COMPARISON OF CLIMATE ACTION PLANS AMONG THREE MAJOR CITIES: VANCOUVER, CHICAGO, AND MEXICO CITY

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DEDICATION

To my future,

May this set you on the path to success.

ACKNOWLEDGMENTS

This thesis represents the longest body of work I have ever completed. To that end, never have I spent as much time or as much effort on a single project. This closing could not have been reached without the significant endeavors of several people. To them, I give my acknowledgments, such as they are.

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Finally, to my family, you will receive a large, ugly copy of this thesis. Please enjoy.

ABSTRACT

Municipal climate action planning continues to grow as a section of climate action planning. Global climate action planning, conducted at a country level, will not suffice to stop climate change. Rather, cities need to step up and take responsibility for their emissions by creating climate action plans of their own. This paper analyzes three climate action plans of three diverse cities: Vancouver, British Columbia; Chicago, Illinois; and Mexico City, Mexico. The study analyzes for motivations behind plan creation, effectiveness of plan created, and effects each plan has had on city greenhouse gas emissions and urban heat island effects. Finally, highlights of each plan, recognized by international organizations, are discussed in order to determine applicability to other cities.

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PREFACE

Governments at all levels struggle to address climate change. Climate change necessitates action on an international level. Countries work amongst themselves to generate new policy and implement new means of mitigating and adapting to climate change. Countrywide strategies can deter climate change on a global scale. National climate plans may struggle to succeed alone, though. The complexity of climate change makes it arduous to address solely on a large scale. Effective climate change action may hinge on engaging other levels of government.

Government necessarily involves layers of institutions that comprise the basis of political power. These layers constitute a ladder through which information is passed up and down, from people to city government to state government and beyond. This ladder of democracy represents a cycle of information that influences ideas and decision-making at each rung (Perrin, 2014). Climate action policy does not and cannot exist on a single rung. Rather, residents vote for climate policy, pushing it up the ladder. This policy advances through the government, influencing national policy, and officials send back new information and new policies, influencing the lower levels of government. This circle of ideas affects the way in which countries respond to climate change.

National climate action planning will not succeed without state or provincial planning and city planning. National planning cannot address climate change on a small enough scale. State and provincial planning come closer but still constitute an area too large to address

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finer, localized details. This is the gap that municipal climate action planning can fill. A municipal climate action plan (CAP) is a plan adopted by a city government in order to combat climate change by reducing greenhouse gas (GHG) emissions and urban heat island (UHI) effects. City CAPs deal directly with local problems and take a personalized approach to local mitigation and adaptation options. They address climate problems more closely than any other level of planning, resulting in plans tailored to specific areas. Furthermore, concentrations of humans, such as in large urban areas, generate the majority of GHG emissions. The United Nations Environment Programme estimates that 75% of GHG emissions come from cities. With cities the leading source of greenhouse gases, they need to take responsibility for themselves and attend to local climate change issues.

Climate action planning, even on a small scale, is complicated. Comprehensive climate action plans still constitute a minority of climate change policy, and even those cities that do have comprehensive plans have not had them for more than a decade. As a developing field of research, one of the tools for evaluating CAPs is through the use of a meta-analysis. This research employs a meta-analysis to draw variables from the current CAP literature and apply them to the planning documents of three major cities. The variables pulled from the literature include motivations for CAP creation, components necessary to be effective, and dangers to avoid.

The meta-analysis provides a framework through which to view municipal climate action plans. The framework for this thesis contains five sections: an overview of current CAP research; an analysis of CAPs adopted by three cities, Vancouver, British Columbia, Chicago, Illinois, and Mexico City, Mexico; a review of the effects of each plan on reducing

harmful climate change; a list of best practices and their applicability to other cities, and a final section detailing directions for future research.

LITERATURE REVIEW

Potential Value of CAPs

Some debate exists as to whether climate action plans will successfully slow climate change. These questions arise: do CAPs achieve the goals that they lay out within their plans? Do they set realistic goals? Do they incentivize actors to comply? Will they effectively reduce climate change? The answers to these questions remain uncertain; however, some conclusions can be drawn from current research.

The first generations of climate action plans leave critics optimistic (Wheeler, 2008). City climate action plans have the potential to be effective and could be a powerful force in tackling climate change (Wheeler, 2008; Stone, Vargo, & Habeeb, 2012; Kousky & Schneider, 2003). In the next few decades, the majority of the global population will reside in cities, and these cities will need to take responsibility for the effects their larger populations cause (Studer Noguez & Koolemans-Beynen, 2010). International agreements, like the Kyoto Protocol and those set forth in the United Nations Framework Convention on Climate Change, will not reach their goals without assistance from cities (Betsill, 2001; Aggarwal, 2013). City actions may even outpace national and international actions (Aggarwal, 2013). Betsill and Bulkeley (2007) argue that polycentricity and multilevel governance serve as an important asset to local climate action. Ostrom (2010) agrees, claiming that polycentricity tends to enhance creativity; learning; adaptation; trustworthiness; cooperation of participants; and the achievement of more effective, equitable, and sustainable outcomes. In addition, Yalçın & Lefèvre (2012) suggest that cities can uniquely attend to climate change because they work closely with local constituencies; possess more direct ability to influence choice of

energy consumption and transportation strategies; and maintain overall control of the daily routines that involve the use of energy, transportation, and other sources of GHG emissions.

Motivation for Adopting City CAPs

Cities choose to create CAPs for a variety of reasons. Each city's motivations for adopting a climate action plan are different, but some factors seem to be consistent across most established plans. These factors can be broken down into sets of internal and external factors. Internal factors are those generated within the city itself. They have to do with municipal government, localization of problems and benefits, constituency, and existing legislation. External factors are those generated outside the city. They include partnerships formed outside the city, international informational networks, higher-level government legislation, and global image.

Further, different motivational factors generate different kinds of plans. Motivational factors play a part in the development of mitigation policies and adaptation policies. The motivators for mitigation may not be the same as those for adaptation. When evaluating motivators for CAP creation, then, each set of motivational factors can be characterized as either internal or external and either influencing mitigation or influencing adaptation.

Internal motivational factors for mitigation vary by city but current research identifies five or six pivotal factors that influence cities. One, all plans seem to need a political leader that can introduce and promote the plan (Carmin, Anguelovski, & Roberts, 2012; Kousky & Schneider, 2003; Betsill, 2001). Two, there must exist an authority responsible for overall targets, normally the municipal government. Some larger cities delegate climate planning to their sustainability and environmental departments, but often cities do not already employ

such departments. Rather, they create a new department to handle the planning, or, if they lack the resources, they create a committee that spans departments (Yalçın & Lefèvre, 2012). Three, cities recognize the co-benefits of creating a CAP (Anguelovski & Carmin, 2011; Kousky & Schneider, 2003). Cleaner living strategies generate co-benefits, benefits like cheaper electric bills or healthier air. For example, a city that takes steps to better insulate its buildings will save money on the electricity needed to regulate temperature. Four, localization of environmental issues can push a city to take action (Betsill, 2001). Cities that understand changes in environment within their local context more likely will adopt climate change strategies. Five, the existence of initiatives already in place may influence a city to adopt a formal climate action plan (Kousky & Schneider, 2003; Yalçın & Lefèvre, 2012). Finally, the existence of an environmental constituency within the city may influence the city to formulate an official CAP (Millard-Ball, 2012; Yalçın & Lefèvre, 2012). Just as existing policy plays a role in CAP creation, so do existing voters.

The relative newness of municipal climate action policy research means that most plans focus solely on mitigation. CAP creators largely ignore adaptation policies, which leaves adaptation less well-documented. Research does acknowledge a few motivational adaptation factors, though. Internal factors influencing the development of adaptation policies include: direct experience with climate change, desire to lessen vulnerability, and a political champion (Anguelovski & Carmin, 2011; Carmin, Anguelovski, & Roberts, 2012). Communities that experience climate change directly will more likely act to adapt to inevitable future changes. As an extension of that, communities that recognize vulnerabilities to climate change will more likely take steps to address adaptation. Finally, just as in mitigation, adaptation policies require a political advocate.

External factors also drive CAP creation. International networks and organizations bring awareness to climate mitigation and motivate cities to seek solutions and develop strategies of their own. International funding now exists to support these programs. The rise of international climate initiative organizations, such as the International Council for Local Environmental Initiatives (ICLEI) and its outgrowth Cities for Climate Protection Campaign (CCPC) and C40 Cities Climate Leadership Group (hereafter referred to solely as C40), also contributes to the development of CAPs. These groups offer guidance and database resources (Zimmerman & Faris, 2011; Kousky & Schneider, 2003). Cities utilize them to gain access to technical knowledge; resources; and process-oriented information, such as methodology and management strategies. A network of external partners must be created and willing to work together to achieve collective goals (Yalçın & Lefèvre, 2012). External partners include other cities, higher levels of government, businesses, and environmental organizations. Additionally, the existence of an environmental agency near the municipality may affect a city's decision to initiate climate change policies (Yalçın & Lefèvre, 2012). The rise in municipal CAPs helped create informational networks that can influence change through the diffusion of ideas (Carmin, Anguelovski, & Roberts, 2012; Bassett & Shandas, 2010). As municipal climate action planning grows, cities rely on one another to share ideas and best practices.

Less research exists on forces acting on adaptation policies simply because most plans fail to take adaptation policies into consideration. However, within the minimal amount of adaptation planning conducted, research identifies some external forces. These forces include: shocks, i.e. natural hazards, like flooding or hurricanes; national or sectional

regulations, like coastal management; and desire to become a leading city in climate policy (Carmin, Anguelovski, & Roberts, 2012; Anguelovski & Carmin, 2011).

Elements of an Effective CAP

Climate action plans vary in their effectiveness. CAPs are complex, requiring internal and external participation. Their scope must encompass numerous actors and partners, and coordinating such a strategy becomes arduous. An evaluation of existing climate action plans reveals some of the highlights and shortcomings of various plans. From the first generation of plans rise a set of suggestions for improvement.

Climate action plans must include a full range of initiatives designed to mitigate and adapt to climate change, like improving transportation, energy efficiency and conservation, revising building codes, water and waste management, and renewable energy (Wheeler, 2008; Zimmerman & Faris, 2011). Yalçın & Lefèvre (2012) note that most projects begin with simple, symbolic initiatives that produce immediate results, like planting trees. While these initiatives provide a fine starting point, plans must move past them to the grittier, more complicated initiatives necessary for plan success.

Plans must design two standards by which to gauge progress: a GHG emissions inventory (Wheeler, 2008; Boswell, Greve, & Seale, 2010; Zimmerman & Faris, 2011) and a method of measuring urban heat island effects (Stone, Vargo, & Habeeb, 2012). Plans need to monitor how they progress toward established goals. Success rests on setting methods by which to measure reductions (Betsill & Bulkeley, 2007). Plans must account for incorporating new data and adjusting course when present actions will not achieve desired results.

Research suggests that cities should attempt to institutionalize climate action (Betsill, 2001). Anguelovski & Carmin (2011) contend that city governments should develop an office of environmental planning or draw workers from across government offices. The formalization of climate action planning should encompass policies, regulations, codes, and support programs. Formal guidelines and informal behavioral norms will allow order to be established, will make planning more predictable, and will enhance cooperation. Yalçın & Lefèvre (2012) assert that CAPs should call for the creation of new bodies such as a steering committee, specific analytical accounting methods, a tool for monitoring the internal plan of action, and, especially, a multidisciplinary working group. A balance must be struck between allowing different agencies the leeway they need to accomplish individual goals and holding them responsible for meeting targets. Wheeler (2008) adds that institutions must maintain climate change goals despite changes in political leadership, and they must maintain long-term planning networks that monitor progress and allow for revisions. While institutionalization can sometimes lead to bureaucratic inertia, Anguelovski & Carmin (2011) disagree with that idea. Rather, they argue, cities that formalize their planning process still show a willingness to experiment and try new ideas.

Surprisingly, Bassett and Shandas (2010) found that city officials do not usually task city planners with creating climate action plans. Rather, planning often falls to the environmental departments or the sustainability departments of a city, or, if neither of those departments exists, new committees often form to complete the task. During the creation and implementation of CAPs, planners should be more proactive, and cities should make an effort to include them. Professional planners boast experience, skills, and training that would be beneficial in the creation of effective blueprints and strategies.

Beyond involving planners, Bassett and Shandas (2010) emphasize the necessity of plan leadership. For many plans, the mayor spearheads development, but any high ranking official can take up the cause. A political champion is necessary in order to bring awareness to climate change, to educate the public, to move policy discussions onto the agenda, and to keep the issue in the public spotlight.

Couching climate action plans in local terms is one of the most effective ways to garner support. CAPs, despite many being based on ICLEI standards, are often diverse, as they form around their target audience. Bassett and Shandas (2010) show that defining issues in a local context becomes especially important in areas where encouraging climate change support is difficult or open to misunderstanding. Plans may emphasize different initiatives depending on the audience. For example, if a city population cannot be motivated to take action simply for the sake of future generations, then focusing on the financial benefits of doing so could be a more prudent strategy.

Bassett and Shandas (2010) conclude that creators of CAPs should look to other cities for ideas and inspiration. As climate action planning continues to grow, comparison between similar cities remains one of the best ways to improve plans and measure success. Many cities post their initiatives and strategies online, forming easy access to best practices, creative ideas, and pitfalls to avoid.

Wheeler (2008) emphasizes that CAPs need to keep up with digital trends, which involves implementing social marketing campaigns and educational strategies. CAPs often face the challenges of educating the populace and raising awareness of climate change behaviors. While individuals may express interest in becoming more eco-friendly, frequently they do not understand what that entails or how to achieve it. Strategies for communicating

with a vast number of individuals via a medium that they access daily should constitute a pragmatic section of each climate action plan.

Once again a distinction must be made between mitigation policies and adaptation policies. Relatively newer than mitigation, adaptation remains in the development phase. Anguelovski & Carmin (2011) highlight the experimental nature of current adaptation strategies. Lacking a formula or procedure to follow, cities design their own processes and proceed on trial and error. While adaptation can follow many of the same strategies as mitigation, cities show relatively little initiative to incorporate adaptation into their mitigation plans. Therefore, when considering adaptation, cities need to consider an additional set of guidelines.

Cities may create an adaptation task force, composed of research institutes, experts, and organizations who work closely with the municipal government. Some communities also link climate initiatives to developmental initiatives to try to engage reluctant businesses and vulnerable populations. Climactic change will disproportionately affect already vulnerable populations, so linking climate and development may help to achieve multiple goals (Aggarwal, 2013; Anguelovski & Carmin, 2011).

Dangers that CAPs Should Avoid

In addition to best practices that all plans should incorporate, existing research points to a list of dangers that all plans should attempt to avoid and inescapable obstacles that plans must attempt to work around. Careful planning and review and thorough knowledge of local environment can best prepare a city to address these issues.

Both Wheeler (2008) and Betsill and Bulkeley (2007) suggest that current CAPs fall short on setting and meeting goals. Concrete goals matter for two reasons. One, cities' success requires that they invest the time to accurately measure emissions and sources of rising temperatures to have a baseline from which to create policies and measure progress. Two, Wheeler goes on to add that cities need to reduce GHG emissions by at least 80% below 2000 levels by 2050. A reduction of this magnitude will most likely prevent the Earth from warming another two degrees Celsius, the maximum point of warming the globe can withstand before major damage occurs. Many cities adopt this baseline as their target. However, short-term initiatives fail to see reductions consistent with that goal. For example, cities in California plan to meet the reductions standard Wheeler suggests. Analysis of their reductions, though, reveals that the short-term goals they have set will not decrease reductions significantly enough to meet their long-term goal. Their short-term goals provide the illusion that they are making progress, without substantially reducing emissions. Unreasonably short-range goals, like the ones from California, only exacerbate the problem by "making progress" on easily attainable goals.

Stone, Vargo, and Habeeb (2012) highlight the lack of technical capacity to adequately collect and construct GHG emissions inventories, one of the tools most commonly used to measure progress. They found that, despite the creation of these inventories, most cities fall prey to errors, such as not following through on conducting sufficient emissions forecasts, not setting adequate targets for reductions, or not forging a link between mitigation measures and the forecasts and targets. As the GHG emissions inventories direct the goals for the climate action plan, failure to adequately create the inventory in the first place can lead to failure of the plan overall and failure to address

climate change. Betsill (2001) suggests that one solution to this may be sending representatives to ICLEI meetings, where they can receive training in creating GHG indexes.

Zimmerman and Faris (2011) and Betsill (2001) found that cities often do not prioritize climate change actions over other, more pressing issues. In the face of poverty, healthcare, crime, and a slew of other issues, officials tend to overlook climate change. Immediate problems regularly overshadow long-term ones, and officials devote funding and administrative capacity to more visible short-term problems, putting off long-term problems for as long as possible. Many cities view climate policies as "luxuries" and therefore not something deserving precedence over other projects in the face of limited funding. Moreover, Betsill (2011) points out that climate change programs require "up-front" spending in order to begin, which many cities hesitate to commit to. Betsill also contends that cities lack the administrative capacity necessary to authorize and maintain CAPs. The human capital necessary falls short of taking on a task as large as climate mitigation and adaptation. Shaking this mindset of short-term over long-term interests should be a priority, as the forecasts for many cities appear bleak without the promise of timely intervention.

Betsill (2001) further contends that some cities fall prey to the "business-as-usual" mindset. By repackaging existing policies as climate change policies, cities imply that they have already taken steps to mitigate climate change, without actually taking any action. When cities do this, they become complacent and unwilling to explore new options for climate change policies and let themselves off the hook without making any progress.

Betsill and Bulkely (2007) suggest that many plans fail because they lack coordination across levels of government and private organizations. Despite attempts to organize across levels of government and in conjunction with local organizations, many

plans remain fragmented. Tozer (2013) finds that problems with jurisdiction impede many CAP actions. To be effective, municipal CAPs need to connect with regional and nationwide policies. Polycentricity is one of the strengths of municipal climate action planning; therefore, organizing actions among government and private partners and municipal and higher-level government needs to be a priority of the planning process.

Once officials establish plans, enforcing them can lead to additional problems. Ostrom (2010) identifies a number of problems associated with enforcement of CAPs: leakage, inconsistent policies, inadequate certification, gaming the system, free riding, and application across demographics. Leakage involves moving a problem from one location to another. For example, regulations placed in one area preventing deforestation may simply encourage businesses in that industry to move to another area with fewer regulations in place. Inconsistent policies can create confusion and drive up expenses for businesses attempting to comply with them. Inadequate certification stems from the relatively new industry of creating CAPs. Governments and professional organizations need more regulations to adequately certify planning experts and to root out individuals fraudulently claiming to possess the knowledge and skills necessary to endorse plans. In gaming the system, businesses take advantage of programs offered to lower emissions. They try to reap the benefits without significantly or meaningfully lowering emissions. Free riders take advantage of the fact that reducing emissions benefits everyone, not just those who take action. Some will benefit from cleaner air, renewable energy, and related improvements, without making contributions or without making adequate contributions. Stevens and Senbel (2012) show that certain sub-populations may need additional resources and education in order to comply with emissions reducing strategies. Households that fit this category are normally owner-occupied, less-

educated non-immigrants. Further, rural households may be less likely to comply than urban households, with the added reason that many rural households depend on carbon-emitting industries for employment.

Measuring what Plans Accomplish

Most plans span decades, so measuring their effects presents no easy task. Boswell, Greve, and Seale (2010) argue that the most common method of measuring plan effectiveness is to measure reductions in greenhouse gas emissions. Cities typically establish greenhouse gas emissions inventories when constructing local climate action plans. City climate action plans create goals based on emissions reductions and use emissions reductions to track progress. Therefore, plans that significantly reduce GHG emissions rate more highly than those that do not.

Stone, Vargo, and Habeeb (2012), on the other hand, emphasize the need to reduce urban heat island effects. Emissions contribute to only a portion of the climate change experienced on a city level. Urban heat island effects are a product of how cities use land. Loss of green space, loss of forested areas, and construction with materials with high thermal capacities contribute to the heat that cities experience. The loss of habitat and the generation of extra heat negatively impact the city environment and the environment around the city.

Plans that attempt to address GHG emissions and urban heat island effects together prove more valuable than plans that do not clearly address both. Tangible results, then, depend on two factors: reduction of GHG emissions and reduction of temperature.

ANALYSIS OF THREE CAPS: VANCOUVER, CHICAGO, AND MEXICO CITY

Climate action plan analyses can focus on one city or multiple cities. Analyzing multiple cities allows for comparison, providing a broader context for understanding CAP complexities. These three cities were selected based on factors such as population, location, governance, and motivation. Each of the cities selected face diverse obstacles and dissimilar conditions in which to conduct their planning. Comparing each plan gives insight into what makes a plan successful and what pitfalls plans should avoid. Differing governments, populations, and locations help reveal what techniques work across the board and which ones are better suited for specific environments.

The field of climate action planning is fairly nascent and research of this type is difficult to come by. Previous research focused on defining what municipal climate action planning is and whether it provides a viable method for fighting climate change. Much research involved a single city or a comparison of similar cities. Now that researchers know what CAPs are capable of, the next step is to determine what plans work best and why. Comparing several cities with well-developed climate action plans will allow researchers to derive best practices and guidelines for future planning studies.

To fully understand the creation and implementation of each plan, a brief overview of relevant city characteristics is needed. The overview of each city is important when comparing climate action plans because it provides a lens through which to evaluate each plan and analyze its effectiveness. It helps when comparing the structure, the steps taken, and the motivation behind creating each plan.

Overview of Relevant Characteristics of Each City

Vancouver

Vancouver has a population of approximately 2,470,289 people. The total land area covers 2,882.6 square kilometers, and the population density is 857 persons per square kilometer ("Annual Population Estimates," 2014). It is a diverse city, with a large immigrant population and a variety of different spoken languages, with English spoken in 67% of households ("NHS Profile," 2011). The average income for Vancouverites is $41,031 ("NHS Profile," 2011).

Vancouver, a coastal city located on the Burrard Inlet, shares borders with the Coastal Mountains to the north, the valley of the Fraser River to the east, the Pacific Ocean to the west, and the US to the south. Vancouver's ocean-side location gives it a temperate annual climate ("Vancouver Economic Commission," 2012). Vancouver includes many different ecosystems, such as forests, wetlands, fresh water, riparian, intertidal, and estuaries ("About Sensitive Ecosystems," 2014). Over the past 25 years, an annual average of 1,169.91 millimeters of precipitation and 48.2 centimeters of snow fell in the city ("Total Precipitation," 2015).

Vancouver boasts a lively, highly-diversified economy with growing knowledge-based sectors and strong global connections ("Vancouver Economic Commission," 2012). Vancouver's position on the coast and its bustling port contribute to its robust economy. Forestry, fishing, mines, and minerals have been Vancouver's dominant resource-based industries for decades, but the city's tourism sector also continues to grow each year ("Vancouver Economic Commission," 2012).

Chicago

Chicago, a city of approximately 2,718,782 people, covers an area of 366.3 kilometers and has a population density of 7,358.4 persons per kilometer (“State and County Quickfacts,” 2014). The Chicago population comprises 26 different ethnic groups and a variety of different languages, with English the most common. Chicago’s median household income is $46,877 (“State and County Quickfacts,” 2014).

Located in the continental climate of the Midwest, Chicago belongs to a forest-grassland transition zone, which includes forests, woodlands, grasslands, and wetlands (Hayhoe et al., 2008). Over the past 30 years, the city received an average precipitation of 992.9 millimeters of rainfall and 94.2 centimeters of snowfall (“Chicago Midway Airport,” 2014).

The city is an economic center for the region. It has a well-integrated regional transportation system and a diverse mix of industries. Chicago's economy revolves around manufacturing, printing and publishing, finance and insurance, and food processing. The substantial industrial base and major inland port solidify the city's position as a national transportation and distribution hub. The city houses the Federal Reserve Bank, the Chicago Board of Trade, and the Chicago Mercantile Exchange (“Chicago: Economy,” 2014).

Mexico City

Mexico City, a city of approximately 8,874,700 inhabitants, covers an area of 1,482 kilometers and has a population density of 5,988.33 people per kilometer (“Mexico: Distrito Federal,” 2014). The population is divided into those of European descent, those of mixed descent, and those of indigenous descent. The mixed cultural history left the city with a rich

social scene and a variety of spoken languages, Spanish the most prominent. The average annual income for Mexico City residents is $47,396 (“Mexico in Figures,” 2010).

Mexico City resides in an enclosed valley, surrounded by mountains and volcanoes. The city boasts a number of different ecosystems, ranging from tropical forest to desert. Part of a subtropical climate, it experiences about 820 millimeters of precipitation per year and almost no snowfall (“Mexico in Figures,” 2010).

Mexico City’s economy centers on textiles, chemicals, furniture, plastics and metals, electronics assembly, and pharmaceutical products. The food and beverage industry, including manufacturing and restaurants, remains a major employer, and tourism brings in millions of dollars of income. An underground economy fueled by street vendors and those who would otherwise be unemployed also exists. Official efforts to quell this economy so far have fallen short (“Mexico City: Economy,” 2008).

Of the three cities studied, Mexico City stands out in two respects. One, Mexico City’s population is much larger than either Vancouver’s or Chicago’s. At nearly nine million people, Mexico City is home to nearly three to four times as many people as the other two cities. Two, while Vancouver and Chicago are post-industrialist countries, Mexico City is a country that is newly industrialized. This difference in development puts Mexico City at a disadvantage, as it must currently contend with issues that Vancouver and Chicago faced in the past. Mexico City also faces more pressing issues in terms of poverty and crime, with less resources and infrastructure to tackle them. Nevertheless, the inclusion of a city with a larger population and different priorities adds to the comparison by enhancing variety and offering a different perspective.

Before delving into the climate action plans of each city, a timeline needs to be established reflecting each plan's significant dates. The Vancouver *Greenest City 2020 Climate Action Plan* (GCAP) is the most recently established of the three climate action plans; it began in 2011. The Chicago *Climate Action Plan* (CCAP) began in 2008, and the Mexico City *Plan Verde* began in 2007. Vancouver's GCAP will remain in effect until 2050, with midterm goals set for 2020. Chicago's CAP ends in the same year, with midterm goals also set for 2020. Mexico City's *Plan Verde* will remain in effect until 2018, concluding 15 years of work. Comparing *Plan Verde's* end date with Chicago and Vancouver's midterm goals draws a rough similarity.

Motives for the City CAPs

The first step in analyzing a CAP is analyzing the motivating factors responsible for the creation of the CAP. Understanding the motivations behind each CAP's creation reveals insights into the plan's effectiveness and the city's willingness to commit to the goals laid out in the plan. Each set of motivating factors can be broken down into two sets of categories: internal and external and mitigation and adaptation. The table below, Table 1, details the internal motivating factors present for each city.

Table 1

Internal Motivational Mitigation Factors			
	Vancouver	Chicago	Mexico City
Political Champion(s)	X	X	X
Authority Responsible for Overall Targets		X	
Co-Benefits	X	X	X
Localization of Environmental Issues	X	X	X
Existing Initiatives	X	X	
Environmental Constituency	X	X	?

Vancouver

Within Vancouver, a powerful political champion, Mayor Gregor Robertson, pushed for the creation of the GCAP. Elected to three consecutive terms, Mayor Robertson pursues an agenda focused on climate change, emphasizing the need to maintain and advance the city's green goals (Williams, 2014). The driving force behind the GCAP, he continues to formalize and institutionalize climate change policies within the municipal government. The continuity in leadership is a strong motivating factor. Continued leadership demonstrates that the current plan functions as it should and that gains made satisfy residents.

The presence of a political champion is complemented by the existence of a planning team. Vancouver created the Greenest City Action Team (GCAT) in 2009, which held responsibility for determining goals and setting targets. The City of Vancouver took their work and used it to create the GCAP. The administration and enforcement of the policies within the GCAP fall to a City of Vancouver staff composed of about sixty individuals. The plan also calls for the inclusion of 120 different local organizations, many of which, though,

are never named within the plan. In all, the city tasked these sixty officials with overseeing the GCAP; however, no solid or defined committee or team charged with overall management exists (*Greenest City*, 2011).

The Vancouver GCAP (2011) includes a list of co-benefits, products of environmental protection policies that also serve to improve living conditions for the city's residents. The list of co-benefits encompasses categories such as health, resiliency, affordability, community, and economy. Sustainable transportation choices, like walking and biking, improve citizen health and air quality and also reduce the risk of accidents. Cities utilizing sustainable transportation, buildings, and infrastructure are more resilient. They better position themselves to respond to climate events. Also, less reliance on fossil fuels frees cities from fluctuating fuel prices. Sustainability is affordable. For example, citizens and businesses can go "car-lite," reducing the number of vehicles they need; they can save money on electricity, by using sustainable methods like solar power; and they can save money on their water bill using water-efficient appliances. Sustainable cities build communities through more efficient use of public space and by planning more around people and less around cars. Cities that design for people create more public spaces, enhancing socialization and facilitating cultural experiences. Green practices also enhance the economy. Vancouver, as a green city, attracts businesses, creating an environment where people want to live and work. The city's green policies also attract tourists, create jobs, and open new opportunities to current residents.

Further, Vancouver localized environmental issues by engaging the public in the planning process. Vancouver hosted workshops and educational sessions designed to discuss climate change in Vancouver and changes residents could expect to experience. Through a

mixture of these in-person events and online social media campaigns, Vancouver received feedback from over 35,000 residents (City of Vancouver, 2014b). Such a large response from citizens greatly boosts the GCAP's chances for success, as a motivated citizen base will continue to push for climate change goals.

Vancouver's environmental policies have existed since the early 1990s, beginning with the Vancouver Clouds of Change task force. The city created Clouds of Change in 1990 to address mitigation efforts and to study possible adaptation strategies. Vancouver adopted both the Vancouver Greenways Plan and the CityPlan in 1995, which supported the advancement of more opportunities for walking and bicycling and provided direction for developing sustainable communities. The comprehensive transportation plan of 1997 reemphasized public transportation, bicycling, and walking. In 2003, another task force, Cool Vancouver, brought together government entities, NGOs, citizens, and industry with the goal of reducing greenhouse gas emissions in the city. Two years later, in 2005, the city adopted the Community Climate Change Action Plan, with updated targets and strategies for GHG reductions, and the same year saw the production of the Climate-Friendly City plan, a corporate plan for city operations. In 2008, Vancouver revised city building bylaws, to include new green home requirements for one- and two-family homes, and passed new legislation, called EcoDensity, which promotes more sustainable planning processes. These collective efforts led to the 2009 formation of the Greenest City Action Team, the group responsible for the GCAP (City of Vancouver, 2014b).

Vancouver also boasts a large environmental constituency, having elected the Vision Vancouver Party, which runs on a platform emphasizing sustainability, to three consecutive terms (Vision Vancouver, 2014). It should be noted that Vision Vancouver lost a number of

seats in the most recent election, losing the majority in the city council; however, these seats went to another major environmental party, the Green Party (Williams, 2014).

Chicago

The City of Chicago has seen two different mayors throughout the course of the Chicago CAP: Mayor Richard M. Daley and Mayor Rahm Emanuel. Through the leadership of Mayor Daley, the city employed a task force designed to create the Chicago CAP, with the explicit goal of reducing emissions and temperatures within the city. In 2011, Mayor Emanuel took over these duties and has had mixed results in maintaining them. While the environment and sustainability remain on his agenda, budget cuts have necessitated a reorganization of duties and responsibilities (Nemes, 2011).

The Green Steering Committee holds responsibility for administering the Chicago CAP. Answering directly to the mayor's office, the Green Steering Committee oversees all other department leaders. An overall leader of the Chicago CAP benefits the plan in that one authority can hold varying departments responsible for their actions. In conjunction with the steering committee, the City of Chicago utilized a Department of Environment, responsible for managing and monitoring the Chicago Climate Action Plan, up until the end of 2011 (Coffee, Parzen, Wagstaff, & Lewis, 2010). Mayor Emanuel disbanded the department in an effort to ease the already strained city budget. The functions performed by the Department of Environment flowed to three separate departments: General Services, Public Health, and Transportation (Nemes, 2011).

The Chicago CAP co-benefits generally mirror the GCAP co-benefits. The Chicago CAP co-benefits, generated by the actions taken in the Chicago CAP, fit into the same five,

general categories: health, resiliency, affordability, community, and economy (Parzen, 2009). Though the plans differ, the positive side effects appear to be similar, if not identical. Either way, both sets of co-benefits are strong motivators when propelling cities to adopt climate action plans.

Chicago localizes climate change through participatory action research. The creators of the Chicago CAP wanted to work with community members, not just enforce new planning regulations on communities. Researchers engaged neighborhoods by conducting Rapid Ethnographic Inventories (Field Museum, n.d.). The Chicago Field Museum worked with neighborhoods and connected with community members to define environmental issues. This approach accomplished two separate goals. One, it engaged residents and brought interest to the plan. It showed Chicago citizens what the CAP was about and how it could benefit them as a community. Two, it helped researchers identify areas of environmental concern. This two-pronged approach motivated citizens who may not have otherwise participated in the CAP.

Chicago, unlike Vancouver, does not have an extensive history of climate change initiatives. Chicago first began to appreciate the challenges climate change posed under the leadership of Mayor Daley. Fifteen years ago, Mayor Daley began integrating environmental awareness into the city's day-to-day activities. He launched research endeavors geared toward measuring GHG emissions and UHI effects. This research eventually culminated in the creation of the Chicago Climate Task Force, which ultimately produced the Chicago CAP ("Climate Change 101," n.d.).

While the state of Illinois is generally politically moderate, the City of Chicago is a Democratic stronghold. Of the 50 wards and the 50 aldermen representing those wards, all 50

aldermen identify as Democrats (City of Chicago, 2015). Democrats usually favor eco-friendly policies and have a strong desire to deter climate change. As the majority of Chicago votes Democratic, it can be said that Chicago boasts an environmental constituency, one of the motivators necessary to the success of a climate action plan.

Mexico City

Mexico City boasts two political champions instrumental in the creation of *Plan Verde*: Mayor Marcelo Ebrard and Secretary of the Environment for the Federal District Martha Delgado (C40, 2012). Mayor Ebrard changed the face of Mexico City, launching the *Plan Verde* in 2007. Together, Mayor Ebrard and Secretary Delgado reduced GHG emissions, revamped transportation, and retrofitted city buildings (Benignos, 2010). In 2012, Mexico City elected Miguel Angel Mancera, a member of the same political party as Ebrard, the Party of the Democratic Revolution. The Party of the Democratic Revolution is a left-leaning party, interested in modernizing Mexico City, especially in terms of the environment. Mayor Mancera's Secretary of the Environment, Tanya Müller García, continues to administer the *Plan Verde* (United Nations, 2014b). Despite the change in leadership, Mexico City's drive to become greener seems to have remained the same.

As in the case of Vancouver's plan, Mexico City lacks a clear authority responsible for meeting all goals. The city integrates various departments into the plan's administration and includes officials from across the mayor's office, but no specific committee exists to administer the *Plan Verde* (*Plan Verde*, 2007). Without such an authority, the city runs the risk of disorganization between departments and lack of accountability for the departments involved.

As in the other two cities, Mexico City's *Plan Verde* (2007) mirrors the list of GCAP and Chicago CAP co-benefits. Again the same five general categories of co-benefits apply: health, resiliency, affordability, community, and economy (Parzen, 2009). The *Plan Verde* increases overall city health, resiliency, and sense of community. It lessens costs and boosts the economy. Though all three plans approach climate change differently, the positive side effects of each plan seem to be analogous, if not completely identical. In any case, the co-benefits of all three serve as strong motivators, compelling even difficult populations to take interest.

Mexico City, maybe moreso than either of the other cities, localized environmental concerns while in the design phase of *Plan Verde*. Mexico City took the time to consult respondents, receiving feedback from over a million people in a three year period (Benignos, 2010). Researchers determined what citizens wanted in a climate action plan and then strived to deliver it to them. This kind of involvement from the community provides a large boost to city motivation. If the residents support the plan, the city is motivated to maintain it.

Mexico City, unlike Vancouver and Chicago, has no history of climate change initiatives. *Plan Verde* marked a departure from previous attitudes toward climate change policy, introducing the first climate framework the city had ever seen (C40 Blog, 2012). Mayor Ebrard's focus on the environment broke ground, leaving a lasting impression and legacy for Mayor Mancera to sustain.

Determining whether Mexico City houses an environmental constituency proved difficult. In contrast to the other two plans, Mexico City did not have widespread support from residents for developing climate initiatives. As of 2003, 30% of Mexico City inhabitants believed the city's climate goals to be self-serving (Hibler, 2003). Conversely,

Mayor Ebrard, largely responsible for *Plan Verde*, left office in 2012 with the highest approval rating of his career, about 65%. Voters appreciated all of the work he had done, including his work in greening the city. Additionally, a member of his own party, running on similar climate policies, succeeded him as mayor (Villagran, 2012). Of course, innumerable factors influence voting in an election, and climate change policies comprised only a small fraction of the issues, which makes it nearly impossible to determine how much climate change policies influenced voters.

Table 2, below, details a second set of motivational factors, those that influence adaptation. While less research focuses on adaptation, as opposed to mitigation, some motivators have been isolated.

Table 2

Internal Motivational Adaptation Factors			
	Vancouver	Chicago	Mexico City
Direct Experience with Climate Change	X	X	N/A
Desire to Lessen Vulnerability	X	X	N/A
Political Champion	X		N/A

Vancouver

The City of Vancouver adopted an adaptation strategy, divided into nine steps and over fifty actions. The establishment of this strategy contradicts the prevailing theory that cities do not expend effort on creating adaptation policies. For Vancouver, all three major

motivating factors are present and could account for the existence of the adaptation initiatives (*Climate Change Adaptation Strategy*, 2012).

Direct experience with climate change and desire to lessen vulnerability go hand in hand. Average annual temperatures have risen about a degree Celsius. Over the last century, British Columbia has lost about half of its snowpack, which may strain Vancouver's water sources. Hotter summers could also cause prolonged droughts. Warmer winters have created a mountain pine beetle epidemic, which has already destroyed forest area four times greater than the area of Vancouver Island. Greater and more frequent extreme weather will impact infrastructure, like roads and bridges, and will affect people's health and well-being. Important fisheries will be affected because of fish sensitivity to surface temperature warming. Sea levels are expected to rise thirty centimeters, and glacier reduction could impact rivers, hydroelectric power, and tourism ("Effects of Climate Change," 2011).

The politician championing adaptation policies is, again, Mayor Gregor Robertson. Under his direction, the city council brought adaptation to the forefront of the city's sustainability plan, beginning with an adaptation assessment in 2007. Vancouver participated in the Local Governments for Sustainability (ICLEI) Climate Change Adaptation Initiative, which included local and regional governments across Canada. The initiative assisted cities in working through ICLEI's five milestone methodology, with the end goal of creating an adaptation plan in two years (City of Vancouver, 2014b).

Chicago

Chicago also includes an adaptation section in its CAP. The Chicago adaptation section is less extensive than Vancouver's adaptation strategy, but, like Vancouver's, it

combines elements of direct experience with climate change and desire to lessen vulnerability to climate change.

In Chicago, the changes wrought by climate change will be extensive and can already be seen at work. Climate change will affect average yearly temperatures. Changes include but are not limited to: hotter, longer summers; warmer winters; more frequent heat waves; and a larger difference between actual temperature and apparent temperature, due to greater humidity. Temperature changes will also affect the environments in which local organisms thrive, driving out current species and introducing new ones. Changes to ecosystems will be extensive, but some major impacts will be decreases in agricultural production, increases in shoreline erosion, and major losses of habitat. Air quality will worsen. Hotter temperatures increase the production of ozone. Continued pollution leads to "precursor pollutants" that will become ozone. The two combined will create even more days of heavy, ground ozone. Climate change will also most likely lead to more vector-borne and water-borne diseases, like West Nile Virus and Lyme disease. Chicago has already seen more than a thousand cases of West Nile Virus in the past few years, and Lyme disease is beginning to make an appearance.

Changes in precipitation patterns also seem likely. The city expects increased spring and winter rainfall, as well as increased, heavy downpours. Snowfall will most likely not change; however, the city expects days with snow on the ground to shrink due to warmer temperatures. Changes in precipitation will lead to changes in hydrology. Evapotranspiration, the amount of water transferred through the ground to plants and back to the atmosphere, will likely increase, as will runoff levels. The city expects Lake Michigan water levels to drop by about half a meter and beach contamination to increase. Finally, climate changes will affect

Chicago's infrastructure and economy. Heavy rainfall and extreme heat will affect roadways, bridges, and railways. Increased flooding will cause damage to buildings and subsequently affect insurance coverage and rates. Changes in frost depth and air temperature will warrant an update of building codes. Finally, residential and commercial energy rates and times of consumption will change to reflect changing temperatures (Hayhoe et al, 2007).

Chicago does not have a political champion for adaptation, per se. As Chicago built adaptation into its original CAP, it could be said that the same champions of that plan, Mayors Daley and Emanuel, also champion adaptation policies.

Mexico City

Mexico City's *Plan Verde* focuses solely on mitigation efforts. No adaptation strategy, nor adaptation section of the plan, exists, unlike in the other two cities (*Plan Verde*, 2007). The absence of such measures confounds expectations. Mexico City is facing rising temperatures and falling precipitation levels. While instances of extreme storms will increase, annual precipitation overall will decrease. These two problems will lead to flooding and damaged infrastructure and extended droughts, something Mexico City is already experiencing. Increased heavy rain will also likely cause landslides in parts of the city, creating more destruction and risk to human safety, and greater amounts of runoff, which will destroy roads and other travel paths (Sosa-Rodriguez, 2013). These climate disturbances reveal the city's vulnerabilities and the impacts residents will face, especially for the lower-income residents, whom climate change disproportionately affects. Despite the existence of factors that would seem to motivate the city to action, no political champion has stepped forward, nor has the government made any effort to address adaptation.

Aside from internal motivating factors, external motivating factors influence city plans. External motivating factors include factors that originate outside of the city, like international networks and organizations, external partners, environmental agencies, and informational networks. Table 3 details which motivators drive each city.

Table 3

External Motivational Mitigation Factors			
	Vancouver	Chicago	Mexico City
International Networks/Organizations	X	X	X
External Partners	X	X	X
Existing Environmental Agency near City	X	X	X
Informational Networks	X	X	X

Vancouver

Vancouver works directly with ICLEI and C40 to create project goals and strategies (*Greenest City*, 2014; C40 Blog, 2015). ICLEI provides advice and frameworks for designing plans. It also offers guidance on data collection and measuring plan progress. The C40 functions similarly, providing technical knowledge and information on methodology and management strategies and connections with other cities.

Vancouver's external partners include the British Columbia Ministry of Environment, Vancouver Economic Commission (VEC), Vancouver Food Policy Council, Park Board, Environment Canada, Port Metro Vancouver, Translink, Environment Canada, Metro Vancouver, BC Hydro, Strathcona Business Improvement Association, Vancouver School

Board, Vancouver Coastal Health Authority, Vancouver Tool Library, and Canada Line (*Greenest City*, 2011; *Climate Change Adaptation Strategy*, 2012). The partners listed here are those explicitly mentioned in Vancouver's planning documents, either the GCAP or the *Climate Change Adaptation Strategy*. While Vancouver may partner with other organizations, unless mentioned somewhere in the documents, those organizations are excluded on the grounds that significant contributions would be documented in the planning phase. Vancouver's inclusion of external partners outpaces both Chicago and Mexico City. Vancouver works more closely with the industrial sector of the city, which should allow more substantial emissions reductions.

Vancouver is home to a variety of environmental organizations and agencies, such as the Stanley Park Ecology Society, the Canadian Environmental Assessment Agency, the Columbia Foundation, the Pacific Salmon Foundation, Greenpeace Canada, the Northwest Wildlife Preservation Society, the Eya Environmental Youth Alliance Society, the Sea Shepherd Conservation Society, the World Wildlife Fund Canada, and the Rainforest Solutions Project (Eco Learning Hive, 2011). The presence of environmental organizations influences a city's decision to adopt a climate action plan. The more organizations present, the more likely a city is to take action.

Vancouver's GCAP draws from a variety of informational networks, citing far-off cities such as Copenhagen, Stockholm, Oslo, and London, as inspirations for different projects. Without their groundbreaking techniques and innovations, Vancouver would have hesitated to proceed with some of its projects, such as sewage heat recovery and heat mapping for energy districts. Closer to home, Vancouver drew from cities such as St. Paul, Seattle, Toronto, and Markham. These cities presented models that could be applicable to

situations in Vancouver, in areas like business, regulatory regime, and energy pricing (C40 Blog, 2015). Seeing comparable cities succeed motivates the City of Vancouver to continue its progress on green goals.

Chicago

Chicago partners with ICLEI, C40, the Clinton Climate Initiative, and Global Philanthropy Partnership (GPP). ICLEI works with Chicago in the same capacity that it does with Vancouver. During Chicago's design phase, ICLEI provided technical expertise and direction. It now showcases Chicago's plan as an example to other cities interested in beginning their own plan (Parzen, 2009). The C40 similarly provides advice and expertise and connects Chicago with other cities interested in exchanging ideas. C40 also coordinates with outside partners who can assist in plan development and implementation (C40 Blog, 2013b). The Clinton Climate Initiative and Global Philanthropy Partnership work to find funding for the plan and to connect volunteers interested in working with the Chicago CAP initiatives (Parzen, 2009). Without these organizations, Chicago may have struggled with creating the CAP. Contact from these international sources provided the impetus necessary to launch the plan.

Chicago also partners with many external organizations, including the Delta Institute; BP America; Baxter International; the Aspen Institute; the School of Earth, Society, and Environment, University of Illinois at Urbana-Champaign; the Joyce Foundation; the Department of the Geophysical Sciences, University of Chicago; Allstate Administration and Real Estate; the Illinois Department of Commerce and Economic Opportunity; the Environmental Law and Policy Center; the International Brotherhood of Electrical Workers,

Local 134; and the Illinois Environmental Protection Agency (Parzen, 2009). These organizations helped design the plan, lending expertise from a multitude of fields and acting as a catalyst for production of the plan. While Chicago has no problem partnering with schools and institutions, the Chicago government has not made as much headway with the industrial sector, unlike in Vancouver. As the industrial sector of the city accounts for a large portion of emissions, Chicago's failure to connect with industry may weigh down its CAP.

According to the Chicagoland Environmental Network, over 200 environmental agencies reside in the Chicago area. Some of the more prominent members include the Illinois Environmental Protection Agency, the Chicago Botanic Garden, and the National Great Rivers Research and Education Center (Chicagoland, n.d.). Like in Vancouver, the network of environmental agencies and organizations motivated the city to adopt a climate action plan, by acting as an environmental presence within the community.

Chicago belongs to the C40 cities and the U.S. Conference of Mayors, both excellent sources of information. C40 provides a web of information from member cities and access to environmental experts. The U.S. Conference of Mayors connects mayors from across the country with like-minded individuals also interested in creating climate action plans for their cities. Mayors constitute the forefront of municipal climate action, a key component in their inception and success.

Mexico City

Mexico City works with ICLEI and C40, just as Vancouver and Chicago do. Much like the other two cities, Mexico City benefited from the range of professional expertise, the technical knowledge provided, and the access to information from other cities around the

world. Contact with these organizations propelled Mexico City into the realm of climate planning, pushing it to recognize problems and begin research. Mexico City also works with the Clinton Climate Initiative, the World Bank, and the United Nations. The Clinton Climate Initiative partnered with Mexico City to provide guidance and supply funding (C40 Blog, 2011e). The World Bank and the UN backed the development of *Plan Verde* (Mexico City's Plan Verde, 2015).

Mexico City, the capital of Mexico, both houses and partners with many of Mexico's national organizations, such as the Secretariat of Environment and Natural Resources, the National Institute of Ecology and Climactic Change, the National Commission of Water, and a host of other governmental agencies (Secretaría, 2015). Mexico City also works closely with many of the city's financial organizations, like National Financing and Banorte Financing Group, to fund plan initiatives. The proximity of all these agencies makes the idea of creating a climate action plan more manageable. The presence of these organizations keeps the environment in the city spotlight, motivating eco-friendly actions. Mexico City, like Chicago, though, does not work as well with the industrial and manufacturing sectors as does Vancouver.

Mexico City, like Chicago, relies on organizations like C40 and ICLEI for access to informational networks (*Plan Verde*, 2007). Mexico City also had encouragement from organizations like the UN, the World Health Organization, and the Clinton Climate Initiative (Mexico City's Plan Verde, 2015). Organizations like these provided technical expertise, data management and resources, and tools for developing the best plan possible.

Finally, external motivators can also be divided into mitigation and adaptation motivators. As with internal adaptation factors, far fewer external adaptation factors exist.

The three researched include shocks, national and sectional regulations, and the desire to lead other cities in climate change policy. Table 4 below illustrates external adaptation motivators.

Table 4

External Motivational Adaptation Factors			
	Vancouver	Chicago	Mexico City
Shocks (i.e. flooding/hurricanes)		X	N/A
National/Sectional Regulations	X		N/A
Desire to Become Leading City in Climate Policy	X	X	N/A

Vancouver

While Vancouver is experiencing climate change, it has yet to experience any environmental shocks. Vancouver anticipates flooding from rising sea levels and a possible strain on the fresh water supply, due to less snow pack, but these changes are not yet severe. As discussed above, the city foresees a range of problems, with the potential to worsen, but that pose no immediate threat (*Climate Change Adaptation Strategy*, 2012).

Vancouver's GCAP stems in part from regulations issued by British Columbia. All cities in BC are required to integrate a climate action plan into their official community plans (Baynham, 2011). In fact, British Columbia requires public sectors in every city to be carbon neutral by 2010. Public sector buildings include government buildings, schools, hospitals, universities, and crown corporations. Further, B.C. requires every city to reduce GHG emissions to 33% below 2007 levels by 2020 and 80% below 2007 levels by 2050 (*B.C. Climate Action Plan*, 2008). Additionally, in 2008, the Green Communities Act passed,

which requires cities to include in their development plans GHG reduction targets, policies, and actions (Baynham, 2011). The provincial regulations pushed Vancouver to both create a CAP and to maintain it. The extra emphasis placed on climate planning from a higher authority encourages Vancouver to stay up to date with its plan. The other two cities lack this motivation.

Vancouver's motivation for creating the GCAP includes, in part, desire for worldwide recognition. The City of Vancouver states within the GCAP a wish to lead North American cities in developing CAPs and to serve as a global example of the potential for cities to impact climate change efforts (*Greenest City*, 2011). Further, Vancouver advocates for open discussion with other cities invested in halting climate change and in holding meetings to offer advice and personal experiences (C40 Blog, 2015).

Chicago

Chicago has experienced both severe storms and flooding in just the past year alone. In 2014, Chicago weathered two severe storms, which resulted in floods throughout the city. Two of Chicago's major news outlets, NBC Chicago (2014) and CBS Chicago (2014), reported on floods in July and August of 2014. The floods shut down roads, knocked out power, and uprooted trees. These kinds of extreme weather events push cities to adopt adaptation plans, driving home the consequences of inaction.

Without much federal direction, few regulations exist for cities to follow. While not a regulation, the City of Chicago does credit the Kyoto Protocol with influencing the plan in that the city planners wanted to bring Chicago in line with the guidelines set out in that international agreement (Parzen, 2009). The Illinois Environmental Protection Agency sets

standards for air quality, waste, water quality, and pollution, but does not act in the same capacity as British Columbia, in that it does not require specific emissions reductions.

Municipal leaders want Chicago to be recognized as the greenest city in North America, and the drive to achieve that goal comprises part of the impetus for the Chicago CAP (Parzen, 2009). As Mayor Emanuel said, "I want Chicago to be the greenest city in the world, and I am committed to fostering opportunities for Chicagoans to make sustainability a part of their lives and their experience in the city" (City of Chicago, 2012).

Mexico City

As illustrated above, Mexico City does not currently have any adaptation strategies in place, not for a lack of motivating factors but for a lack of government interest and initiative. Mexico City has experienced environmental shocks, such as flooding, due to climate change, but even those extreme events have done nothing to motivate the city to adopt an adaptation plan (Gallucci, 2010).

As a final note, Mexico City is unique in that it may experience one type of motivation not yet mentioned in other climate action planning research. The city faced a strong international pressure to clean up its air and provide a healthier atmosphere for its citizens. International critics, like the United Nations, considered Mexico City the most polluted city on the planet in 1992 (Hibler 2003). In 1996, it was considered hazardous for children to live there because of the air quality (Hibler, 2003). As a result of these health concerns and international outcry over the air quality, Mexico City began designing climate change initiatives to address these issues. The *Plan Verde* arose from these efforts.

Effectiveness of Each Plan

Each plan must encompass certain elements in order to be effective. Table 5 below outlines the components necessary for plans to be effective, delineating which components are present in each of the three plans.

Table 5

Components Necessary to be Effective			
	Vancouver	Chicago	Mexico City
Full Range of Climate Actions	X	X	X
GHG Emissions Inventory	X	X	X
UHI Effects Inventory	In Progress	In Progress	
Institutionalized Climate Action	X	X	
Involvement of City Planners		X	X
Political Leadership	X	X	X
Localized Issues	X	X	X
Comparison to Other Cities	X		
Social Marketing	X	X	

Vancouver

Vancouver's plan encompasses the five major categories of necessary climate actions: improving transportation, energy efficiency and conservation, revising building codes, water and waste management, and renewable energy (Wheeler, 2008; Zimmerman & Faris, 2011). Vancouver's plan adds its own sections such as sustainable food, green jobs, and access to nature (*Greenest City*, 2011). An additional adaptation strategy supplements the GCAP.

Vancouver's plan includes some simpler, morale-building initiatives, like planting trees and increasing access to nature by building parks, but it also includes more innovative, complex initiatives like a neighborhood heat exchange system and the introduction of a hybrid bus fleet.

The City of Vancouver conducts a GHG emissions inventory every five years (*Greenest City*, 2011; Metro Vancouver, 2013). Metro Vancouver prepared the majority of the 2010 emissions inventory and forecast and backcast, except for the 2010 ocean-going vessels emissions inventory and the volatile organic compounds emissions inventory, which SNC-Lavalin prepared under contract with Environment Canada and the railway and locomotive emissions inventory which SNC-Lavalin prepared under contract with Port Metro Vancouver. Additional data came from the United States' Environmental Protection Agency's National Emissions Inventory Database, Northwest Clean Air Agency, Puget Sound Clean Air Agency and Washington Department of Ecology (Metro Vancouver, 2013).

Vancouver is in the process of designing a UHI inventory. Under the city's *Climate Change Adaptation Strategy* (2012), the Extreme Hot Weather Committee works to complete heat mapping, identifying the areas most affected by heat. This mapping is the first step in addressing urban heat island effects.

Vancouver, more than either of the other two cities, institutionalized climate action. Both the GCAP (2011) and the *Climate Change Adaptation Strategy* (2012) contain indexes detailing which departments and groups hold responsibility for different actions. For example, developing a policy by 2020 for facility back-up power falls to the city engineering and real estate departments and the facilities management team. Those specific groups have a specific task assigned to them. Identifying actors, goals, and dates of completion are integral

to climate action planning. Vancouver has created policies, goals, and programs used to formalize climate action planning and solidify it as part of the city's overall development agenda. This formalization began with Vancouver's election of Mayor Roberts and continues to progress each year he holds office. Vancouver may face two difficulties, though. One, no authority oversees the entirety of the plan. Rather, various offices and organizations work together across the city to achieve goals. The mayor's office is the ultimate authority on the plan, but the lack of a department tasked with these goals or the oversight of a group of city planners could cause trouble. Two, Vancouver has not seen a change in leadership since the plan's launch. Vision Vancouver, Mayor Roberts' party, held a majority of the city council until the most recent elections (Williams, 2014). This loss of seats could upset the plan, but it is too early to tell for certain.

Vancouver does not seem to use city planners in its creation and management of the GCAP (2011). Rather, Vancouver's GCAP team consists of about 60 city officials, across city departments (City of Vancouver, 2014b). The planning documents came from the existing sustainability department and environmental department. Vancouver's city planners' website does not mention the GCAP, except to provide a link to Vancouver's Greenest City page.

Mayor Gregor Robertson leads Vancouver in meeting the goals of the GCAP. Recently elected to his third term, Mayor Robertson ran on a platform largely stressing the need to sustain and advance the city's green goals (Williams, 2014). A pivotal driver of the GCAP, he works to formalize and institutionalize climate change policies within the city government. The retention of the same leader and leadership team also benefits the city, as there need be no transition to new and perhaps different-minded politicians.

Vancouver localizes issues in its campaign to meet GCAP goals. Through a mixture of in-person educational and workshop events and online social media campaigns, Vancouver consulted over 35,000 residents, during the planning phase of the GCAP (City of Vancouver, 2014b). Citizens can find educational materials and interactive content on Vancouver's Greenest City website (2014). City officials are also available through an online chat system. All of these efforts serve to emphasize why climate planning is necessary in Vancouver and how local efforts can make a difference. This localization of the issues fuels Vancouver's GCAP's success.

Vancouver's GCAP leadership looks to a variety of different cities for inspiration and uses them as a comparison to gauge its own progress. Inspiration came from distant cities like, Copenhagen, Stockholm, Oslo, and London. Their influential techniques and innovations assisted Vancouver's development of its own projects, such as its sewage heat recovery system and heat mapping system for energy districts. Closer to home, Vancouver compares itself with cities such as St. Paul, Seattle, Toronto, and Markham. These cities, similar to Vancouver, present models that could be adapted in areas like, business environment, regulatory regime, and energy pricing environment (C40 Blog, 2015). Vancouver uses these models in its own planning, learning what works best and what to avoid.

Vancouver's social media marketing campaign succeeds on all levels. The Vancouver city website, vancouver.ca/green-vancouver.aspx, includes the *Greenest City 2020 Action Plan*, implementation updates, background information, and access to a host of other plan-related documents. The page includes contact information for the City of Vancouver and links to the City's Greenest City 2020 Facebook, Twitter, and Flickr pages. The city website

includes educational and informational links and provides an easy-to-use interface for citizens interested in learning more about the plan. Vancouver's use of social media makes it simple for residents to be involved, a necessary component of any successful plan.

Chicago

Chicago's plan, like Vancouver's, includes the five sections necessary to complete a climate action plan. Chicago's plan breaks down into five key sections: transportation, buildings, renewable energy sources, waste, and adaptation. Energy efficiency and conservation, seen in steps such as installing more efficient appliances and retrofitting buildings, are built into the plan. Chicago's initiatives are a mix of simple, motivational actions and complex, long-term strategies. For example, Chicago plans to plant 100,000 trees, which will be beneficial to the environment, but not the kind of hard-hitting action necessary to deter climate change (*Chicago Climate*, 2008). Chicago plans to take more complex steps, like revamping its railways and installing new sewer lines and water basins to better deal with storm runoff (C40 Blog, 2013b).

Chicago's goal is to reduce GHG emissions by 25% of 1990 levels by 2020 and by 80% of 1990 levels by 2050 (*Chicago Climate*, 2008). Researchers from the University of Illinois and Texas Tech University reached these reduction goals after analyzing five years of emissions data collection from 2000-2005 (Coffee, Parzen, Wagstaff, & Lewis, 2010). The city continues to monitor emissions data; Inner City Fund (ICF) International conducted the most recent GHG emissions index in 2010.

Chicago, like Vancouver, is researching urban heat island effects and planning a UHI inventory (*Adaptation Report*, 2008). Unlike Vancouver, though, Chicago already

experiences dangerous heat waves. Within the next century, Chicago could experience conditions on par with that of the 1995 heat wave every summer. The city began measuring UHI effects in a 1990 study conducted with the assistance of the U.S. EPA (1990). The study tracked broad areas of heat, from the outskirts of Chicago to the suburbs to the city center; it helped determine a plan of action for reducing heat; and it measured the effects reducing heat would have on residents, air quality, and energy. According to an interview on PBS' Coping with Climate Change (2012), the city uses thermal radar and mapping to pinpoint hotspots within the city and to create a more detailed heat map. While Chicago is in the process of mapping heat areas within the city and compiling its UHI inventory, it has launched initiatives to increase tree canopy within the city and to plant more rooftop gardens (*Progress Report*, 2010).

Chicago's plan meets most of the criteria necessary to institutionalize climate change as a lasting part of the city's agenda. The Green Steering Committee oversees the plan, and the plan calls for workers across government offices. Six departments, the Office of Emergency Management and Communications, the Department of Water Management, the Department of Buildings, the Department of Transportation, the Department of Zoning and Land Use Planning, and formerly the Department of Environment, lead different sections of the plan, taking charge of the work groups under them. The City of Chicago's Continuous Improvement through Performance Measurement initiative includes periodic measurement of progress on each mitigation and adaptation strategy in the plan (Coffee, Parzen, Wagstaff, & Lewis, 2010). Chicago may have an issue with sustained plan leadership across political leaders. Mayor Emanuel's administration of the plan differs from that of Mayor Daley, and Mayor Emanuel may prioritize other city projects over climate change (Nemes, 2011).

Chicago seems to have employed one city planner in the creation of its plan, Michael Berkshire of the Chicago Department of Planning and Development (Parzen, 2009). While it seems doubtful that one city planner could have an impact on such a large plan, that does put Chicago ahead of Vancouver, which had no planners on its design team.

As of 2008, the year the city established the Chicago CAP, two different mayors had served: Mayor Richard M. Daley and Mayor Rahm Emanuel. Mayor Daley created a green task force charged with the creation of the Chicago CAP, and with the goals of reducing rising emissions and temperatures within the city. In 2011, Mayor Emanuel took control and has had mixed results in maintaining the climate action plan and meeting its goals. Mayor Emanuel orchestrated budget cuts in 2012, resulting in the disbanding of the Department of Environment and dispersing the responsibilities of the CAP to three other departments. Mayor Emanuel continues to incorporate environmental policies into his agenda, albeit with a smaller budget and on a smaller scale.

Chicago localizes climate change issues by conducting Rapid Ethnographic Inventories (Field Museum, n.d.). The Chicago Field Museum, responsible for the research, worked with neighborhoods to connect with community members and identify areas of concern. This served two purposes. One, it engaged residents and brought interest to the plan. Two, it identified areas of environmental concern that needed to be addressed. Direct contact with various neighborhoods assisted with education and participation and allowed the CAP team to localize environmental issues in a clear, comprehensible way.

Throughout Chicago's planning documents no mentions of comparisons with other cities appear. Articles written on the Chicago CAP do not mention comparisons or similarities drawn between Chicago and nearby cities. Published interviews with government

officials provide no insight into whether Chicago looked to other cities for guidance or which cities Chicago may be matching itself up against. That is not to say that Chicago does not interact with other cities or climate change groups, but no record of informational exchanges between Chicago and other cities with climate action plans was identified.

Chicago's social marketing plan does not provide quite as easy access as Vancouver's. Chicago has a website, chicagoclimateaction.org, which hosts a variety of planning documents, like the *Chicago Climate Action Plan*, implementation updates, frequently asked questions, contact information, and the like. The Chicago CAP has its own Twitter handle, but no Facebook page or image sharing account. Chicago's plan does have an education section, though, detailing community events and meetings and listing ways citizens can become involved. Overall, Chicago's social media achieves a similar, if less far-reaching, effect as Vancouver's social media. Citizens have access to the information and can engage with the plan.

Mexico City

Plan Verde (2007), like the other two plans, encompasses the five basics necessary for plan success: transportation, waste and water, renewable energy, revising building codes, and energy efficiency and conservation. Mexico City's bus rapid transit system and bicycle sharing system received worldwide recognition (C40 Blog, 2012). Mexico City's *Plan Verde* contains steps related to water and energy conservation, with actions such as educating residents on eco-friendly practices and replacing inefficient appliances. *Plan Verde* also calls for the installation of solar panels, and officials are researching the idea of adding geothermal energy systems (C40 Blog, 2011d). As for waste, Mexico City is working with the Clinton

Climate Initiative to reduce the amount of waste that goes into landfills and to capture methane released from landfills (C40 Blog, 2011e). Revised building codes call for better insulation throughout buildings and the installation of rooftop gardens, useful in rooftop insulation and in lessening UHI effects (*Plan Verde*, 2007).

Mexico City, lacking the technical capacity necessary to develop a GHG emissions inventory for *Plan Verde*, contracted the Mario Molina Center for Strategic Studies on Energy and the Environment to perform the inventory. The production of the GHG emissions inventory followed IPCC guidelines and meets IPCC regulations for best practices. Mexico City's first GHG emissions inventory was conducted in 2006 by the federal government, and the Molina report extends that research using data from 2011 (*Estrategia Local*, 2014).

The temperature in Mexico City has risen almost four degrees Celsius in the past eight years due to UHI effects (Sosa-Rodriguez, 2013). Despite this rise, no effort has been made to map heat areas in Mexico City. *Plan Verde* (2007) contains provisions for land use and green rooftops, but these measures will be put in place without the benefit of a UHI effects inventory. Temperature reductions stemming from the increased greenery cannot be measured without heat mapping.

Whereas Vancouver and Chicago successfully institutionalized climate action planning, Mexico City has struggled to do the same. The *Plan Verde*, while receiving international recognition, seems to have no publicized mechanism for measuring progress. No documents exist on the plan's website with updates or progress reports. Mexico City's complementary plan, the four-year Climate Action Plan, completed almost all initiatives in 2012, but the *Plan Verde* seems to have fallen to the wayside. Mexico City's goals, at times, conflict with Mexico's national goals (Sosa-Rodriguez, 2013). On the positive side, Mexico

City has maintained its climate change goals across a change in leadership, from Mayor Ebrard and Secretary Delgado to Mayor Mancera and Secretary García.

Mexico City, like Chicago, included the city planning department in its development of *Plan Verde.* Mexico City's approach to planning created a cabinet-level office composed of the city's department heads. Every department head contributed to the 27 strategies of the plan, including the department of urban planning (Ebrard, n.d.).

In 2012, Mexico City elected Miguel Angel Mancera, a member of the Party of the Democratic Revolution. The Party of the Democratic Revolution is a left-leaning party, attempting to modernize Mexico City, especially the treatment of the environment. Mayor Mancera's Secretary of the Environment, Tanya Müller García, now heads the administration of the *Plan Verde* (United Nations, 2014b). Despite the change in leadership, Mexico City's drive to become greener seems to have remained on track. Climate change policies remain in the public eye, and Mayor Mancera continues to work with international organizations, like ICLEI and C40. The plan remains prominent although progress on the plan seems to have remained unrecorded. These contradictions seem to indicate that, while Mexico City continues to pursue climate change policies, its implementation of them may be falling short.

Mexico City localized environmental concerns, initially. Outdoing both Vancouver and Chicago, Mexico City consulted respondents and received feedback from over a million people (Benignos, 2010). Researchers analyzed this feedback, found what Mexico City residents wanted out of *Plan Verde*, and then designed a plan to meet those wishes. With the plan underway for almost eight years, though, Mexico City seems to have stopped prioritizing localization of the issues. No updates have been made to the plan's website, and information has stopped flowing to the citizens, neither of which contribute to plan success.

Mexico City, the first city in Latin America to conduct a municipal climate action plan and perhaps one of the first on such a large scale, did not look to other cities for guidance; rather, it serves as an example after which other cities model their own (Gallucci, 2010). Mexico City's climate action plan is original in that the planning and implementation happened all in Mexico City and all for Mexico City. While international organizations helped with funding, technical experience, and data analysis the plan constructed for Mexico City came solely from Mexico City.

Mexico City's social media marketing leaves much to be desired. The plan's main Spanish website, planverde.df.gob.mx, covers some of the plan's basic information, but does not include the planning document itself, nor does it host any updates or supplemental information. It contains some basic information, a summary of *Plan Verde*, ecotips for citizens, and some background information. As far as connecting with social media, the page does include a link to the Facebook page, a link to the twitter account, and a form for subscribing to the RSS feed. The site's English counterpart, while not as integral as the Spanish version, does not work. The homepage is active, but the links are inactive.

Dangers Plans Should Avoid

While all plans should attempt to include best practices, a list of dangers that all plans should attempt to avoid also exists. The table below, Table 6, highlights to which of the dangers the cities under study have fallen prey.

Table 6

Dangers to be Avoided			
	Vancouver	Chicago	Mexico City
Failed to Meet Goals	X	X	X
Neglect Climate Change Actions			
Repackage Existing Policies		X	
Lack Coordination			X

Vancouver

Vancouver's goals for reducing GHG emissions and UHI effects, if they continue at the current rate, will not be met by 2020. Vancouver will fall short of GHG emissions reductions by about 126,000 tons of CO_2. Without a UHI index, measuring Vancouver's progress toward UHI reductions is not possible. However, examining progress on the actions in Vancouver's GCAP (2011) that are designed to reduce temperature can substitute for progress on by-degree reductions. If the initiatives designed to reduce temperature show progress, then by extension, temperatures in those areas of the city are cooler.

Focusing on just Vancouver's GHG emissions, the most recent emissions data show that the goal set during the planning phase may be unreasonable. When taken as a percentage, Vancouver will miss its goals by about 14%. Unless the city steps up its reductions, it will be unable to meet the expected reductions.

Under UHI effects, Vancouver set five goals designed to reduce temperature. The city has completed two goals, with three in progress. The city completed its TreeKeepers Program and its Urban Forest Agenda, both designed to encourage citizens to plant more

trees within the city. One of the goals, creating a UHI index, shows no progress. Another, planting 150,000 trees within the city by 2020, appears that it will fall short of this goal by about 50,000 trees. The third goal, creating mini-parks in five neighborhoods, is still in development and on track for completion by 2020 (City of Vancouver, 2013).

Chicago

Chicago, like Vancouver, has not met its goals throughout the course of its climate action plan. According to Chicago's GHG emissions inventory, the city planned to reduce carbon dioxide emissions by 15,570,000 tons. Also similar to Vancouver, Chicago has yet to create a UHI effects index, making measuring heat reductions impossible. However, Chicago established a set of factors designed to reduce this effect, and analyzing those factors reveals some indication of how that part of the plan is progressing.

Chicago's goal to reduce emissions by 15,570,000 tons of CO_2 is completely unattainable at its current rate of reduction. Based on Chicago's current rate and the time it has remaining to reach this goal, it will never cut emissions quickly enough to see a reduction that large. Rather, it will fall short of its goal by almost 10,000,000 tons or by 64%.

Chicago has completed half of its initiatives designed to reduce UHI effects. In 2010, Chicago completed its green alleys and permeable pavements program and its green roofs program. The two remaining initiatives, the cool roofs grant program and the urban forest agenda, are currently underway. The city does not publish data on its websites regarding the number of people who applied for a cool roof grant or the number of cool roofs installed. Chicago also neglected to set an end date for the grant period. Without further information, determining how effective that goal is and whether it can reasonably be reached is

impossible. The urban forest agenda, on the other hand, is monitored and is on track to completion by 2020. The city wants to install 129.5 square kilometers of trees by 2020. As of 2010, the city included 109.27 square kilometers of trees and installed 2.02 square kilometers of trees each year. If the city maintains that rate, it will reach its goal by 2020.

Chicago, rather than consistently working on the Chicago CAP, seems to have repackaged this policy and presented it as new initiatives. Mayor Rahm Emanuel announced in 2012 the creation of Sustainable Chicago 2015. This new, miniature climate action plan contains similar initiatives to the *Chicago Climate Action Plan* of 2008, but he has presented it to the public as a new strategy that the city just created (City of Chicago, n.d.). Sustainable Chicago 2015 will hinder Chicago in reaching the goals set in the *Chicago Climate Action Plan*. Taking focus away from the major plan will detract from its initiatives and lessen its chances of success.

Mexico City

Mexico City, like the other two cities, failed to attain its goals set when designing *Plan Verde*. For both GHG emissions and UHI effects, Mexico City did not create indices, making measurement of *Plan Verde's* success impossible. The only current gauge of Mexico City's success comes from a GHG emissions inventory conducted in 2012, comparing emissions data from 2007, and the increase in greenery since *Plan Verde's* inception.

Mexico City planned to reduce emissions by 7 million tons of CO_2, from 2007 to 2012 (Ten Highlights, 2011). The city missed this goal by 1.3 million tons, reducing emissions by only 5.7 million tons (New York City Global Partners, 2012). Statistically, Mexico City missed its goal by about 18%.

As for reducing UHI effects, Mexico City has planted 232,748 new trees, bushes, and ornamental and groundcover plants since 2007 and has increased rooftop green spaces by 21,949 square meters. These two actions will reduce UHI effects, but, as is the case in the other two plans, without a UHI index, measuring how much temperatures will be reduced is not possible.

Mexico City tends to relegate climate change to the bottom of the priority list, focusing instead on economic and poverty problems. While every city must choose how to distribute funds and resources, cities that dismiss climate change or consign it to a lower status will never be as effective as cities that make it a priority (Sosa-Rodriguez, 2013).

Further, Mexico City's plan lacks coordination with the federal government. Due to poor or no monitoring systems, the different levels of government have difficulty working together. The city government and federal government find collaboration difficult when the city has set unclear goals or failed to research initiatives thoroughly before beginning them. Combining that with a focus on other priorities, as discussed above, contributes to the difficulties, creating a confusing working relationship (Sosa-Rodriguez, 2013).

PLAN ACCOMPLISHMENTS

Reductions in GHG Emissions

Greenhouse gas emissions are the number one indicator of city climate action plan effectiveness. Cities design initiatives around their potential to reduce GHG emissions. The more potential initiatives have for reducing emissions, the more highly they rank within planning goals. Emissions reductions set standards for cities to meet and also serve as a means of tracking progress (Boswell, Greve, & Seale, 2010).

Table 7, below, offers a comparison of GHG emissions between the three cities. In order to facilitate an easier comparison, the table shows GHG reductions in per capita per year reductions, allowing for the population of each city and the timeframes in which each city made reductions. Note that lower rates of reduction do not necessarily mean that one plan outperforms another. Rather, the percentage of each plan completed and the amount by which each plan will meet or miss its goal determines the plans' effectiveness.

Table 7

GHG Emissions Reductions			
	Vancouver	Chicago	Mexico City
Tons of CO2 Reduced/Person/Year	0.02	0.18	0.13
% of Target Reached	18.1	16.1	82.0
% of goal unmet by 2020	13.9	63.1	18.0

Vancouver

Vancouver plans to reduce GHG emissions to 33% below 2007 levels by 2020. This goal puts them on track to be carbon neutral by 2050, surpassing the minimum safety goal of 80% below 2000 level emissions. The city needs to reduce emissions by 909,000 tons, in order to reach 1,864,999 tons of emissions, 33% below 2007 levels. Thus far, the city has reduced emissions by 6%, putting the level of emissions to 2,585,000 tons in 2013, about 721,000 tons over the goal of 1,864,000 tons (City of Vancouver, 2014a). If the city continues to reduce emissions at the same rate, it will fall short of its goal by about 126,000 tons of CO_2. If Vancouver misses its short-term reductions in 2020, it will jeopardize its long-term goal of carbon neutrality in 2050.

Chicago

Chicago plans to reduce greenhouse gases by 25 percent below 1990 levels by 2020 and 80 percent below 1990 levels by 2050 (Climate Change 101, n.d.). For 2020, that means Chicago intends to emit only 15,329,000 tons of CO_2. Those goals would put Chicago in line with the goals outlined in the Kyoto Protocol and represent what Chicago would have had to accomplish had the U.S. signed the Kyoto Protocol. It also aligns Chicago with the generally accepted 80% below 2000 levels by 2050 benchmark. Chicago breaks down emissions reductions into four categories: energy efficient buildings, clean and renewable energy sources, improved transportation, and reduced waste and industrial pollution. The city calculated GHG emission reductions per category, setting goals for each category. By 2020, each category should experience reductions respectively of 4,600,000 tons, 5,330,000 tons,

3,610,000 tons, and 2,030,000 tons of CO_2, for a total reduction of 15,570,000 tons of CO_2 (*Chicago Climate*, 2008).

In the course of pursuing that goal, Chicago saw reductions of 2,500,000 tons of CO_2 from 2005 to 2010. The current total of emissions from Chicago is 32,500,000 tons (ICF International, 2010). Chicago still needs to cut emissions by almost 16,930,000 tons of CO_2 emissions. If Chicago continues to reduce emissions at the same rate, it will not meet its goal of emitting only 15,329,000 tons of CO_2; it will fall short by over 10,000,000 tons. This colossal failure to meet short-term goals will make it nearly impossible for Chicago to meet its long-term goal.

Mexico City

Mexico City reports GHG reductions in five different sectors: transportation, energy, water management, waste management, and reforestation. The transportation sector accounts for the largest GHG reductions, accounting for reductions of 4,851,783 tons of CO_2. Reforestation follows with reductions of 607,846 tons of CO_2. Energy comes third with reductions of 183,425 tons of CO_2. Waste management reported reductions of 127,175 tons of CO_2, and finally, water management saved the city 1,804 tons of CO_2 (New York City Global Partners, 2012).

Mexico City planned to reduce emissions by 7 million tons by 2012 (Ten Highlights, 2011). The city missed this goal, reducing emissions by only about 5.7 million tons of CO_2, which is about 82% of the intended target (New York City Global Partners, 2012). Despite *Plan Verde* being a fifteen year plan, Mexico City does not seem to have set further reduction

targets as of this year. This lack of a concrete goal will make future measuring of Mexico City's success difficult.

Reductions in UHI Effects

While GHG emissions are a major concern for cities interested in climate action planning, cities should keep in mind that reducing urban heat island effects also merits attention. Emissions contribute to only a portion of city climate change. Temperatures within a city, especially areas with substantial amount of concrete and asphalt, can be up to nine degrees Celsius hotter than areas outside of the city. This heat, not only dangerous to humans, affects the environment within the city, distorting habitats and increasing pollution. Loss of green space, loss of forested areas, and construction with materials with high thermal capacities all contribute to UHI effects (Stone, Vargo, & Habeeb, 2012).

While each plan contains initiatives designed to reduce UHI effects, the effects of these initiatives cannot be determined without further data. Until each city completes UHI mapping, other than acknowledging that the initiatives should lower temperature, saying definitively that they do and by how much, is not possible. In fact, no city seems to have measured the changes between before-temperature-reducing strategies and after-temperature-reducing strategies.

Vancouver

Within Vancouver, five GCAP (2011) initiatives address UHI effects: the TreeKeepers Program, the support and expansion of extreme heat planning, the urban forest management plan, the creation of mini-parks, and the planting of 150,000 more trees. The

city already completed two of the initiatives: the TreeKeepers Program and the Urban Forest Management Plan. The other tree initiatives remain in progress.

The TreeKeepers Program partnered with the Park Board to encourage residents to plant more trees. According to the *Greenest City Implementation Update* (2014), citizens planted almost 11,000 new trees in 2013, nearly doubling the number planted since 2010. Other programs, such as the Citizen Forester training program, the first-ever TreeKeepers Day, and tree distribution events, enabled residents and businesses to engage with the *Greenest City 2020 Action Plan*, resulting in 900 trees, including more than 200 fruit trees, planted on private land in 2013, with a target of 4,000 more for 2014.

In 2014, city council members voted to approve the comprehensive Urban Forest Strategy which involves protecting existing trees, strategically planting new trees, and managing the urban forest. The Urban Forest Strategy updates the Protection of Trees by-law, which prohibits property owners from removing healthy trees from their property without reasonable cause. The update to the by-laws brings Vancouver in line with tree protection measures in place in other cities in the region and beyond (*Greenest City Implementation Update*, 2014).

The City of Vancouver, in its *Climate Change Adaptation Strategy* (2012), planned to support and expand extreme heat planning. An Extreme Hot Weather Committee is in the process of completing heat mapping, revamping the city's emergency response to heat waves, and studying vulnerable populations. However, the city's implementation updates of 2013 and 2014 include no mention of progress on any of those fronts. So while those projects are part of the plan, no work seems to have been completed on them yet.

The City of Vancouver plans to create mini-parks in five neighborhoods that the city deems nature deficient. These neighborhoods are: Mount Pleasant, Renfrew-Collingwood, Grandview-Woodland, Downtown Eastside, and Marpole. These neighborhoods do not have close access to nature, and mini-parks would bring green spaces into those sections of the city. The green spaces will help cool temperatures and cover impervious surfaces, with eco-friendly, pervious material (City of Vancouver, 2013).

As of the *Implementation Update* of 2014, the city has planted 23,400 trees of the 150,000 trees that it would like to have planted by 2020. If the city continues at about the same rate of tree-planting each year, it may not reach that goal, though. Rather, unless Vancouver accelerates its tree planting, it will fall short of 150,000 trees by about 50,000 trees.

Chicago

Chicago's plan dedicated four initiatives to reducing UHI effects. The four initiatives include: green alleys and permeable pavements, a cool roof grant program for installing reflective roofs, green roofs, and an urban forest agenda. The city completed nearly all of the initiatives by 2010 (*Progress Report*, 2010; Carbonn Center, n.d.). The two initiatives still in progress are the cool roof program for installing reflective roofs project and the urban forest agenda.

Under green alleys and permeable pavements, Chicago installed over 120 green alleys resulting in over 9,753.6 square meters of pervious, eco-friendly material in place of impervious, heat-trapping material. The green alleys will reduce urban heat, by trapping less heat from sunlight, and will additionally reduce stormwater runoff (*Progress Report*, 2010).

The completion of the green roof program involved installing over 1,219,200 square meters of green rooftops across the city. The benefits of green roofs include an eco-friendly form of insulation and maintaining cooler temperatures in the summer and warmer temperatures in the winter. The roofs do not trap heat from sunlight, like concrete and asphalt do. Also, although not a UHI reduction benefit, the green roofs cut down on carbon dioxide by filling the city with more vegetation (*Progress Report*, 2010; Carbonn Center, n.d.).

The cool roofs grant program awarded $6,000 each to help residents and small business owners install roofs which meet or exceed the cool roof standards (*Chicago Climate*, 2011). Chicago's update reports, though, do not include information on how many people and businesses applied for the grants, nor how many buildings received reflective roof upgrades.

The urban forest agenda began in 2009 and has an end goal of about 129.5 square kilometers of trees within the city by 2020. The city had 72.84 square meters of trees in 1993, and, after adding 36.42 square kilometers of trees, the city had in 2010 about 109.27 square meters of trees comprising its urban forest. If tree planting continues at the same rate, a little more than 2.02 square kilometers a year, then the city should meet its goal (*Progress Report*, 2010).

Mexico City

Mexico City's government's contribution to UHI effects reduction comes in the form of two initiatives: planting more greenery within the city at ground level and installing rooftop gardens on buildings throughout the city. As of 2012, 213 citizen committees have planted 232,748 trees, shrubs, groundcover and ornamental plants within the city to help

reduce UHI effects and also to help mitigate local flooding (New York City Global Partners, 2012). In 2013, the government spent nearly a million dollars to plant green rooftops on city buildings, hospitals, and schools, which resulted in about 21,949 square meters of new green space (Jones, 2014). The green rooftops cut down on heat, shielding the buildings from the sun's rays and allowing the heat to dissipate rather than trapping it, like concrete would. Additionally, the green roofs help to trap rainwater, which cuts down on flooding, and the green roofs filter the air, improving air quality. While Mexico City set no specific goals for increasing greenery, like Vancouver and Chicago did, the city continues to encourage residents and businesses to add green space.

BEST PRACTICES AND RECOMMENDATIONS

After evaluating the plans for effectiveness and ability to achieve goals, moving to commentary from international environmental organizations reveals which sections of the plan stand out for ingenuity, creativity, and overall success. Looking at the plans from an international perspective serves to highlight the best sections of each plan and provide an unbiased look at what each plan can supply to other cities interested in either starting a plan or improving an existing one. Recommendations for applicability to other cities follow the best practices of each plan. While some practices will work well in all cities, some practices may work best in select cities.

Best practices are selected based on a combination of factors. The number one factor, of course, is the extent to which the action will help the city to mitigate or adapt to climate change. However, international organizations take other factors into account, such as cost benefit to the city and improvements to quality of life. For example, an action that will reduce GHG emissions significantly may not rank as highly as an action that reduces GHG emissions less significantly but that also costs the city less. Or, an action may reduce temperature and thereby increase quality of life, but it may not reduce GHG emissions. Each factor will normally be comprised of each different element, leaving planners the task of sorting out which benefits will most greatly affect the city.

Vancouver

Vancouver's green buildings impressed international critics ("Vancouver Greenest City," 2013; C40 Blog, 2013c; World Green Building Council, 2013). The secret to Vancouver's low building emissions comes from Vancouver's Neighborhood Energy

Strategy (NES). The NESs run on steam power, eliminating a large portion of GHG emissions previously created from district energy use. Vancouver's NESs have reduced GHG emissions, in the neighborhoods in which they are installed, by about 55%. The systems required $40 million startup capital, but the city has fully recovered that amount through customer utility rates. The NESs currently connect about 1.1 million square meters of mixed-use buildings. District energy utilities, like the NESs, usually provide rate stability that outperforms traditional energy sources, so long as the energy utility makes use of renewable and waste energy sources (C40 Blog, 2013c).

Establishing NESs is possible in any city, not just Vancouver. Vancouver created energy centers in each of its NES neighborhoods. These energy centers can use a variety of low-carbon fuels, such as sewage heat recovery, wood chips, geothermal, and heat recovery from industrial processes. Waste energy source availability; site conditions; and economic, technical, and risk considerations all influence the fuel used in the creation of the energy center. Vancouver also thoroughly documented its planning process while designing its NESs (C40 Blog, 2013c). Other cities can follow the same planning process should they choose to adopt a similar system. All cities will have some type of fuel available, and cities, especially developing cities, should be able to establish similar energy districts when designing power grids. The largest obstacle is the startup cost, but, should cities succeed in obtaining the funding, they should also be able to recover that funding from the money saved in fuel cost reductions, making this GHG emissions reduction strategy applicable worldwide.

Chicago

Chicago received praise for its green roofs initiatives and its installation of LED traffic lights ("Chicago Green Roofs," 2012; C40 Blog, 2011b). Chicago is the first city to extensively use green roofs, making it a leader in the technology. Chicago also pioneered the use of LED traffic lights, the first of few in the United States.

Chicago leads the way in the number of green roofs in a city and is a frontrunner in the techniques. Chicago leads the United States in green-roofed buildings, with installations on 450 buildings and over 20 Chicago-based companies with expertise in installing green roofs ("Chicago Green Roofs," 2012). Chicago's green roofs reduce urban heat island effects, lowering city temperatures; help clean the air by filtering out harmful materials; and also cut down on stormwater, as rooftop gardens soak up rainwater as opposed to letting it run down drains. Buildings with green roofs will notice energy savings from running air conditioning and heating less, as well.

Chicago's green roofs can be applied in any city. Not only do they have a range of benefits, but they are also easy and cost-effective to install. Rooftop installations depend solely on the climate in which the city is located. Other cities, like Mexico City, have already copied Chicago's idea, installing gardens on buildings across the city.

Chicago's LED traffic lights have delivered immediate and sustained reductions in the city's emissions. LED traffic lights significantly reduce energy consumption by almost 85% when compared to other bulbs. With incandescent bulbs, one intersection can cost almost $600 per year in electricity. Before LED bulbs, Chicago spent around $3 million annually. As a result of these bulbs, the city now saves $2.55 million annually in energy savings and $100,000 annually in materials. LED lights also eliminate the dangers associated

with light burn out, as LED lights will not all go out at the same time. This feature eliminates safety risks and traffic congestion problems. It also reduced CO_2 emissions by 23,000 tons. The city funded the project through money won in a lawsuit against ComEd and through a grant from the Illinois EPA (C40 Blog, 2011b).

This project is applicable to other cities, provided they can bear the initial start-up cost. Chicago received funding from outside sources to help cover the costs. The savings provided by the initiative made maintaining it easier. If other cities can find funding for the initial costs, then the Chicago initiative should be easy to replicate.

Mexico City

Mexico City received accolades for its transportation initiatives, specifically its bus rapid transit (BRT) system, its EcoBici program, and its taxi replacement program ("Mexico City Wins," 2013; United Nations, 2014a; C40 Blog, 2013a). Mexico City extended its BRT system straight through the narrow streets of its historical center; expanded bike sharing and bike lanes; and replaced all registered taxis with eco-friendly substitutes (C40 Blog, 2013a).

Mexico City's BRT system introduced new metro lanes throughout Mexico City, extending service to previously disconnected portions of the city. The new system introduced articulated BRT vehicles to the city's bus fleet, replacing 350 standard buses with 97 new ones. The buses can carry a maximum of 160 passengers per trip. Currently, the buses transport about 250,000 passengers per day. The city does not own all of the buses. CISA, a private company, and RTP, a public company, own some of the buses. A trust fund manages, invests, and distributes all fare revenues. Benefits of the city's BRT system include a lessened commute time from 1.5 hours down to 1 hour; reduced passenger exposure to

carbon monoxide, benzene, and particulate matter, as compared with previous bus service; reduction of CO_2 emissions by 35,000 tons annually; and increased market opportunities for BRT systems (United Nations, 2011).

The BRT systems, while an excellent resource in Mexico City, may not function well in all cities, depending on population size and city layout. Mexico City has a large population, more than 8 million. Such an extensive network of buses is practical for such a large city. Additionally, before the introduction of the BRT, most residents relied on cars to travel around the city. The addition of the buses cut down immensely on congestion. Other cities of similar size and experiencing similar congestion would benefit from a BRT. Smaller cities with fewer people and less congestion would need to scale the plan down, in order for it to be effective. Also, a plan such as this one entails massive start-up costs. Cities interested in creating BRT systems will need significant funding.

The United Nations heralds Mexico City's EcoBici program as a bicycle program ideal for any city. EcoBici's design reflects simplicity and easy access. Members of the program pay a fee and receive a card, which can be used to check out a bike from any station around the city. Members may ride the bike anywhere they need to, running errands, getting to work, or simply having fun. The bicycles facilitate easy and quick transportation, not to mention the fact that they cut GHG emissions. When members finish using the bikes, they can return them to any nearby station. The United Nations also praised the EcoBici program because it improves women's quality of life. Women in Mexico City often find themselves without reliable transportation. EcoBici provides them with an affordable means of navigating the city (United Nations, 2014a).

EcoBici is applicable to other cities. The system needs only three major components: bicycles, bicycle stations, and a card member system. The project receives financing from a combination of city and federal governments, private investors, and users, making it easily applicable to other cities. In fact, Guadalajara, Mexico, implemented its own public bicycle system, while two other Mexican cities are in the process of establishing similar programs (United Nations, 2014a).

Taxis accounted for 35% of transportation emissions in 2007, prompting the municipal government to replace all taxis eight years or older with newer, more eco-friendly taxis. The program works with National Financing, the Banorte Financing Group, the Secretariat of Economic Development, the Secretariat of Transportation, and Mexico City's Secretariat of the Environment. The program allows taxi drivers to apply for 15,000 pesos, which they can use toward paying for a 70,000 peso new taxi. The program also includes a loan, where taxi drivers can pay off the remaining 55,000 pesos over four years. Mexico City partnered with a local bank, which agreed to work with the taxi drivers on the loans, while National Financing acts as the guarantor of the loan. Any taxi driver who fails to pay back the loan will lose the new taxi (C40 Blog, 2011c).

This plan could also extend to other cities, depending on their use of taxis and the city's ability to work with outside entities. The vital pieces to this initiative are partnerships with differing levels of government and partnerships with financial institutions. Mexico City could not have started this initiative without first reaching agreements with both groups. If cities are willing to work with outside actors, though, this program could be instituted elsewhere.

FUTURE IMPLICATIONS FOR RESEARCH

This research represents a small portion of all that remains to be done in the field of climate action planning. Some future directions for climate action planning could include a broader comparison of cities with climate action plans, a study of the ladder of democracy and how it includes municipal climate action planning, a comparison of best practices and their prevalence worldwide, a search to determine why cities repeatedly set unreasonable goals, and an evaluation of city temperatures before and after heat-reducing initiatives are implemented.

A broader comparison of cities with climate action plans would serve to highlight similarities and differences between plans worldwide. One of the limitations of this research is its focus on cities in the Western hemisphere. An expansion to include cities in the Eastern hemisphere, European, Asian, or African, would further illuminate the ways in which climate action planning functions.

A study of the ladder of democracy and how it includes municipal climate action planning would provide insight into how policies are formed. Climate action plans do not form inside a vacuum. Individuals, organizations, levels of government, and more play a part in the formation of policies and their implementation. Studying the ways in which ideas form and the directions they travel will help to track the development of climate action plans.

Studying the best practices of various plans and their prevalence worldwide would help to set a standard of practices that all plans should include. Isolating best practices would be the first step, followed by their applicability to other cities, and finally the number of cities that employ the applicable practices. A list composed of best practices that cities can consult would improve chances and degrees of success.

Determining why cities repeatedly set unreasonable goals should be the focus of significant research. Evaluations as early as 2007 contend that plans set unreasonable goals, but plans created after 2007, like Vancouver's GCAP, have still set goals that the city cannot meet. The reasoning behind this defies explanation. Determining why this flaw exists and why it remains prevalent merits future study.

Finally, research needs to be conducted on the temperature reductions from UHI initiatives. While cities acknowledge that UHI effects exist and have measured city temperature fluctuations, no city seems to have calculated the difference between city temperatures before temperature-reducing initiatives and city temperatures after temperature-reducing initiatives. Perhaps understanding that temperatures are lower is enough for current research, but by-degree reductions would seem to be a useful method of gauging progress.

CONCLUSION

Municipal climate action planning reflects the changes seen in national and international approaches to climate action planning. While countries work together to set broad goals on a global scale, cities work to influence climate change on a local scale. Cities represent the frontline in climate action planning. Individuals experience climate change on a local level. Global climate change remains an amorphous concept, but local climate change is familiar and tangible, giving cities an edge in mitigating and adapting to climate change. Cities will play a large role in cutting emissions and lowering temperatures. With the majority of the world's population residing in cities, they must take responsibility for stopping climate change.

Vancouver, Chicago, and Mexico City represent three different cities with three different approaches to climate action planning. Variations in population, location, and government served to create personalized climate action plans, administered in different ways but with similar goals. Examinations of the three cities' climate action plans expose contrasts and similarities, revealing the inner gears behind each plan.

The cities found motivation for their plans in different areas. For Vancouver and Chicago, motivation came internally from the residents pushing strongly for climate change. For Mexico City, motivation came externally from pressure from the international community. For all, international organizations pushed for CAPs by providing assistance and access to networks of information. These motivators ultimately led to successful creation of CAPs in all three cities.

Analysis shows that each plan has its high points and its low points, and that, while each plan fails in some respects, all of them succeed in others. Studying what works well for

each plan and the applicability of that knowledge to other cities can lead to improvements in future plans. Climate action planning research is still a nascent field. Comparisons such as this allow researchers to find similarities and differences between plans and use those differences to construct new plans.

Cities will continue to face climate change for the next century and most likely long after. Municipal climate action planning has a long way to go. This project is but a small part of the research that needs to be conducted if cities are to survive rising temperatures.

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VITA

Holly Miles attended school in Tehachapi, California, until her senior year of high school, when she transferred to and graduated from Ballinger High School, Ballinger, Texas. She continued her schooling at Angelo State University, receiving a Dual Degree, a Bachelor of Arts in Spanish and a Bachelor of Science in Sociology, with Highest Honors, in May 2015.

While at Angelo State University, Holly served as an Honors Program mentor, helping students connect with the Program and with the upperclassmen. Holly also worked as a research assistant for Professor of Sociology Kenneth Stewart. As his assistant, she managed community development projects and helped to conduct and analyze surveys. She attended four conferences while at ASU, two National Collegiate Honors Council Conferences and two Great Plains Honors Council Conferences.

In December 2014, Holly received a Thomas R. Pickering Foreign Affairs Fellowship. The Fellowship precipitated her matriculation to the Middlebury Institute of International Studies at Monterey, where she plans to pursue a Master's of Arts in International Environmental Policy.

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