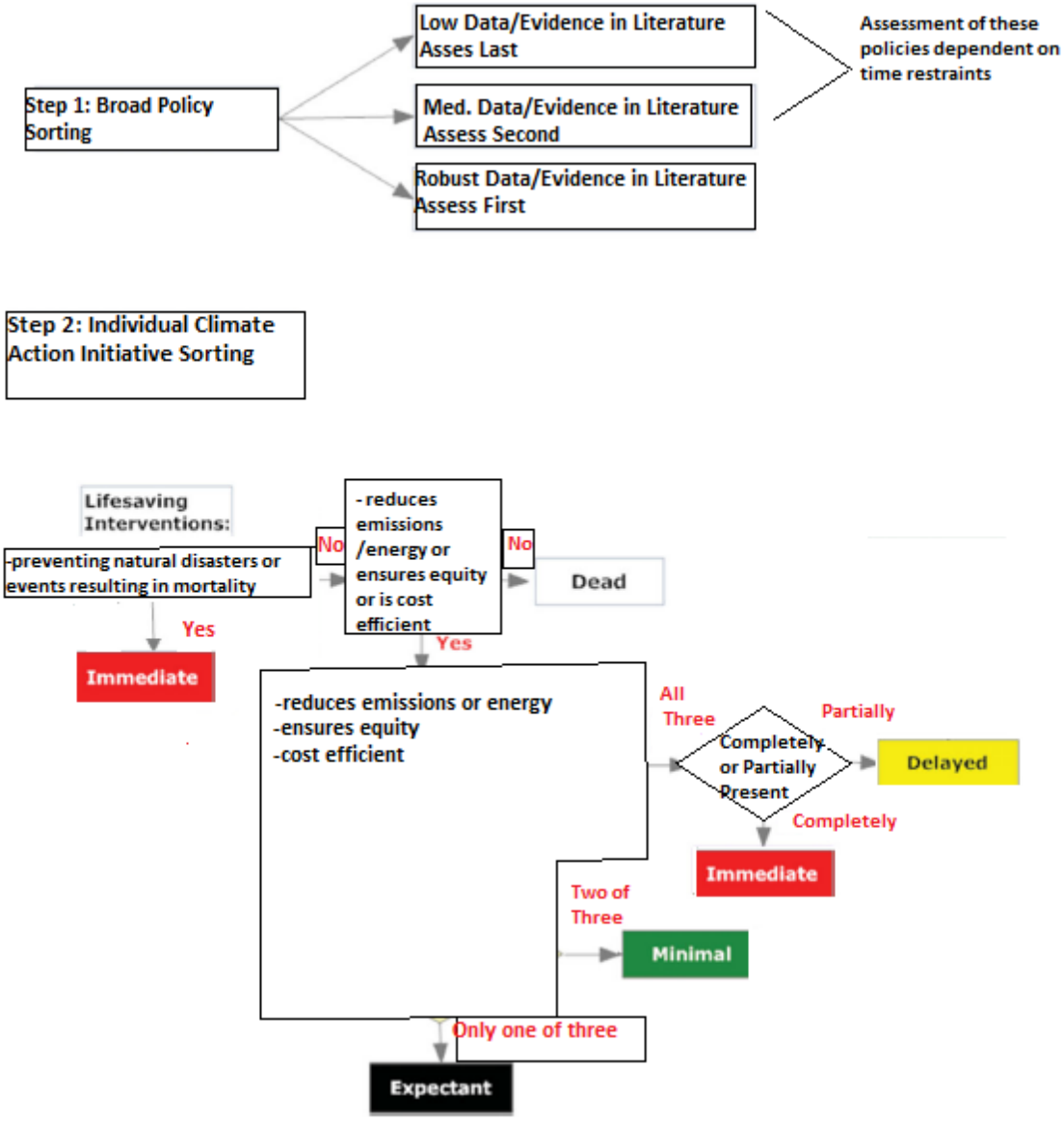
1) In your professional opinion, do you believe climate action planning in Waterloo is leading to meaningful change? Why or why not?
2) In your professional role, did you notice any barriers or limitations to implementation that could be attributed to the planning process?

Section 4: Planning, Policy & Decision-Making Through the COVID-19 Response

3) From your professional perspective, can you provide any insight on planning and decision-making regarding the COVID-19 pandemic more broadly in Waterloo Region?
4) To your knowledge, were they any links between the climate action planning process and the pandemic response planning process?
    - For example, were those involved in climate policy and planning consulted for pandemic response planning or has pandemic planning affected how the most recent climate action plan is being formulated?

Section 5: Triage in Planning & Policy

My research involves formulating a framework for municipalities to utilize when prioritizing climate policies & initiatives based on a model of medical triage that views the climate crisis as an emergency similar in nature to the COVID-19 pandemic. This framework acknowledges that since time and resources to reduce the impacts of climate change are limited, municipal climate policies should significantly and irrefutably lead to emission/energy reductions, be achievable at reasonable costs, lead to future cost savings, be applied fairly & lead to inclusive benefits for all communities. My Climate Policy & Climate Action Initiative (CPCAI) Decision-making Algorithm is displayed below.



5) Based on your experience, is it realistic to work towards making municipal climate policy more efficient, more effective, and more just?

6) In your professional opinion, is the climate crisis an emergency? Does Waterloo Region respond to climate change as if it is an emergency?

7) In your professional role, could you foresee such a framework being useful for climate policy & planning in Waterloo Region?
   - What barriers or limitations do you foresee for a framework of this nature?
   - Any advice or suggestions for formulating such a framework from your perspective in the climate planning & policy realm would be greatly appreciated!

8) Any further questions?

9) Any recommendations on other participants for this interview?

Thank you very much for your time. Your participation in this interview is greatly appreciated. Please feel free to email me with any concerns or questions, jritch66@yorku.ca or jennaritch@gmail.com. I intend to integrate the results of these interviews into my framework. If you would be interested in viewing the resulting paper, please let me know.