

Maximizing Value: Linking Climate Change Action and Well-Being in Cities

A Thesis

submitted by

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In partial fulfillment of the requirements
for the degree of

Master of Arts

in

Urban & Environmental Policy & Planning

TUFTS UNIVERSITY

2012
August

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Abstract

Cities are heavy emitters of GHG emissions and serve as centers of innovation for climate change action. However, with limited resources, they must establish priorities. As cities also become increasingly interested in improving quality of life and livability, connecting these themes to climate action has increasing salience.

This thesis explores how cities might use climate action to improve resident well-being. The Gallup-Healthways Well-Being Index is examined as a long-term standard for cities to track trends in resident well-being against efforts to address climate change. Four cities in the Great Lakes Region are studied for their approach to managing environmental, health, and social consequences of climate change. Results suggest that cities in this region are making connections between actions that both address climate change and improve well-being, although sometimes not explicitly. In the context of climate adaptation, however, case cities overlooked infrastructure improvement and risk assessment in favor of visible short-term projects.

Acknowledgements

I would like to thank Ann Rappaport for support throughout this research process in her role as Thesis Advisor. You have my gratitude for providing valuable feedback and encouragement, listening to my ideas, answering my countless questions, and sharing your knowledge on the research subject. Thank you as well to Julian Agyeman, for serving as my Thesis Reader and also providing valuable comments and feedback.

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Chapter 1

Introduction

Global climate change will most certainly have an effect on human life and people in different regions of the United States will encounter varying impacts. Climate models suggest that the people of the Great Lakes Region will experience increased average temperatures, shorter winters, more intense precipitation events, and more frequent extreme weather events. These impacts have environmental, health, social and economic consequences on the well-being of Great Lakes residents.

In the U.S., cities have emerged as first responders in climate change mitigation and adaptation planning, both because they are a major source of greenhouse gas emissions and because cities are directly accountable to their citizens. However, cities have limited resources and inevitably must prioritize certain social and political values over others. For this reason, cities will benefit from identifying co-benefits to climate action and tying it to broader agendas. As cities have also become more interested in improving well-being, quality of life and livability, connecting these themes to climate action has increasing salience.

Research supports that climate change will have an impact on mental and emotional health, but current publications focus primarily on the physical health impacts of a warming planet. A comprehensive report of links to overall human well-being is lacking. This thesis explores how cities might use climate action to improve resident well-being. A review of the academic

literature on climate action in cities, the concept of well-being, and the links between climate action and well-being helped to inform the research. The Gallup-Healthways Well-Being Index is examined as a long-term resource for cities to track trends in resident well-being while evaluating their efforts to address climate change. Well-being is often defined in neoclassic measures, such as income and life expectancy, but more recent research aims to capture psychological measures of well-being that reveal how people feel about their lives.

As an example of this type of well-being measurement, the Gallup-Healthways Well-Being Index was created in 2008. It is designed to track the well-being of U.S. residents for 25 years through a daily survey of at least 1000 people. The data from these surveys is organized into an annual Well-Being Index, which ranks states and cities on six domains of well-being. Although the Well-Being Index has only presented three years worth of data so far, over time it will provide critical insight into trends in well-being for U.S. residents. As an ongoing, standardized measurement of overall well-being, the Well-Being Index could help cities to better understand how their efforts to mitigate and adapt to climate change are impacting well-being.

In the final stage of research for this thesis, four cities in the Great Lakes Region are studied for their approach to managing and framing the environmental, health, and social consequences of climate change on residents. Like the Gallup-Healthways Well-Being Index, climate action planning, and especially implementation, is still relatively new. This work is

intended to provide deeper insight into the links between climate action and well-being, and also to encourage cities to maximize the value of their limited resources by linking climate action and well-being co-benefits.

Chapter 2

Research Methodology and Sources of Analysis

In attempting to answer the research question of “How might cities use climate change action to improve the well-being of residents?” two research methodologies were employed. First, a review of the academic literature on several topics was conducted. This review included the predicted impacts of climate change on people in the Great Lakes Region, existing frameworks of human well-being, the links between climate change action and well-being, and forms of climate change action in U.S. cities. Throughout the thesis, an attempt is made to describe how these literatures inform the theoretical framework that over time, cities that pursue more climate change action will exhibit higher levels of resident well-being.

The second research methodology utilized is a multiple case study approach. Yin (1990 p. 9) indicates that “case studies are valuable for ‘how’ and ‘why’ research questions, for situations when the investigator has little control over events, and when the focus is on contemporary happenings.” As all of these criteria apply to this research project, case studies are an appropriate methodology. Yin also advises on the importance of developing an overarching theory. In this case, the theory is that, over time, cities that pursue more climate change action will exhibit higher levels of resident well-being. This theory was explored through the literature review process and also helped to structure my case study design and the analysis of the case study findings.

The sources of analysis for this research consisted solely of publicly available, online data. Specifically, all documents relating to climate change planning or action for case cities were reviewed. This included formal Climate Action Plans when available, as well as Sustainability Plans and reports, Progress Reports, State of the City transcripts, and relevant programs and initiatives. Only efforts that were directed by the city itself were considered, although this could include a collaborative effort between the city and some other institution or group. It is acknowledged that work is being done within cities to address climate change that does not specifically involve the municipality. While these efforts are incredibly important and should not be undervalued, they were excluded as the purpose of this research was to examine how the city, as a governmental body, might achieve co-benefits in resident well-being through climate change action. Further, it is acknowledged that the data reviewed is narrow in its scope. This was intentional based on the time constraints of the research, as well as a desire to utilize information that was freely and publicly available to all citizens.

The sources of analysis were reviewed with the following criteria and questions in mind.

How is the city addressing climate change?

- Is there a formal climate action plan?
- Or a sustainability plan, which addresses climate change impacts?

What appears to be driving climate change action in the city?

- How is climate change action framed?

- Is the type of climate action taken influenced by the city's vision of itself, or vice versa?

How do the city's climate or sustainability initiatives relate to the dimensions of well-being?

- Specific initiatives
- Is the connection made explicit?

How are climate change initiatives being implemented, monitored and evaluated?

- Who is responsible?
- How is success measured?
- Is there a qualitative or quantitative emphasis?

Case City Selection

Four individual case studies were constructed to provide a closer examination of how cities are developing and implementing climate change action and how these mitigation and adaptation initiatives are linked to human well-being. In addition, a cross-case analysis was performed to explore commonalities and distinctions among the case cities.

For the purpose of this thesis, I chose to focus on cities in the Great Lakes Region of the United States. This selection was based on several factors, including scientific evidence that this region will be significantly impacted by climate change and the importance of the Great Lakes as a natural freshwater resource. Additionally, the eight Great Lakes states rank poorly as a region on the Gallup-Healthways Well-Being Index for 2011, which will be described in more detail in the next section. Although Minnesota holds the high rank of 3rd

out of the 50 states, the others are ranked significantly lower: Wisconsin – 22nd; Pennsylvania – 31st; Illinois – 32nd; New York - 34th; Michigan - 37th; Indiana -38th; and Ohio – 46th. As stated, the intent of this research was to explore how cities might use climate action to improve resident well-being. Consequently, a region with well studied projected impacts of climate change and below average well-being made for a suitable region of study. It should be noted, however, that the methodology used for this research could certainly be applied to other sets of U.S. cities. Indeed, the intent of this research is to encourage all cities to consider how they might improve the overall well-being of residents through climate change action.

In selecting the four case cities, several criteria were used. First, cities from four different states in the region were chosen, as this would allow for a broader range of climate change action in the Great Lakes Region. Second, cities in Ontario were excluded, even though the Canadian province is part of the Great Lakes Region and Toronto, in particular, has developed a thorough Climate Action Plan. The reasoning behind this exclusion was that the Gallup-Healthways Well-Being Index survey is not conducted in Canada. Without ongoing well-being information from Canada, it would not be possible to track the progress of climate action against subsequent changes in well-being of residents. The third criterion for case cities was the presence of some sort of climate change planning by the city, which was necessary as this served as the primary source of analysis for the case study. It was, however, acceptable

for the plan to fall under a broader “sustainability” context, so long as climate change action was addressed.

Fourth, to include a comparative element to the case studies, it was decided to select cities that represented a variety of positions along the Well-Being Index spectrum, as represented by the overall well-being rank of the Gallup-Healthways Well-Being Index. The overall rank is a composite of the six Well-Being Index dimensions - life evaluation, physical health, emotional health, healthy behavior, work environment and basic access. It serves to rank 190 U.S. cities, following the U.S. Census Bureau definition of Metropolitan Statistical Areas (MSA). To this point, a mix of cities was desired, including those experiencing an increase in overall well-being rank (indicating an improvement in well-being) from 2009 to 2011, those experiencing a decrease in overall well-being rank, and those whose rank remained relatively stable. The final criterion was variation in population size, to gain an understanding of how cities with different levels of resources are addressing climate change action.

Based on the above criteria, the following cities were chosen for case study analysis. Grand Rapids, Michigan is a small city that has experienced a significant improvement in Well-Being Index rank. Chicago, Illinois is a very large city and its well-being rank has fallen considerably over the three years of reporting. Milwaukee, Wisconsin is a mid-size city with a well-being rank that has also decreased. Minneapolis, Minnesota is a small to mid-size city with a very high well-being rank and one that has remained stable.

Grand Rapids, MI [2010 U.S. Census pop: City - 188,040; MSA-776,742]

2009 Well-Being Index rank = 67

2010 Well-Being Index rank = 42

2011 Well-Being Index rank = 47

Sources of Analysis: Office of Environment and Sustainability documents; Grand Rapids FY 2011-FY 2015 Sustainability Plan; Green Grand Rapids report

Chicago, IL [2010 U.S. Census population: City - 2.7M; MSA- 9,569,624]

2009 Well-Being Index rank = 89

2010 Well-Being Index rank = 88

2011 Well-Being Index rank = 113

Sources of Analysis: 2008 Chicago Climate Action Plan; 2010 CCAP Progress Report

Milwaukee, WI [2010 U.S. Census pop: City - 594,833; MSA - 1,549,308]

2009 Well-Being Index rank = 96

2010 Well-Being Index rank = 103

2011 Well-Being Index rank = 109

Sources of Analysis: 2005 Green Team Report; Office of Environmental Sustainability documents; 2012 Milwaukee sustainability planning outline

Minneapolis, MN [2010 U.S. Census pop: City - 382,578; MSA - 3,229,878]

2009 Well-Being Index rank = 19

2010 Well-Being Index rank = 21

2011 Well-Being Index rank = 18

Sources of Analysis: Minneapolis Living Well Sustainability Reports and GreenPrint Indicator annual reports; Minneapolis-St. Paul Urban CO₂ Project Plan; 2009 Carbon Footprint Report

The information collected from these case studies was analyzed for its ability to help answer the general research question of “*How might cities use climate change action to improve the well-being of residents?*”

Because well-being is a subjective concept, it was helpful to identify a measurement of well-being that had both national scope and city-level data. Starting in 2009, that data became available through the Gallup-Healthways Well-Being Index.

The Gallup-Healthways Well-Being Index

From a research perspective, well-being has often been defined in traditional neoclassic measures, such as income, GDP, life expectancy and poverty rates. More recent research, however, has addressed psychological measures of well-being that seek to measure how people feel about their lives (Harter and Gurley 2008). An important advancement in these types of well-being measurements was made in January of 2008, when Gallup, the public opinion data collector, and Healthways, the largest provider of wellness programs for health care plans and businesses, began a partnership to collect and track the well-being of U.S. residents. Information is gathered through a 56-question phone survey, which is administered to no fewer than 1000 people daily, and is scheduled to continue for a total of 25 years (Well-Being Index 2008).

The data from these surveys is organized and statistically analyzed in order to present an annual Well-Being Index, which includes the sub-

categories of Life Evaluation, Physical Health, Emotional Health, Healthy Behavior, Work Environment, and Basic Access. The Well-Being Index also provides a ranking for each U.S. State, as well as a ranking of 190 U.S. cities, for both overall well-being and for each of the sub-categories. Survey samples take into account a variety of confounding factors to reduce sampling error. The survey also includes a required percentage of cell-phone-only households and availability of Spanish language interviews. Overall, the Index designers estimate that 98% of the adult population is represented in the sample (Methodology 2008).

Well-Being Index Survey Domains

The Wellbeing Index survey consists of a mix of evaluating and experience questions, which fall into six sub-categories or domains (Methodology 2008). While experienced well-being is concerned with momentary states and the way people feel about experiences in real-time, evaluative well-being is the way that people remember experiences after they happen. The Gallup-Healthways Well-Being Index uses the life evaluation question series first developed by Hadley Cantril (1965) of Princeton and his colleagues. The evaluative dimensions of well-being are captured through individual assessments of specific life domains, such as one's standard of living, community, job, relationships, and personal health. The six domains that are covered in the Well-Being Index survey are detailed on the next page.

Life Evaluation is a self-evaluation scale consisting of two parts – how respondents view their present life, and how they view their future anticipated life in five years

Emotional Health asks respondent about ten indicators of emotional well-being, including happiness, worry, anger, and depression

Physical Health inquires about a respondent's disease burden, obesity risk, rest, energy, and common health ailments such as headaches and colds

Healthy Behavior questions relate to smoking, eating healthy, produce intake, and frequency of exercise

Work Environment concerns job satisfaction and supervisor relationship

Basic Access is a series of questions about respondent's satisfaction with community; perception of the area getting better as a place to live; if walking alone feels safe; access to clean water; affordable fruits/vegetables; enough money for food, shelter, and healthcare; and access to a doctor and insurance

The Well-Being Index has now released three years worth of data, for 2009-2011. It is still in its early stages, but over the full 25 years of the survey, valuable insights into the well-being of Americans will be provided. In exploring the research question, *"How might cities use climate change action to improve the well-being of residents?"* this thesis examines the links between climate change action and human well-being. The research explores

the potential for cities to use the Well-Being Index as a tool to track its trends in resident well-being against efforts to address climate change.

It is acknowledged that there are some limitations to the Well-Being Index for this purpose. For example, some dimensions of the index can be connected more clearly to climate change action than others, and certainly climate change is just one of many phenomena that impact well-being. In addition, the Well-Being Index does not adequately address issues of environmental, health, and economic inequity within cities. At this time, the Index only provides annual data at the city level. It would be useful for cities to be able to analyze the correlation of climate action and well-being on distinct neighborhoods and vulnerable populations.

Despite these limitations, such a large pool of data offers the possibility to break it down further for a more detailed analysis. The survey includes many of the standard demographics, including race, religion, income, education, employment status, occupation, and household density, which could be used for more localized comparisons. Furthermore, the Well-Being Index provides insight into aspects of human nature that are notoriously difficult to measure, such as emotional health, mental health, life evaluation and healthy behaviors. The literature supports that climate change will have an impact on mental and emotional health, but current research focuses primarily on the physical health impacts of a warming planet. As an ongoing, standardized, and cost free measurement of overall well-being, the Well-Being Index could be used as a resource to help cities to better understand these impacts.

Chapter 3

Climate Change and the Great Lakes Region

There is widespread agreement within the scientific community that climate change will have an impact on humans. By the end of this century, global climate models indicate that the world's mean temperature will increase by 1.8-4 degrees Celsius, the sea level will rise .18-.59 meters, and weather patterns will become more inconsistent (Solomon et al. 2007). The potential consequences of these changes include increased average temperatures, heat waves and other extreme weather events, an increase in climate sensitive diseases, decreased air quality, freshwater shortages, ecosystem destruction, food system disruptions, and an overburdened energy grid (EPA 2011, Frumkin et al. 2008). It is evident that many of these outcomes have the potential to negatively impact human wellbeing.

The United States, with its technological and economic resources, is likely better prepared to handle the threats of climate change, and its advanced public health system may also lessen some of the impacts (McMichael et al. 2003), but at a significant cost. One preliminary estimate places the cost of addressing health problems related to climate change at \$200 million annually for the U.S. (Ebi et al. 2009). Not all regions of the country will be impacted equally with regard to severity and type of climate change impacts. Regional variation will have an effect on the necessary type of response to climate change. For example, the Northeast is vulnerable to sea level rise, and

flooding and wind damage from increased coastal storms (Frumhoff et al. 2007), while the Southwest is predicted to suffer more from drought and heat waves (CLIMAS 2010).

This thesis is particularly focused on the Great Lakes Region, which encompasses the eight U.S. states of Michigan, Ohio, Indiana, Illinois, Wisconsin, Minnesota, Pennsylvania, and New York, as well as the Canadian province of Ontario. The region represents the largest freshwater ecosystem in the world and has a population of approximately 40 million residents according to the 2010 U.S. Census. The Great Lakes Region has long been treated with special interest from governmental entities. In 1955, the Great Lakes Basin Compact led to the creation of the Great Lakes Commission. The purpose of this ongoing interstate public agency is to “promote the orderly, integrated and comprehensive development, use and conservation of the water and related natural resources of the Great Lakes basin and St. Lawrence River” (Great Lakes Commission 2012). Founded in the mid 1980s, the House and Senate Great Lakes Task Forces function as bipartisan working groups that cooperate to enhance the economic and environmental health of the Great Lakes. At the federal level, the Great Lakes Restoration Initiative (GLRI 2010) represents the largest financial investment in the Great Lakes in two decades. Introduced in 2010 by President Obama, GLRI funding was \$475 million that year, and \$300 million each in 2011 and 2012 (EPA Funding 2012). The GLRI Action Plan spans five fiscal years and is concentrated on five focal areas: toxics cleanup; invasive species

management; non-point source pollution; wetlands restoration, and outreach (GLRI 2010).

The Great Lakes Region is a compelling arena for study due to the availability of existing research on this region and the value of the Great Lakes as prominent national treasures and freshwater resources. Furthermore, global climate models suggest that climate change will have significant impacts on mid-latitude regions such as the Upper Midwest (Wuebbles et al. 2010, Patz et al. 2008) and evidence supports that the climate of the Great Lakes Region is already changing (Kling and Wuebbels 2005, Wuebbels et al. 2010). In fact, the 2012 Great Lakes Restoration Initiative request for grant proposals includes a specific interest in proposals that aim to increase the climate change resiliency of Great Lakes communities (EPA 2012). The impacts of climate change on the Great Lakes Region are expected to include higher average annual temperatures, shorter winters, more frequent extreme heat and precipitation events (Ebi and Meehl 2007), and increased risk of waterborne diseases due to higher precipitation (Patz et al. 2008). These impacts have environmental, economic, health and social consequences for Great Lakes residents.

Governmental Climate Change Action

In the absence of a U.S. national climate policy, a great deal of climate action has been happening at lower levels of government. At the state, provincial and regional level, much of this work has centered on greenhouse

gas mitigation, especially vehicle emission reductions, clean energy sources, and energy efficiency (Thoman et al. 2010). However, five of the nine Great Lakes states and provinces have also begun some variation of climate adaptation (Thoman et al. 2010). In the Great Lakes Region, there are instances of regional climate action, but these tend to be outside of formal policy channels. For example, a workshop was held in 2010 with sixty stakeholders from throughout the Great Lakes Region, to discuss ways to advance climate change adaptation. Recommendations for regional adaptation planning that emerged from this workshop included information sharing, connecting climate science to local situations, and enhanced funding support (Hinderer et al. 2010). Although the Great Lakes Restoration Initiative is not specifically targeted at climate change, many of the projects that are being funded through GLRI actually encourage climate adaptive infrastructure (GLRI 2010) and as indicated earlier, proposals highlighting Great Lakes resiliency were sought for 2012. There have also been some multi-state efforts to address climate change in the Great Lakes Region, such as a recent agreement between the Michigan and Wisconsin Departments of Natural Resources to cooperate on climate change resiliency efforts, but the most comprehensive climate action seems to be happening at the municipal level.

Cities represent a major source of greenhouse gas emissions, with the International Energy Agency estimating that urban areas account for 71% of global energy-related carbon emissions (Rosenzweig et al. 2010), and they

are especially vulnerable to climate change because they are often built on coasts or riverbanks. Cities also contain densities of people, infrastructure and resources (Dawson 2007). Despite these facts, cities may be best positioned to oversee climate mitigation and adaptation since they deal most directly with the immediate impacts associated with climate change and are directly accountable to their citizens (Foster et al. 2011). Additionally, cities are already in the position of handling emergency response plans, land use and water planning decisions, and infrastructure planning. As such, they are in possession of knowledge and tools that are critical in building climate resilience (Thoman et al. 2010). This reasoning is echoed in the following quote from Agenda 21, a comprehensive plan for global environmental action, which emerged from the 1992 United Nations Conference on Environment and Development (UNEP 2000, p. 28.1).

Because so many of the problems and solutions being addressed by Agenda 21 have their roots in local activities, the participation and cooperation of local authorities will be a determining factor in fulfilling its objectives. Local authorities construct, operate and maintain economic, social, and environmental infrastructure, oversee planning processes, establish local environmental policies and regulations, and assist in implementing national and subnational environmental policies. As the level of government closest to the people, they play a vital role in educating, mobilizing, and responding to the public to promote sustainable development.

Urban areas have been referred to as “first responders” in the field of climate action, stepping in where nations have failed - completing comprehensive risk assessment, creating Climate Action Plans, setting targets, and most importantly, committing to act (Rosenzweig et al. 2010).

Climate Change Action in U.S Cities

In order to curb the impacts of global climate change, it is necessary to implement mitigation strategies. Mitigating climate change refers to actions that either reduce greenhouse gas (GHG) emissions or create sinks for capturing them. According to the Intergovernmental Panel on Climate Change (IPCC 2007), mitigation has been the primary driver of climate change discussions thus far. However, even with strong greenhouse gas mitigation efforts, climate models indicate that a certain amount of climate change is inevitable based on current levels of carbon dioxide in the atmosphere (IPCC 2007). Climate adaptation refers to actions that are aimed at reducing the vulnerability of humans and natural systems to existing and future impacts of climate change (ICLEI 2011).

Adaptation encompasses actions that are taken to prepare for or protect against the impacts of climate change. Adaptation planning will need to occur at the national, local, and individual level, and will vary depending on the projected climate impacts for a particular geographic region (Maibach et al. 2008). ICLEI, now known as Local Governments for Sustainability, maintains that adaptation is “the other half of comprehensive climate protection” and can benefit communities by protecting lives, health, property, and ecosystems, now and into the future (ICLEI 2011). The IPCC (2007, p 2.7) supports that “adaptation is a necessary strategy at all scales to complement climate change mitigation efforts.” Because there is a level of uncertainty

with climate models, especially those that predict more regional and local effects, it will be necessary to take some actions even before an effect of climate change is apparent (Smith 1997). These have been referred to as anticipatory adaptation measures and require policies that are both flexible and economically sound, to accommodate a variety of potential climate outcomes (Smith et al. 1991).

Mitigation and adaptation do not have to be mutually exclusive. Strategies that serve to both mitigate climate change and facilitate adaptation of communities are often called co-benefit strategies. Dawson (2007) proposes that the same concentration of people and resources that create vulnerabilities for cities could also yield unique opportunities for integrating mitigation and adaptation. Therefore, cities should seek to create synergies between mitigation and adaptation (Rosenzweig 2010), especially in the case of limited municipal resources.

Cities have chosen to frame climate action in different ways and to prioritize certain actions over others. A 2010 study (Bassett and Shondas) revealed that cities favor highly visible actions and those that produce immediate results in their climate planning. However, the same study revealed that there is no set process for developing a climate change plan and what works for one city may not work for another. This is complicated by the fact that the consequences of climate change seem far off and therefore less actionable. Giddens (2009) suggests that climate planning should connect with everyday life, in the present, and counsels policy makers to promote the

positives of climate change action. For some cities, this might mean taking action against climate change, but calling it something else, such as sustainability planning, greening, energy security, or sustainable economic development. Ultimately, local culture and context are important (Bassett and Shondas 2010) and cities should identify “local hooks” (Betsill 2001 p. 398-399), framing climate action in terms of specific concerns.

The topic of climate change has also been politicized. If naming something is a way of classifying it, and therefore constitutes a political act (Stone 2001, p. 309), then cities must consider the way that they frame climate action. Because there is no set of political actions and innovations that would be guaranteed to limit climate change impacts (Giddens 2009), cities should seek to link climate change to broader agendas (Rosenzweig et al. 2010). Within the climate change literature, a connection has been made between climate action and public health (Frumkin et al. 2008, Keim 2008), and the impacts of climate change on physical health are fairly well studied, but a comprehensive view of overall well-being is lacking. Cities have become more interested in improving livability, quality of life, and happiness of residents, but they have also have limited resources. Portney (2003) warns that in the pursuit of sustainability, certain social and political values must be favored over others. If this is the case, cities will benefit from maximizing the value of climate change action by connecting it to other values, such as well-being. This requires as understanding of the concept of well-being and its potential links to climate change action.

Chapter 4

The Concept of Human Well-Being

The concept of human well-being is inherently subjective. In fact, Webster's dictionary defines well-being as the "state of being happy, healthy, or prosperous" – three very subjective terms themselves. Seedhouse (1995 p. 65) offered the following quote about the term: "Either 'well-being' is an empty notion, or 'well-being' is an important and meaningful term which conveys meaning no other term conveys, or 'well-being' is essentially contested—its meaning and content fluctuates dependent on who is using it, and why they are using it." Well-being is often referred to interchangeably with the concepts of quality of life, life satisfaction and happiness, with authors choosing to feature different domains and concepts depending on the discipline that they hail from (Mitchell et al. 2001). Deiner (2009 p. 11) defined the concept of subjective well-being as "the general evaluation of one's quality of life, consisting of three components: a cognitive appraisal that one's life was good (life satisfaction), experiencing positive levels of pleasant emotions and experiencing relatively low levels of negative moods."

The purpose of this discussion is not to suggest a correct definition of well-being, but rather to highlight the obvious complexity of the concept and its interconnected nature with other concepts. To help visualize this, several models of quality of life and well-being are presented in this chapter. Figure 1 outlines the six components that contribute to quality of life, as defined by Mitchell (2000).



Figure 1: Quality of Life Model, (Mitchell 2000)

Taking a somewhat different approach, satisfaction research such as that of Campbell and co-authors (1976) defines life satisfaction as the sum of satisfactions with individual environmental domains. This model is shown in Figure 2.

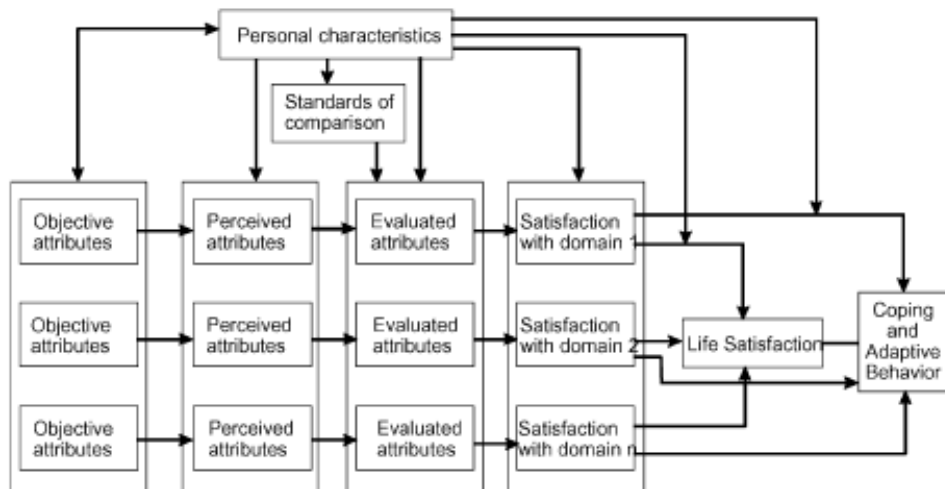


Figure 2: Life Satisfaction and Quality of Life Model. (Campbell et al. 1976)

Finally, the Gallup-Healthways Well-Being Index draws on a variety of well-being research. The survey used to collect the index data relies on a mix of evaluating and experience questions. Experienced well-being is concerned with momentary affective states and the way people feel about experiences in real-time, whereas evaluative well-being is the way that people remember their experiences after they are over. The six dimensions of the Gallup-Healthways Well-Being Index are represented in Figure 3. They include Life Evaluation, Emotional Health, Physical Health, Healthy Behavior, Work Environment, and Basic Access.

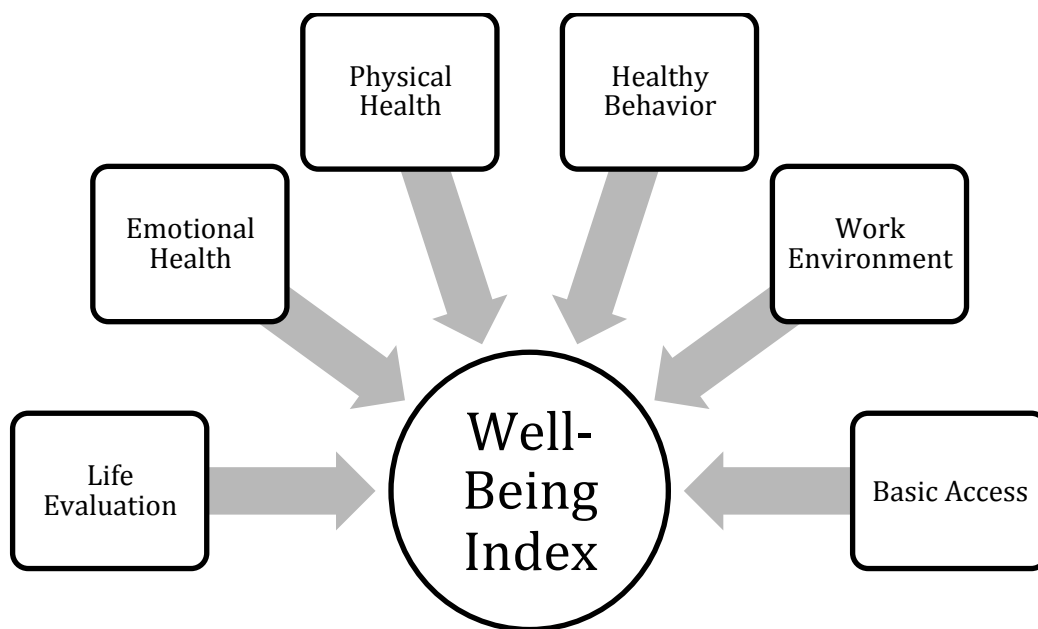


Figure 3: Gallup-Healthways Well-Being Index dimensions

Well-Being and the Built Environment

In the realm of urban policy and planning, well-being again takes on a variety of connotations. According to Kamp and co-authors (2003), concepts

such as urban environmental quality, livability, quality of life, and sustainability have become ubiquitous terms in the planning and policy world, but there is variability and ambiguity in specific definitions and circumstances of use (Kamp et al. 2003). Their work concludes that we are still lacking an adequate framework around well-being as it relates to environmental quality. This presents a challenge, especially as policy makers are looking beyond traditional economic measurements to place more of an emphasis on well-being and quality of life indicators (Leyden et al. 2011).

The study of the built environment has expanded to include the ways in which it might positively or negatively impact well-being. Evidence persists that there is a link between the physical design and maintenance of cities and the happiness of residents (Leyden et al. 2011). Research by Smith and co-authors (1997) reviewed urban planning visions of environmental quality and quality of life. They coined the term “community quality” to refer to the ability of the physical environment to provide opportunities for people to meet both their social and psychological, as well as physical, needs and desires. Among the elements identified as contributing to community quality were those that promote livability, connection, mobility, and diversity.

The idea of a person-environment relationship refers to the strong relationship that exists between the physical environment and health and well-being (Ulrich 1981, Suresh et al. 2006). Quality of life, livability, and sustainability are all dimensions of the person-environment relationship, with environment broadly defined as encompassing the physical, built, social,

economic and cultural (Kamp et al. 2003).

If society consists of a physical, economic, and social domain, Figure 4 (Shafer et al, 2000) highlights the interaction between these domains and shows how various environmental sustainability and well-being concepts relate to each other.

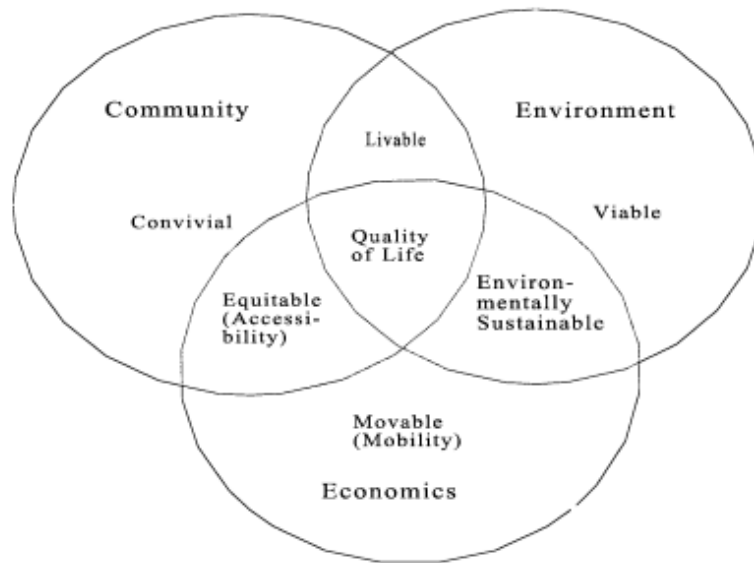


Figure 4: Societal Domains. (Schafer et al. 2000)

As the models presented in this chapter have shown, there are many ways to conceptualize well-being and its related domains. One is not necessarily more right than the others, but it is worth noting that some words may carry with them associations to their reader. For instance, the word sustainability is future oriented, while livability and quality of life are rooted in the present (Kamp et al. 2003). This could be problematic if those concepts and terms are used interchangeably in policy and planning documents. Likewise, quality of life is often grounded in the context of

physical health, which might overlook other important dimensions of the term.

“There is no agreement yet on [what defines] quality of life” (Mitchell et al. 2001), or presumably, well-being. However, it has been established that alterations to the built environment can influence well-being and also that taking action to curb global climate change will require alterations to the built environment. It seems likely, then, that climate change mitigation and adaptation measures have the potential to impact well-being.

Climate Change and Human Health

Because public health responses exist for many anticipated climate health impacts, there is a growing call for a public health centered approach to climate change (Frumkin et al. 2008, Keim 2008). Much like climate change, public health preparedness often operates in the presence of scientific uncertainty and with a precautionary approach (Frumkin et al. 2008). Experts in the environmental health community see a particular opportunity for linkages between climate health impacts and adaptation planning (Keim 2008, Anguelovski and Carmin 2011).

Within the climate change literature, a connection has been made between climate action and physical health, but researchers speaking at an April 2012 web-based seminar on climate health impacts urged that “scientists and public officials need to do more to show the public how climate change affects diseases and physical well-being” (Irfan 2012). In

addition, there is a lack of research available on the mental health impacts of climate change. In the U.S. and worldwide, mental health often receives low priority in the public health arena, and its impacts on human and societal well-being are typically underestimated (Portier 2010).

Climate change will directly impact health in the form of higher temperatures and extreme weather events, as well as indirectly via poorer air quality, insect and waterborne diseases, and various psychological effects. The heat impacts of global warming are well studied (Luber and McGeehin 2008, Keim 2008). Heat waves can cause heat stress or heat strokes and can even lead to mortality, with the highest risk classes being the elderly, isolated individuals, and those without air conditioning. Increases in heat have also been associated with a rise in cardiovascular disease episodes, as well as stroke (Portier 2010). While most emphasis in the literature is on the dangers of extreme heat waves, new research also shows that even day-to-day temperature variability, which is expected to rise with climate change, has adverse health impacts (Abel 2012).

The consequences of global warming in cities are compounded by the urban heat island effect. This phenomenon is caused by concentrated vehicle emissions and the transformation of land from its natural state to a built environment, which allows heat to become trapped during the day in surfaces like roads and rooftops, and then released throughout the night (Stone and Rogers 2001). The urban heat island effect results in cities experiencing a local climate that is anywhere from 2-10 degrees Fahrenheit

warmer than surrounding suburban and rural areas (Luber and McGeehin 2008). There is also evidence to suggest that within cities, low income communities have a higher percentage of impervious surface, which traps heat, and fewer trees, which promote cooling (Foster et al. 2010). This and other research (Friel et al. 2011) calls attention to the social equity component of climate change and the need to address health equity in climate change planning.

In addition to direct health impacts, climate change is also expected to have indirect impacts on human health. One way in which this will manifest is through decreased air quality, which is related to increased temperatures. Ground level ozone and particulate matter levels are known to rise on hot days (Luber and McGeehin 2008). These air pollutants can lead to spikes in respiratory illness and asthma symptoms (Tagaris et al. 2009, Frumkin et al. 2008). Health can also be negatively impacted by heavy precipitation events, which often lead to combined-sewer overflows, dumping excess wastewater into drinking supplies during heavy storms. Increased pollutants in drinking water mean an increased potential for waterborne diseases (Patz et al. 2008) and outbreaks of contaminated water containing bacteria, parasites, and viruses can cause both morbidity and mortality (Morris et al. 2006). As warmer temperatures migrate north, they bring diseases such as malaria carried by mosquitoes and Lyme disease from ticks, both of which thrive in warm weather (Epstein and Ferber 2011). Other potential indirect health effects include possible disruptions in the food supply due to agricultural

shortages (Frumkin et al. 2008) and increases in allergies from accelerated pollen formation, which has been linked purely to increased carbon dioxide levels (Epstein and Ferber 2011).

If the consequences to physical health by climate change are fairly well researched, the same cannot be said for mental and emotional impacts. It is recognized that extreme weather events brought on by climate change may result in mild or chronic stress associated with geographic displacement, damage to property, and loss of loved ones. Each of these situations can negatively affect mental health, but research in this area is new and very difficult to quantify and address (Portier 2010). Health equity issues also arise in the discussion of psychological impacts of climate change, as lower socioeconomic groups tend to have less access to and poorer quality of mental health care (Portier 2010).

Some research has pointed out that “examining climate change from the psychological angle goes beyond the traditional frame of human and environmental systems to account for psychological well-being and human experience” (Reser and Swim 2011, p. 278). Within climate change research, it would seem that there is a need to expand the traditional health model to include a more comprehensive view, such as that of the World Health Organization, which defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO 1946).

Linking Climate Action and Well-Being in Cities

Cities are engaging in a variety of activities that address climate change, sometimes under the heading of sustainability or green planning. These actions can result in GHG reduction (mitigation), reduced vulnerability (adaptation), or they may perform both functions, resulting in a co-benefit. Many climate actions also produce a co-benefit of improved health and well-being. When mitigation, adaptation, and health benefits converge, the strategy can be thought of as a “win-win-win” (Rosenzweig et al. 2011 p. 201). The opportunities for co-benefits in climate action and health is greatly enhanced when all dimensions of well-being are considered, rather than just physical health.

Any effort on the part of a city to reduce the urban heat island effect lowers energy demands for air conditioning to combat the warmer temperatures (Stone and Rodgers 2001), thus resulting in GHG mitigation. These efforts include increasing building energy efficiency, green roofs, white roofs, creating green infrastructure and open space, and increasing tree canopy. The health benefits of urban heat management strategies are reduced heat distress and better air quality. Increasing green infrastructure such as connected park space and overall tree canopy in a city reduces temperature variability (Abel 2012), provides natural stormwater management and also represents an opportunity for physical activity and a place to connect with others (Smith et al. 1997). This is a clear example of a triple win strategy.

Initiatives aimed at reducing energy consumption or increasing energy derived from non-fossil fuel sources also reduce greenhouse gas emissions and result in lower urban air pollution (Portier 2010). Air quality is also improved through efforts to reduce auto emissions and vehicle miles traveled. This includes increased public transit use; the building of infrastructure to support and encourage active transportation, including bicycling and walking; and land use planning that prioritizes density, mixed use and walkability. In addition to air quality, these actions can also increase connectivity and livability (Smith et al. 1997), as well as promote physical activity (Corburn 2009). Cycling and walking are shown to help combat obesity and cardiovascular disease (Dannenberg et al. 2011). Finally, when cities improve access to public transit and prioritize safe active transport routes, they are reducing the health equity gap (Hosking 2011).

Stormwater management strategies are necessary for cities to adapt to heavy precipitation events. Infrastructure projects such as sewer upgrades and installing permeable pavement result in better water quality and flood protection. As indicated previously, natural stormwater management techniques such as rain gardens, green roofs, and green infrastructure provide the same benefits and also help to manage urban heat impacts (EPA 2011). Promoting local food production and increased access to farmers' markets can increase food security threats associated with climate change. This adaptation measure also carries the co-benefits of improving physical

health, controlling obesity risks, and addressing health inequities (Dannenberg et al. 2011).

Creation of extreme weather response systems by cities prevents physical harm and also alleviates stress (Keim 2008). It has already been indicated that the mental health impacts of climate change are under-researched and difficult to track. Reser and Swim (2011 p. 281) define climate change as a continuous stressor with periodic “acute stressors,” such as extreme weather events. A March 2012 Gallup survey (Polling 2012) reported an increase in the number of people who claim to be worried “a great deal” or “a fair amount” about climate change, up to 55% from 51% in 2011. A city’s effort to educate residents on climate change impacts and engage them in the climate planning process could lessen this negative impact on emotional well-being. Empowering people with knowledge about climate change and how they can take action reduces feelings of hopelessness and gives them the feeling that they can make a difference (CRED 2009).

Efforts of community education and engagement might also serve to strengthen what Delaney and Eckstein (2003) term community self-esteem, or the way a community views itself, gets along, and is perceived by others. This somewhat intangible attribute of well-being can also be enhanced through climate action focused on revitalizing the local economy and creating green jobs (McKibben 2007).

Overall, climate change action can be seen as having an influence on many of the dimensions of human well-being. Physical health may be improved and

protected by cleaner air and water, increased physical activity, and extreme weather response programs. Furthermore, climate action can promote healthy behaviors, such as making local produce accessible and encouraging active transportation. Although it is harder to measure, research also indicates that climate action could contribute to emotional health through stress reduction and satisfaction with one's community as a place to live.

Research suggests that people are most likely to respond to environmental issues that they can see close to home (Portney 2003). This reinforces that cities are an appropriate level of government to address the overlap between climate action and well-being and that it is useful for cities to frame global climate issues in the context of local health and well-being. Based on the research presented in this and preceding chapters, I have constructed Figure 5 on the next page to illustrate the relationship between various climate actions and the six dimensions of the Gallup-Healthways Well-being Index. Each action is also defined as a mitigation, adaptation, or co-benefit strategy.

Climate Action	Mitigation Adaptation or BOTH (Co-benefit)	Well-being Connection
Increase renewable energy	Co-benefit	Physical Health
Promote energy conservation	Co-benefit	Physical Health
Increase bldg insulation	Co-benefit	Physical Health
White roofs	Co-benefit	Physical Health
Smart Growth policies/zoning	Co-benefit	Basic Access, Phys. Health
Tree Canopy	Co-benefit	Physical Health
Park Creation	Co-benefit	Healthy Behaviors, Basic Access, Physical Health
Green Infrastructure	Co-benefit	Healthy Behaviors, Basic Access, Physical Health
Green Roofs	Co-benefit	Physical Health
Business Community Engagement	Co-benefit	Physical Health
Green Jobs	Co-benefit	Work Environment, Basic Access
Active transport infrastructure	Mitigation	Physical Health, Healthy Behaviors
Increase Public Transit	Mitigation	Physical Health
Parking/traffic/ congestion fees	Mitigation	Physical Health
Reduced fuel consumption	Mitigation	Physical Health
Recycling/waste reduction	Mitigation	Physical Health
Infrastructure resiliency	Adaptation	Physical Health, Basic Access
Extreme weather alert systems	Adaptation	Physical Health, Mental Health
Control Vector-borne disease	Adaptation	Physical Health
Upgrade sewers	Adaptation	Physical Health
Flood Risk Mgmt	Adaptation	Physical Health, Mental Health
Community Education	Adaptation	Mental Health
Permeable Pavement	Adaptation	Physical Health (water)
Local food production	Adaptation	Physical Health, Healthy Behaviors, Basic Access
Water Conservation	Adaptation	Physical Health, Basic Access
Disaster planning/Insurance	Adaptation	Physical Health, Mental Health

Figure 5: Links between climate change action and the six dimensions of the Gallup-Healthways Well-Being Index

Chapter 5

In this chapter, four case studies are presented to provide a closer examination of how cities in the Great Lakes Region are developing and implementing climate change plans, as well as how these mitigation and adaptation initiatives are linked to human well-being. As Chapter 2 indicated, the case cities are Grand Rapids, Michigan, a small city that has experienced a significant improvement in Well-Being Index rank since the rankings were introduced in 2009; Chicago, Illinois, a very large city with a well-being rank that has fallen considerably over the three years of reporting; Milwaukee, Wisconsin, a mid-size city with a well-being rank that has also decreased; and Minneapolis, Minnesota, a small to mid-size city with a very high well-being rank and one that has remained stable. In each case study, a background of the city's climate and sustainability efforts is provided, as well as current plan components, implementation, and reporting. Finally, goals and initiatives that address both climate change action and well-being are highlighted.

Case City: Grand Rapids, MI

Grand Rapids is the second largest city in Michigan, with a population of 188,040 in the 2010 U.S. Census. The Grand Rapids Metropolitan Statistical Area has a population of 774,160. The city lies on the Grand River, east of Lake Michigan by about 30 miles.

Grand Rapids and the Well-Being Index

Although Michigan ranks 37th out of the 50 States in overall Well-Being on the Gallup-Healthways Well-Being Index, the Grand Rapids MSA consistently performs better than the state across index dimensions. In 2011, the overall Well-Being Rank for Grand Rapids was 47, representing

Figure 6: Depicts Well-Being Index ranks for Grand Rapids MSA, 2009-2011

* A rank in the highest quintile is expressed with GREEN shading

Grand Rapids (MSA) Pop. 774,160		Rank (out of 190)
Overall Rank	2011	47
	2010	42
	2009	67
Life Evaluation	2011	52
	2010	39
	2009	39
Emotional Health	2011	55
	2010	28*
	2009	42
Physical Health	2011	30
	2010	56
	2009	138
Healthy Behavior	2011	88
	2010	157
	2009	126
Work Environment	2011	119
	2010	40
	2009	100
Basic Access	2011	21
	2010	58
	2009	30

advancement in rank of 20 over the city's 2009 rank of 67. The major drivers of this improvement in Overall Well-Being are in the dimensions of Physical Health and Healthy behavior. The Grand Rapids MSA also ranks well in the Basic Access dimension. Figure 6 is a representation of the Well-Being Index rankings for the Grand Rapids MSA for 2009-2011.

Background

Grand Rapids, MI subscribes to the “triple bottom line” philosophy of balancing economic, social, and environmental values. In 2005, the city partnered with several area academic institutions to form a multi-stakeholder initiative called the “Community Sustainability Partnership (CSP).” The goal of this collaboration was to develop sustainable Grand Rapids communities by “learning and living the triple bottom line” through preserving environmental integrity, increasing economic prosperity, advancing and achieving social equity, improving the quality of life, and elevating the value of education. Also in 2005, Grand Rapids made its first commitment to climate change when it adopted and signed the U.S. Mayors Climate Protection Agreement (OES 2012).

In 2006, the city replaced its Strategic Plan with a Sustainability Plan. This plan resembled a visioning document, outlining sustainability values and a sustainability vision and framework. The plan did not provide specific targets and climate change was not mentioned at all, although greenhouse gas reduction is listed under potential air quality goals (Sust. Plan 2006). In 2007, the United Nations University designated Grand Rapids as a Regional Centre for Excellence in Education for Sustainability. Also that year, a new zoning code was adopted based on the principles of Smart Growth, LEED-Neighborhood Development, Transit-Oriented Design and the community and city-driven visioning process, *Green Grand Rapids*. *Green Grand Rapids* served to update the city’s 2002 Master Plan with a focus on “maintaining the

city’s livability and competitive edge in attracting and retaining residents and businesses.” Recommendations from the process were to expand green infrastructure, create community gardens, and design streets for all users (Green GR 2011).

In 2009, Grand Rapids commissioned a greenhouse gas inventory as part of its Energy Efficiency and Conservation Strategy and application for an Energy Efficiency Conservation Block Grant (EECBG) from the U.S. Department of Energy. Figure 7 below outlines the results of this inventory. Emissions from the community as a whole were measured at just over 2 million metric tons of carbon dioxide equivalent (CO₂-e), with 57% of emissions originating from transportation, 19% from commercial, 23% from residential, and the remaining 1% from industrial and waste processing (Energy 2009). The report notes that completing this baseline assessment was somewhat difficult due to flawed, and at times unavailable, data.

Figure 7: Table of Grand Rapids GHG emissions; from the Grand Rapids Energy Efficiency and Conservation Report, 2009. (using data from 2007 and 2008)

Table 13 – Community of Grand Rapids GHG Inventory Summary (Metric Tons)					
	CO₂	N₂O	CH₄	CO₂e	%
Residential	454,716	1.09	58.78	456,289	22.6%
Commercial	379,245	0.72	35.74	380,217	18.9%
Industrial	5,683	0.02	0.15	5,693	0.3%
Transportation	1,128,275	54.52	47.04	1,146,164	56.9%
Waste	-	-	1,299.31	27,285	1.4%
Total	1,967,919	56.35	1,441.01	2,015,648	

In 2010, Grand Rapids was chosen as one of eight “Climate Resilient Communities” by ICLEI, also known as Local Governments for Sustainability. These cities are to pilot the tools and resources that ICLEI developed to help local governments prepare for climate change adaptation.

Grand Rapids Five-Year Sustainability Plan

In 2010, the city of Grand Rapids developed a five-year Sustainability Plan, spanning from the fiscal year 2011 to fiscal year 2015. The plan was created and will be managed by the Office of Energy and Sustainability, which coordinates the city's efforts in energy efficiency, sustainability, conservation and renewable energy. The Grand Rapids Sustainability Plan is divided into three sections based on the triple bottom line principles of economy, social welfare, and environment. References to climate change appear under the environmental section of "Energy and Climate Protection". The goal of reducing greenhouse gas emissions includes targets to meet the obligations of the U.S. Mayors Climate Protection Agreement for GHG emissions reductions and to reduce total direct and indirect CO₂-e emissions from city operations by 10,000 metric tons by June 30, 2013. The plan makes no mention of the citywide GHG inventory of 2009, or of a target for citywide emissions reductions. The goal of reduced energy demand and fossil fuel consumption cites energy independence as essential for long-term national security, integrity of the environment, and climate protection. Targets for this goal include reduced fuel consumption by city vehicles and at least 30% of city energy sourced from renewables by June 30, 2013 (GR Sustainability Plan 2011 p. 27).

Other targets within the plan can be identified as contributing to climate change mitigation or facilitating adaptation, although they are not classified as climate actions in the plan language (GR Sustainability Plan 2011 p. 22, 28-

30). These targets include increasing reuse of captured water and/or gray water, reducing overall city water consumption, eliminating combined sewer overflow points, increasing green roofs in the city, replacing pavement with impervious surface, increasing tree canopy, increasing city open space, and increased access to community gardens and farmers' markets throughout the city.

Many of these strategies also have well-being impacts, although with the exception of increased access to healthy foods through community gardens and farmers' markets, this connection is not specifically made in the Sustainability Plan. Stormwater management efforts can contribute to healthier water, while energy and fuel usage reductions can have the added benefit of cleaner air for people to breathe. Increased open space not only reduces the urban heat island effect, but also encourages physical activity and social connectedness.

Current State of Climate Action

As of the (November) 2011 Sustainability Progress Report, Grand Rapids claimed to have reduced GHG emissions by 6,500 metric tons, more than half way to the goal for 2013. These reductions came from changes in city operations (GR Progress 2011). The report also states that the city is in the process of aligning environmental goals of the Sustainability Plan with the city's other plans. The Office of Environment and Sustainability acknowledges that it makes sense to account for current and future climate change in city policies, plans, and codes. The *Green Grand Rapids* updates to

the city's Master Plan promote mixed-use development, efficient land use, and greening of the cityscape, but climate change impacts are not mentioned as a consideration.

According to the Grand Rapids Sustainability Plan (2011 p. 26), the city has made the connection between climate change and well-being, as evidenced by the statement, "We know how to counteract the effects of global warming and we know our efforts will be rewarded with a higher quality of life and a cleaner and greener community." However, as of this writing, Grand Rapids does not have a published Climate Action Plan, or any citywide climate mitigation or adaptation goals. The GHG reduction goals of the five-year Sustainability Plan refer to city operation emissions only and there is no indication of the use of climate modeling in any plan to predict necessary adaptations. It is also not clear where the city stands on progress with the ICLEI Resilient Communities program to develop an adaptation plan.

Case City: Chicago, IL

With a population of just under 2.7million people, Chicago is the 3rd largest city in the U.S. and the Chicago Metropolitan Statistical Area (MSA) had a population of nearly 9.5 million as of the 2010 Census. Chicago is on the southern shore of Lake Michigan.

Chicago and the Well-Being Index

Illinois ranked 32 out of the 50 states in the 2011 Well-Being Index, down from 26 in 2010. Chicago’s Metropolitan Statistical Area rank also dropped, from 88 out of the 190 MSAs measured in 2010, to an Overall Rank of 113 in 2011. The city’s ranks for Emotional Health and Life Evaluation have fallen

Figure 8: Depicts Well-Being Index ranks for Chicago (MSA), 2009-2011
 * A rank in the highest quintile is expressed with GREEN shading

Chicago (MSA) Pop. 9,461,105		Rank (out of 190)
Overall Rank	2011	113
	2010	88
	2009	89
Life Evaluation	2011	88
	2010	77
	2009	49
Emotional Health	2011	123
	2010	105
	2009	79
Physical Health	2011	38
	2010	34
	2009	21
Healthy Behavior	2011	131
	2010	140
	2009	128
Work Environment	2011	138
	2010	116
	2009	138
Basic Access	2011	97
	2010	51
	2009	90

by 44 and 39 since the Well-Being Index was first introduced in 2009. The one dimension of the Well-Being Index that Chicago consistently ranks well in is Physical Health. Figure 8 is a representation of the Well-Being Index rankings for the Chicago MSA for 2009-2011.

Background

Chicago's commitment to the environment can be traced back over two decades. The city has made efforts to green itself through extensive tree planting initiatives, the construction of bicycling infrastructure, clean air programs, and green building strategies. In 2008, Chicago released its comprehensive Climate Action Plan. At the request of former Chicago Mayor Daley, a multi-stakeholder Chicago Climate Task Force developed the plan. The Chicago Climate Action Plan (CCAP) is described as having 5 goals (CCAP 2008):

- Determine the challenges that Chicago faces as a result of climate change
- Identify the sources of Chicago's GHG emissions
- Set goals to reduce those emission and adapt to already changing climate impacts
- Seek ways to improve the economy and quality of life for Chicagoans through climate change planning and action
- Outline concrete, achievable goals

The Task Force consulted with an extensive research team and leading climate scientists to understand the likely impact of climate change on Chicago under a "business as usual" scenario as well as various GHG reduction scenarios. Based on this analysis, it was determined that without any action, Chicago's GHG emissions could increase by 35% by 2050. The result for Chicago would likely be more extreme heat in the summer, more heavy rainstorms, a growing risk of flood, and a negative impact on city's public health and economy.

With the consequences of these impacts in mind, the Task Force decided upon a long-term GHG emission target of an 80% reduction from 1990 levels by 2050, with an interim target of 25% reduction from 1990 levels by 2020. The purpose of the 2020 goal is to allow Chicago time for necessary infrastructure and behavioral changes before “checking in” to make sure that the city is on the right track to meet the ultimate goal. A 2005 GHG inventory revealed Chicago GHG emissions of 36.2 million metric tons (MMT) of CO₂-e. The 1990 baseline GHG level for Chicago was established at 32.3 MMT of CO₂-e. In order to reach the Climate Action Plan goal for 2020, it was estimated that projected emissions would need to be cut by 15.1 MMT of CO₂-e (CCAP 2008).

The Chicago Climate Action Plan

Chicago’s CAP is focused on five strategies: energy efficient buildings, clean and renewable energy sources, improved transportation options, reduced waste and industrial pollution, and climate adaptation. Within these strategies, the Task Force recommended 35 actions necessary to reach the city’s climate action goals. Of these actions, 26 are related to the first four strategies of GHG mitigation. The remaining nine address Chicago’s adaptation measures.

For each of the five strategies, the CCAP explicitly highlights potential co-benefits of the recommended actions. For instance, “Energy Efficient Buildings” actions will have a GHG mitigation impact, but are also noted as

reducing energy costs, creating jobs, improving air quality and health, improving quality of life, and contributing to adaptation. In fact, all five of the CCAP strategies are identified as having positive co-benefits in the area of physical health and/or quality of life (CCAP 2008 p. 19, 25, 29, 35, 39).

Each action in the plan is also associated with a corresponding estimate for its GHG reduction potential. In aggregate, these account for the 15.1 MMT of CO₂-e that must be reduced to meet the CCAP 2020 goal. The estimated mitigation impact of different actions varies greatly, with some having a very small impact (.01 MMT for improving walking and biking infrastructure) to the significant impact of 3 MMT of CO₂ that could be reduced by shifting the city's sources of power from fossil fuels to renewable resources (CCPA 2008 p. 26, 31). In all cases, the co-benefits of various actions are highlighted, even though in many instances, these are not quantifiable. Finally, the plan highlights the city of Chicago's intention to lead by example. Each strategy identifies examples of city initiatives already taking place.

With regard to adaptation, Chicago focuses on nine dimensions. Managing the urban heat island seems to be a primary target, along with stormwater management to reduce flood risk. Many of the suggested initiatives also serve to reduce GHG emissions, but the priority for adaptive strategies is to prepare people and infrastructure for an altered Chicago climate. Specific attention is directed at engaging the public and business communities, making them aware of vulnerabilities and helping them to take protective measures.

Climate Action Progress

In the summer of 2010, the first CCAP Progress Report was released, detailing successes of the plan from 2008 and 2009 (CCAP Progress 2010).

Highlights of this report include:

- Over 20,000 buildings have been retrofitted for energy efficiency
- Over 30,000 appliances traded in for more efficient models
- Chicago now has the nation's largest urban solar field, supplying 10 MW of energy
- 7 million sq. feet of green roofs were finished or under construction
- 120 green alleys installed
- 6,000 trees planted in urban heat island communities
- A new stormwater management ordinance resulted an increase of 55 acres of permeable surface area

As the Plan intended, many of the completed initiatives have a positive effect on well-being in addition to their carbon mitigating impact. The total impact of actions accomplished under the CCAP is reported as advancing the city of Chicago more than 8% of the way towards its 2020 greenhouse gas reduction goal. The Progress Report indicates that an emissions inventory was to be performed in 2011 to track overall progress. However, no indication of the results of this inventory were found on the CCAP website as of May 2012.

Implementation, Funding, and Monitoring

Management of the Chicago CAP targets and initiatives is spearheaded by the Chicago Department of Environment. However, there are 20 additional departments and sister agencies, which are jointly responsible and have their own CCAP work-plan. Staff from these offices meet monthly to discuss

progress, collaborate on ideas, and hear updates on the plan. Since its launch in 2008 through September 2010, the Chicago Climate Action Plan has received or leveraged more than \$142 million (CCAP FAQ 2008). Funding sources include Federal stimulus funds, in-kind services, city funds, State funds, local and national foundations, and utility partners.

As work is completed on the 26 mitigation actions, stakeholders are able to enter the metrics directly into an online platform. This platform tracks greenhouse gas mitigation progress, allowing for better real-time monitoring. In addition, an external group of Chicago civic, business, and organization leaders known as the Green Ribbon Committee, is responsible for “reviewing performance against the Plan’s goals and recommending revisions, adjustments and improvements” (Green Ribbon 2008). The Chicago CAP is also designed to deliberately complement other Chicago and regional planning efforts. In 2008, around the time the CCAP was released, the Chicago Plan Commission adopted a new comprehensive plan, “Adding Green to Urban Design: A City for Us and Future Generations.” The plan is focused on the design elements of increasing green infrastructure in the city, while reducing urban heat and managing stormwater. The results of this ongoing planning effort serve to enhance the goals of the CAP. In addition, the city of Chicago, the Chicago Metropolitan Agency for Planning, and local organizations work together to align the values, actions and implementation efforts of various regional plans.

The primary goal of the Chicago Climate Action Plan is made very clear: to reduce the city's emissions and prepare for climate change. Secondary emphasis is placed on improved livability, cost savings, and jobs through climate action. The plan addresses mitigation and adaptation simultaneously, with the recognition that quality of life and human well-being will also benefit. Throughout the plan, a shared responsibility for action is stressed. It is acknowledged that to meet the CCAP goals, the city, residents, and businesses will have to play a part. The portrayal is that Chicago can take control of its future by addressing climate change and also be seen as a leader for other cities to emulate (CCAP 2008, Introduction).

Case City: Milwaukee, WI

Milwaukee is the largest city in Wisconsin, with a population of 594,833 as of the 2010 Census and a Metropolitan Statistical Area (MSA) population of 1,555,908. The city is located on the southwestern shore of Lake Michigan.

Milwaukee and the Well-Being Index

The state of Wisconsin ranks in the middle of the Well-Being Index for 2011, with an overall rank of 22. Milwaukee’s MSA also ranks near the median, with an Overall Well-Being rank of 109 out of 190 Metropolitan Statistical Areas in 2011. Milwaukee ranks highest in the dimension of Basic

Figure 9: Depicts Well-Being Index ranks for Milwaukee (MSA), 2009-2011
 * A rank in the highest quintile is expressed with GREEN shading

Milwaukee (MSA) Pop. 1,555,908		Rank (out of 190)
Overall Rank	2011	109
	2010	103
	2009	96
Life Evaluation	2011	150
	2010	123
	2009	144
Emotional Health	2011	65
	2010	43
	2009	55
Physical Health	2011	51
	2010	91
	2009	66
Healthy Behavior	2011	120
	2010	117
	2009	93
Work Environment	2011	130
	2010	155
	2009	95
Basic Access	2011	32
	2010	22
	2009	37

Access, while Life Evaluation, Healthy Behavior, and Work Environment rank very low on the Index. From 2010 to 2011, there was an improvement in rank of 40 in the dimension of Physical Health. Figure 9 is a representation of the Well-Being Index rankings for the Milwaukee MSA for 2009-2011.

Background

In his 2004 State of the City speech, Milwaukee's Mayor Tom Barrett called for the creation of a Green Team with members from both the city and environmental groups. This Green Team was challenged to create a green vision to maximize the city's economy, health and quality of life by working with nature's systems. Specifically, the team looked to develop strategies in three areas of concern for the city: stormwater reduction and management, smart energy policy, and stimulating a green economy.

The Green Team Report was published in 2005, outlining nearly 40 recommendations to the city (Green Team Report 2005). Many of these recommendations were not specific measurable targets, but rather suggestions to do additional research, collect data, and support certain green activities. The report's recommendations for stormwater management included prioritization of investment in stormwater infrastructure, the creation of a network of greenways and increased tree canopy, smart growth policies to reduce storm system burdens, and education of the public on stormwater management.

Smart energy recommendations included reduced consumption and efficiency upgrades, alternative fuels and hybrids for city vehicles, and support for alternative transportation systems including mass transit, car-pooling and commuter lanes, bicycle lanes, and pedestrian friendly infrastructure. It was suggested that renewable energy sources be developed in part because of their ability to change the perception of Milwaukee as a

“dirty industrial city”. The Green Team also recommended that Milwaukee adopt a climate protection plan with GHG emissions reduction targets and gave a suggested timeline of 2006 for completion.

The report recommended a variety of actions for building a green economy, including working to create green jobs, making an inventory of the existing green services market in the city, and developing incentives for businesses to improve environmental performance. It was also suggested that the city capitalize on the cluster of energy technology leaders already located in Milwaukee, as well as build markets for, remove barriers to, and incentivize green technologies. The possibility of developing a Green Corridor or eco-industrial park to attract green technologies and services was highlighted as well.

In 2006, the Mayor was responsible for creating the city’s Office of Environmental Sustainability (OES 2012). This 100% grant-funded office works with city departments, the Common Council, and Milwaukee for-profit and non-profit institutions to promote city sustainability initiatives.

Sustainability Planning

In his 2012 State of the City Address in February, Mayor Barrett announced that Milwaukee had acted on 85% of the recommendations from the 2005 Green Team Report. He called for the creation of a new Green Team and the development of a Sustainability Plan with quantifiable targets (State of the City 2012). According to the city’s website (Milwaukee 2012), the

purpose of the city of Milwaukee Sustainability Plan will be “to provide a community and city endorsed strategic vision for Milwaukee’s sustainable economic development for the next 5-10 years. The plan will document the vision, goals, targets and specific actions that the city of Milwaukee and its community partners will undertake in order to ensure that both current residents and future generations can attain and enjoy a higher quality of life.” The sustainability planning process will involve multiple stakeholders, led by an individual from the Office of Environmental Sustainability. A Milwaukee Sustainability Fund is also being built through the help of a private foundation, ensuring that the planning process leads to action. The new Green Team will utilize the 2005 Green Team Report as a foundation for developing the Milwaukee Sustainability Plan. In addition, the city plans to use guidelines from two community sustainability frameworks, the *Natural Step for Communities* and ICLEI STAR Communities. The Natural Step model promotes a holistic approach to community sustainability (NSC 2012) and ICLEI Star Communities is a set of goals and principles designed to help cities create sustainability plans and measure progress (STAR 2012).

The city has made it explicitly clear that it is not developing a Climate Action Plan because “The city of Milwaukee wants to cover more territory than is generally covered in Climate Action Plans, including a focus on the economic development aspects of sustainability. As a result, the more comprehensive sustainability planning process is being utilized” (Milwaukee Climate 2012). The recommendation of the 2005 Green Team Report to

conduct a greenhouse gas inventory and develop a Climate Action Plan was never acted upon. The ICLEI STAR Communities framework does suggest creating a Climate Action Plan during the sustainability assessment period (STAR 2012). However, although there is an emphasis in the current planning outline on choosing targets and indicators that can be tracked with quantifiable results, no mention is made of conducting a baseline GHG analysis.

The Mayor's recent State of the City address called attention to two themes, which are expected to drive the Sustainability Plan. The first is an emphasis on continuing the city's efforts to create sustainable economic development. Milwaukee acknowledges that its economy and the environment are interdependent and thinks that promoting this connection can result in job growth. The city is looking to continue recruitment of clean energy manufacturers, prioritize redevelopment with attention to natural systems, and capitalize on the natural appeal of city settings (State of the City 2012). The second theme permeating Milwaukee's sustainability-planning outline is one of branding and creating a vision of Milwaukee as a clean, green, livable, and innovative city – the *Fresh Coast Capitol of North America*. (Green Vision 2012). Green festivals are suggested as a way to promote the City's vision.

Co-Benefits for Well-Being and Climate Change

Economy, the likelihood of rising energy costs, and quality of life are driving the sustainability movement in Milwaukee. Although climate change does not appear to be a specific focus of Milwaukee's planning process, some of the city's initiatives are examples of strategies that both address climate change and improve well-being. Stormwater management initiatives can improve health through better water quality, as well as the mental and physical health impacts of green infrastructure. Strategies that aim to increase energy efficiency and/or increase energy derived from renewables both improve air quality and reduce emissions and peak demand. Support for active transportation infrastructure encourages the healthy behaviors of walking and biking. The city recognizes that people desire certain features in a place to live, and that many of these relate to sustainability. Milwaukee also explicitly acknowledges that sustainability can improve well-being (Green Team Report 2005, State of the City 2012).

Case City: Minneapolis, MN

As of the 2010 Census, the population of Minneapolis is 382,578. The city is part of a U.S. Metropolitan Statistical Area (MSA) that also includes St. Paul, and is home to nearly 3.3 million people. Minneapolis lies on both banks of the Mississippi River.

Minneapolis and the Well-Being Index

As a state, Minnesota has ranked in the top quintile of the Well-Being Index for all three years so far. The MSA that includes Minneapolis also

Figure 10: Depicts Well-Being Index ranks for Minneapolis (MSA), 2009-2011

* A rank in the highest quintile is expressed with **GREEN** shading

Minneapolis (MSA) Pop. 3,317,306		Rank (out of 190)
Overall Rank	2011	18*
	2010	21
	2009	19
Life Evaluation	2011	30
	2010	65
	2009	46
Emotional Health	2011	26
	2010	15
	2009	15
Physical Health	2011	13
	2010	16
	2009	11
Healthy Behavior	2011	84
	2010	50
	2009	86
Work Environment	2011	50
	2010	49
	2009	54
Basic Access	2011	10
	2010	12
	2009	6

scores well on the Well-Being Index. Minneapolis received an overall rank of 18 out of 190 MSAs in 2011. This represents a composite of all six dimensions of the Well-Being Index. Minneapolis ranks especially well in the dimensions of Physical Health and Basic Access. Additionally, there was a large improvement in the rank for Life Evaluation from 2010 to 2011. Figure 10 represents the

Well-Being Index rankings for the Minneapolis MSA for 2009-2011.

Background

The city of Minneapolis made its first commitment to climate action in 1993, when it adopted a joint CO₂ reduction plan with the adjacent city of St. Paul (MSP 1993). The Minneapolis-St. Paul Urban CO₂ Project Plan pledged to reduce carbon dioxide produced by the two cities to 20% below 1988 levels by 2005. The 1988 base level was established at 14 million metric tons for the two cities. Notably, the plan only presents a combined total for Minneapolis and St. Paul, rather than a breakdown for each city. Additionally, the base level measurement represents carbon dioxide only, rather than CO₂-equivalent (CO₂-e), which would have included other greenhouse gases, such as methane. These choices make it somewhat difficult to assess the success of the project over time.

Notes from the Minneapolis City Council resolution to pass the Project plan (MSP 1993, preface) state a recognition that curbing global warming carries a variety of other benefits, including reduced air pollution, increased energy independence, urban sprawl limitation, and cost savings in efficiency. This early appreciation of co-benefits in climate action is noteworthy.

Climate Change Mitigation in Minneapolis

Fast forwarding to the present, Minneapolis is in the process of updating its formal Climate Action Plan during 2012. According to the city's website, residents and businesses are encouraged to participate in working groups regarding the plan, complete a climate change survey, and take advantage of

existing resources to reduce environmental impact (Minneapolis CAP 2012). The ongoing Climate Action Plan is described as a “roadmap to guide Minneapolis towards our emissions reduction targets”. It is not clear whether climate change adaptation will be a focus of the Climate Action Plan, but the wording suggests a focus on mitigation activities. In fact, all specific references to climate change on the city’s website are positioned in terms of carbon mitigation activities.

In 2007, Minneapolis Mayor R.T. Rybak signed the U.S. Mayors Climate Protection Agreement, appealing to Congress to take climate change action. The city also set a new target to reduce citywide greenhouse gas emissions by 17 percent by 2020 and 30% by 2025, using 2006 as a baseline.

To establish this baseline for measuring results, the city completed an inventory of greenhouse gas emissions for 2000 and 2006, and noted that community-wide GHG emissions decreased slightly during this period in both absolute terms and on a per-capita basis (Carbon Footprint Report 2009). These results are depicted in Figure 11.

Table 1: Community GHG Emissions by Sector for 2000 and 2006 (1,000 MtCO_{2e})				
	2000	2006	Change	% Change
Residential	1,246.3	1,268.3	(22.1)	-2%
Commercial & industrial	3,084.0	2,951.1	(132.9)	-4%
Transportation	1,633.5	1,520.5	(112.9)	-7%
Solid waste	15.0	14.1	(0.9)	-6%
Total GHG emissions	5,978.7	5,754.0	(224.7)	-4%
Per-capita emissions (tonnes)	15.6	14.8	(0.8)	-5%
Per-household emissions	36.8	34.4	(2.4)	-7%

Figure 11: Minneapolis Citywide Emissions by Sector for 2000 and 2006; 2009 Carbon Footprint Report

The most current data from the city shows greenhouse gas emissions for years 2006 through 2010, which is depicted in Figure 12. According to this inventory, greenhouse gas emissions from Minneapolis have declined 12 percent during this period.

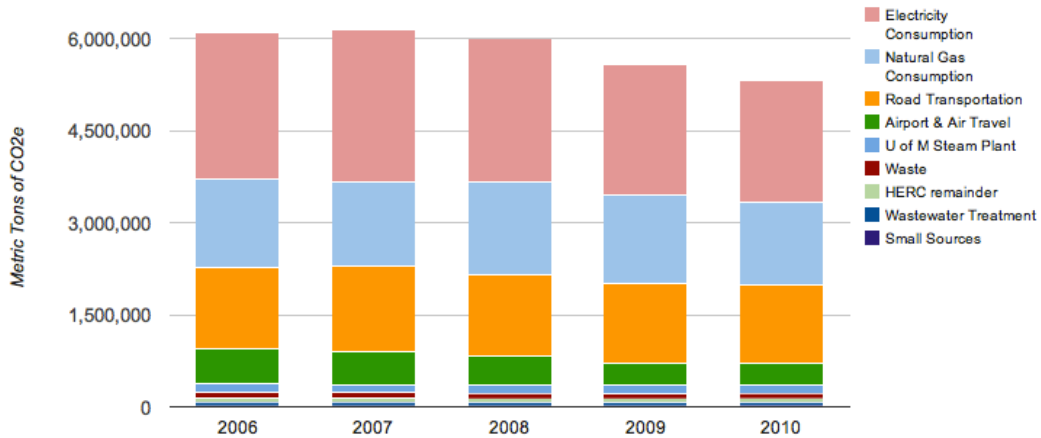


Figure 12: Minneapolis Citywide GHG Emissions 2006-2010; GreenPrint 2011

The city attributes this decrease to “cleaner electricity supplied by Xcel Energy, a reduction in the use of natural gas in the community, cleaner airport operations, and cleaner cars and trucks on the road being driven fewer miles.” (Citywide GHG Emissions 2012). If the GHG reduction trends indicated through 2010 continue, Minneapolis believes that it is on target to meet its intermediate goal of a 15 percent reduction by 2015, with the ultimate target of 17 percent by 2020 and 30 percent reductions by 2025.

Minneapolis and Sustainability

As indicated, climate change is primarily referenced with regard to greenhouse gas mitigation on the City of Minneapolis Environment website

and in city reports. This is not to say, however, that adaptation initiatives are absent. Rather, they are presented in the context of sustainability and wellness planning. Beginning with Resolution 2003R-133 of the Minneapolis City Council in 2003, which initiated the creation of the Minneapolis Sustainability Plan, the city has steadfastly pursued a goal of becoming more sustainable. In 2005, subsequent Resolutions amended the city's Comprehensive Plan to include sustainability indicators and set forth a requirement that every department incorporate the indicators into the business planning process and report on progress. Groups such as the Minneapolis Citizens Environmental Advisory Committee and the city's Environmental Coordinating Team were instrumental in developing and implementing the indicators. In 2006, the city released its first Sustainability Annual Report, which included baseline data and actions taken on 24 Sustainability Indicators.

Today there are 26 Sustainability Indicators, grouped into three categories - "A Healthy Life", "GreenPrint" (which contains the environmental indicators), and "A Vital Community". Ten-year targets have been set for each indicator and progress toward these targets has been updated annually through the Minneapolis Living Well Sustainability Report (Living Well 2011), which includes the GreenPrint Report (GreenPrint 2011).

Climate Change Action and Well-Being Converge

Among the 26 Sustainability Indicators, as many as 14 can be identified as having a connection to both climate change mitigation or adaptation and human well-being. Many of these fall within the indicators' GreenPrint section:

- Climate Change Indicator – refers to the city's GHG emission target
- Renewable Energy – 70 renewable project permits by 2015
- Improve Air Quality – reduce pollutant levels of ozone
- Waste Reduction – Increase both composting and recycling
- Bikeways – 179 miles of bike lanes and/or trails by 2015
- Transportation Alternatives – Increase transit use and carpooling
- Tree Canopy – maintain the 31% tree canopy in the city
- Storm water Mgmt. – Increase rain gardens in the city to 3000 by 2015
- Clean Water – Improve quality of lakes, rivers, and streams
- Green Jobs – 30% growth in green jobs by 2015
- Local Food – create additional acre of food-producing gardens by 2014

In addition, within the Healthy Community section, the “healthy weight” indicator advocates for more walkable neighborhoods and access to local produce. Finally, several of the Vital Community section indicators are related to community resilience and community self esteem. In particular, “community engagement”, which aims to increase resident participation and diversity of city leaders, and “cost burdened households,” which promotes sustainable affordable housing practices such as higher density, proximity to transit and energy efficient buildings. Figure 13 outlines examples of

Minneapolis sustainability initiatives from 2005 to 2010 that address both climate change and well-being.

MINNEAPOLIS SUSTAINABILITY INITIATIVES THAT ADDRESS CLIMATE CHANGE AND WELL-BEING
<u>2005</u> <ul style="list-style-type: none">• Secured Bus Rapid Transit as part of highway expansion project• Created a storm water utility fee system, encouraging eco-friendly techniques such as installing rain gardens and permeable pavers
<u>2006</u> <ul style="list-style-type: none">• Rezoned a large portion of downtown to support higher density housing and mixed uses along a light-rail corridor• Provided transit passes instead of parking vouchers for Planning Commission members
<u>2007</u> <ul style="list-style-type: none">• Became the 1st city in the nation to award 25 micro grants to residents and businesses for taking action to reduce climate change. [One group used the grant money promote clothes lines – saving money and energy by minimizing use of dryers]
<u>2008</u> <ul style="list-style-type: none">• Launched “Homegrown Minneapolis” to increase the growing, sales and consumption of local, healthy and fresh food for all residents
<u>2009</u> <ul style="list-style-type: none">• Xcel Energy Plant in northeast Minneapolis was converted from coal to natural gas, producing more electricity while emitting much less carbon dioxide and other pollutants• Reduced the city fleet’s fuel use by 14,000 gallons and increased the number of hybrid vehicles by 9 percent
<u>2010</u> <ul style="list-style-type: none">• geothermal system installed at Minneapolis Public Works Facility to provide 100% of heating/cooling needs and is expected to pay for itself in about 5 years• Minneapolis named America’s best bike city in by Bicycling Magazine

Figure 13: Highlights of sustainability initiatives in Minneapolis, from 2005-2010 Annual Living Well Sustainability Reports

Monitoring and Evaluation

Responsibility for implementing Minneapolis' sustainability initiatives is widespread. The City Council formed a new committee, the Health Energy and Environment Committee, to provide a stronger sustainability focus, but Minneapolis also recognized that it was necessary to integrate the sustainability program into the business plan of each of the city's 18 departments. To this end, each department "reviewed the Sustainability Indicators, assessed their challenges and opportunities to influence the Indicators, and outlined their implementation plan" (Sustainability Initiative 2012). Overall success of the program is measured by progress toward the Sustainability Indicator targets, which are reported annually in the Living Well Sustainability Report.

The city of Minneapolis has a multitude of policies and initiatives aimed at increasing the sustainability of the city. Many of those strategies are related to the dimensions of well-being. They also serve to promote mitigation or adaptation to climate change, even though climate change is only specifically referenced with respect to greenhouse gas reduction. The targets that have been established for each of the Sustainability Indicators are quantitative and progress toward these goals is shared annually and publicly.

Chapter 6

Cross-Case Analysis

The four case cities examined present certain similarities in their approach to climate change action, but there are also many differences. To better understand these similarities and differences, this chapter introduces a cross-case analysis of each of the case studies, using the questions laid out in Chapter 2.

How is the city addressing climate change? Is there a formal Climate Action Plan or a Sustainability Plan that references climate impacts?

Grand Rapids addresses climate change through its five year Sustainability Plan, which spans from 2011 to 2015. The Sustainability Plan references climate change only in the environmental section of “Energy and Climate,” which appears last in the plan, following economic and social sustainability goals. The goal for CO₂-e mitigation is low, only 10,000 metric tons by June 2013, and only refers to reductions in City operations. Furthermore, the plan completely ignores the GHG inventory of 2009, which established emissions for the Grand Rapids community as a whole at 2 million metric tons CO₂-e. Another goal in this section sets a renewable energy target of 30%, but again this refers only to city operations, which represent a small portion of the community-wide Grand Rapids emissions. In addition, the targets have a short time frame of five years, with no indication of the city’s intentions for climate planning beyond 2015.

Overall, Grand Rapids fails to adequately address mitigation in its Sustainability Plan. It is possible that the city will consider a formal Climate Action Plan as they progress with the ICLEI Resilient Communities program to develop an adaptation plan. Adaptation initiatives do appear in the Sustainability Plan, although they are not identified as climate actions.

Chicago is the only one of the case cities examined to have a formal Climate Action Plan, which addresses both mitigation and adaptation. The Chicago CAP also sets the longest-term mitigation goal of 2050 and is the only one to utilize input from scientific researchers and regional climate models to predict impacts of climate change on the city. Chicago has an intermediate CO₂-e reduction target for 2020 to determine progress, and for each of the 35 goals in the CAP, the actions necessary to meet that goal are outlined. The Chicago CAP is remarkable in its attention to detail and comprehensive nature. Not surprisingly, the city's efforts to face climate change have garnered attention and praise across the country and beyond (Greening 2011, Kaufman 2011).

Milwaukee addresses climate change through its Sustainability Plan, which was first created in 2005 and is currently being updated in 2012. The 2005 plan focused on stormwater reduction and management, smart energy policy, and stimulating a green economy. The city has indicated that it is choosing to develop a Sustainability Plan rather than a Climate Action Plan because of a presumption that the latter does not allow for consideration of sustainable economic development. The planning process that Milwaukee

has outlined does not show any intention of conducting a GHG inventory or of setting concrete, measurable reduction targets. Milwaukee has clearly categorized climate change as an environmental issue, overlooking the fact that the impacts of climate change will certainly have an impact on the economy. The city seeks to create jobs through sustainable economic development, but does not appear to be taking climate change impacts into account in the process.

Milwaukee is facilitating climate adaptation through some of its sustainability measures, such as stormwater management and green infrastructure. However, these are not classified as adaptation and the city fails to incorporate adaptation research and recommendations from the Milwaukee Working Group of the Wisconsin Initiative on Climate Change Impacts (WICCI 2011). WICCI represents a partnership between the University of Wisconsin and the Wisconsin Department of Natural Resources. The Milwaukee Working Group was tasked with identifying climate risks and adaptation opportunities for Milwaukee to address the challenges of rising temperatures and extreme weather events. Among other things, the report outlines suggestions for management of growth and development, property protection, and potential infrastructure impacts. My research did not indicate that the city of Milwaukee is involved with the Milwaukee Working Group or that it is taking advantage of the group's valuable research by incorporating recommendations into its planning process. Although WICCI is a state-run project, this oversight seems surprising.

Minneapolis is currently in the process of developing a formal Climate Action Plan in 2012, with assistance from ICLEI and participation from residents. In the mean time, the city addresses climate change through its 26 Sustainability Indicators, which were established in 2006. The Climate Change Indicator establishes the city's intermediate goal of a 15 percent GHG reduction by 2015, with the ultimate target of 17 percent by 2020 and 30 percent reductions by 2025. Several of the other indicators also have climate change implications, but are not identified as such. This includes renewable energy procurement, stormwater management, transportation, and green infrastructure targets. Many of the targets are relatively short-term, with goals only extending as far as 2015.

Minneapolis has been committed to sustainability and climate action for a long time, first developing a joint CO₂ reduction project in 1993 with nearby St. Paul. The early adoption by Minneapolis of a plan to fight climate change is commendable and it will be interesting to note how the city's Climate Action Plan will integrate and complement sustainability initiatives when it is completed.

What appears to be driving climate change action in the city?

Across the case cities, a variety of factors seem to driving climate action. In Grand Rapids and Milwaukee, the primary driver is sustainable economic development, with a secondary focus on livability of the city. Both cities indicate a desire to increase job creation, and attract companies in the

renewable energy field to spur investment. In the case of Milwaukee, energy issues are framed around rising energy prices and energy security, with climate change mentioned as a secondary consequence of fossil fuel use. Milwaukee also views clean energy as a way to change perceptions of the city as dirty and industrial. This is emphasized in Milwaukee's quest to be known as the *Fresh Coast Capitol of North America*. Grand Rapids, too, has vision of being perceived as a green, livable place that attracts a talented workforce. The *Green Grand Rapids* plan, which complements the city's Sustainability Plan, reflects this goal.

Climate action in Chicago is framed specifically as climate action. It is the only one of the case cities to frame each of its initiatives around their CO₂-e mitigation potential or adaptation potential. The Chicago CAP highlights Chicago's ambition to be seen as a leader in the field of climate change action. It also emphasizes the shared responsibility in climate action and the role that residents need to play. It is stated that choosing the future of Chicago is within the city's control. Throughout Chicago's plan, recognition is given to the fact climate action has the co-benefit of improving quality of life for the city's people.

Although each case city references a desire to improve quality of life, none is so focused on this as Minneapolis. The city's Sustainability Plan is called the Living Well Sustainability Report, and each of its three sections contains indicators that impact wellness. In addition to the environmental indicators in the *Greenprint* section, the report also includes *Healthy Life* and

Vital Community indicators. Climate change is only specifically referenced as an environmental indicator. Although Minneapolis currently frames climate action as a sustainability initiative, the city's plan to develop a formal Climate Action Plan indicates that it may be following in the footsteps of Chicago.

How do the city's climate or sustainability initiatives relate to the dimensions of well-being?

Grand Rapids has explicitly made the connection between climate action and well-being in its Sustainability Plan, writing "We know how to counteract the effects of global warming and we know our efforts will be rewarded with a higher quality of life and a cleaner and greener community." As previously indicated, though, Grand Rapids does not currently have a Climate Action Plan, and its mitigation targets are minimal and short-term. The city does accomplish some climate mitigation and adaptation, without labeling it such. There are goals of reduced energy demand and fossil fuel consumption, increasing reuse of captured water, reducing overall city water consumption, eliminating combined sewer overflow points, increasing green roofs in the city, replacing pavement with impervious surface, increasing tree canopy, increasing city open space, and increasing access to community gardens and farmers' markets throughout the city. These goals also have well-being impacts, but with the exception of healthy food access, this connection is not made in the Sustainability Plan.

Chicago goes beyond making a connection between sustainability and well-being, specifically linking climate actions to improved dimensions of

well-being. All five of the CCAP strategies are identified as having positive co-benefits in the area of physical health and/or quality of life. Within adaptation, the city has also developed a comprehensive Extreme Weather Operations Plan, which has been enhanced by adding a separate extreme precipitation plan section.

In 2005, the Milwaukee Green Team was challenged to develop a green vision to maximize the city's economy, health and quality of life by working with nature's systems. Their report acknowledged that sustainability has as much to do with achieving well-being for people as it does for preventing environmental destruction. Many of the report's recommendations for clean energy development, stormwater management, and green jobs creation had an impact on both climate and well-being. In the planning guidelines for the city's in-progress 2012 Sustainability Plan, however, climate change takes a back seat to sustainable economic development. Although highlighting livability as a driver for the new plan, Milwaukee overlooks the negative impacts to quality of life that are a likely to accompany climate change.

Minneapolis very clearly links sustainability to quality of life and well-being for its residents, and many of these initiatives also address climate change. Co-benefits are present in the city's efforts in GHG emission reduction, renewable energy projects, air and water quality initiatives, transportation alternatives, stormwater management, waste reduction, green infrastructure, green jobs creation, and local food availability.

With regard to climate change, the acknowledgement is made that rising GHG emission represent a risk to city residents of heat waves, reduced air quality, more insect and waterborne diseases, and periods of flooding. However, it is not clear whether Minneapolis will frame climate actions as having the potential to improve well-being in its Climate Action Plan.

How are initiatives that address climate change and well-being co-benefits being implemented, monitored and evaluated?

In each case city, the management of climate change initiatives is handled a little differently. In Grand Rapids, the Sustainability Plan was created and will be managed by the Office of Energy and Sustainability, which coordinates the city's efforts in energy efficiency, sustainability, conservation and renewable energy. Targets are set for each goal in the plan, but as indicated previously, the targets have a short time frame, as the Sustainability Plan only covers fiscal year 2011 – fiscal year 2015. Success is measured by progress toward the established targets and is presented in an annual progress report. It is unclear how Grand Rapids will implement and monitor adaptation initiatives once they are established. The city claims to be in the process of incorporating climate adaptation and mitigation strategies into all Grand Rapids' plans and policies, thereby providing consistency. However, without a Climate Action Plan to lead the way, it is difficult to see how this will be accomplished. In general, it seems as though Grand Rapids is saying all of the right things with regard to climate action, but very little

measurable climate action is occurring at this time. In order to truly exemplify a resilient city, Grand Rapids needs a strong climate mitigation plan to accompany its ICLEI Resilient Communities efforts.

Chicago's CAP targets and initiatives are led by the Chicago Department of Environment, while an additional 20 departments and agencies are jointly responsible and have their own CAP work-plan. According to the Chicago CAP website, staff from these offices meet monthly to discuss progress, collaborate on ideas, and hear updates on the Plan. Stakeholders are responsible for entering actions that contribute to GHG mitigation directly into an online platform, and the Green Ribbon Committee - an external group of Chicago civic, business, and organization leaders - acts as an additional source of monitoring. An official progress report of the CAP was released in 2010 and the city indicates that it is testing new ways to measure and communicate progress. The Chicago CAP is designed to deliberately complement other Chicago and regional planning efforts, including a 2008 comprehensive plan for the city, which emphasizes green design. Overall, the Chicago Climate Action Plan would seem to be a model effort in climate planning. The city is addressing big changes along with small ones, has a focus on long-term targets, and specifically integrates climate goals with the Planning Commission's comprehensive plan. Chicago has made the most progress of the four case cities in addressing infrastructure impacts and risk assessment, but there is room for more action targeted to these adaptations.

Milwaukee's Office of Environmental Sustainability (OES) directs its

sustainability initiatives. It is interesting to note that this city office is 100% grant-funded. Until the new Sustainability Plan is presented, it is not possible to say how exactly Milwaukee will implement and monitor initiatives, but there is an emphasis in the Sustainability Planning outline on choosing targets and indicators that can be tracked with quantifiable results. In order to track climate change mitigation progress, Milwaukee will need to commit to a GHG inventory, which at the time of this research it had not done.

Overall, Milwaukee's compartmentalization of climate change as an environmental issue is troubling. The city does not seem to be taking climate change impacts seriously, choosing instead to focus on the potential for economic development by bring renewable energy business to Milwaukee. Although this focus on expanding clean energy technology has positive climate change benefits that stretch beyond the borders of the city, it may leave Milwaukee and its residents unprepared for the risks it faces. A valuable first step in addressing this gap would be to collaborate with the Wisconsin Initiative on Climate Change Impacts and to incorporate the Milwaukee Working Group's report findings into the city's 2012 Sustainability Plan.

Responsibility for implementing sustainability initiatives in Minneapolis is widespread. The City Council formed a new committee on Health, Energy, and Environment, to provide a stronger sustainability focus. The city also recognized that it was necessary to integrate sustainability into the business plan of each of its 18 departments. Each department reviewed the

Sustainability Indicators and identified their individual implementation plan. Overall success of the program is measured by progress toward the Sustainability Indicator targets, which are reported annually in the Living Well Sustainability Report.

Minneapolis stands out in that its Sustainability Indicators are a formal amendment to the city's Comprehensive Plan and because members of the city's planning office were on the Environmental Coordinating Team, which helped develop the indicators. Minneapolis presents the most comprehensive sustainability action of the four case cities and is arguably accomplishing the greatest achievement of co-benefits between climate action and well-being, even though the city doesn't always apply the label of climate action. It would be beneficial for Minneapolis to develop its Climate Action Plan in such a way that it builds on the accomplishments of the Sustainability Indicators, while establishing longer-term targets and formally addressing climate adaptation.

As the analysis in this chapter indicates, Grand Rapids, Milwaukee, Chicago, and Minneapolis are tackling climate change action in somewhat different ways and are at different stages in the planning and implementation process. However, the four cities overlap at times in the framing of their climate action and many strategies have been popular with multiple cities. Figure 14 expands on the table presented in Chapter 4, indicating the presence of climate change actions with well-being co-benefits that appear in each case city's Sustainability Plan or Climate Change Action Plan.

Climate Change Action	Mitigation/Adaptation/Co-benefits	Well-being Connection	Grand Rapids MI	Chicago IL	Milwaukee WI	Minneapolis MN
Increase renewable energy	Co-benefit	Physical Health	X	X	X	X
Promote energy conservation	Co-benefit	Physical Health	X	X	X	X
Increase bldg insulation	Co-benefit	Physical Health	X	X	X	
White roofs	Co-benefit	Physical Health		X		
Smart Growth policies/zoning	Co-benefit	Basic Access, Physical Health	X	X		X
Tree Canopy	Co-benefit	Physical Health	X	X	X	X
Park Creation	Co-benefit	Healthy Behaviors, Basic Access	X			
Green Infrastructure	Co-benefit	Basic Access, Healthy Behaviors, Physical Health	X	X	X	X
Green Roofs	Co-benefit	Physical Health	X	X		X
Engage Business Community	Co-benefit	Physical Health		X	X	
Green Jobs	Co-benefit	Work Env., Basic Access	X	X	X	X
Permeable Pavement	Co-benefit	Physical health	X	X		
Local food production	Co-benefit	Physical Health, Healthy Behaviors, Basic Access	X			X
Active transport infrastructure	Mitigation	Physical Health, Healthy Behaviors	X	X	X	X
Increase Public Transit	Mitigation	Physical Health	X	X	X	X
Parking/traffic/congestion fees	Mitigation	Physical Health				
Reduced fuel consumption	Mitigation	Physical Health	X	X	X	X
Recycling/waste reduction	Mitigation	Physical Health	X	X		X
Infrastructure resiliency	Adaptation	Physical Health, Basic Access				
Extreme weather alert systems	Adaptation	Physical, Mental Health		X		
Control Vector-borne disease	Adaptation	Physical Health				
Upgrade sewers	Adaptation	Physical Health	X		X	X
Flood Risk Mgmt	Adaptation	Physical, Mental Health		X		
Community Education	Adaptation	Mental health		X		X
Water Conservation	Adaptation	Physical Health, Basic Access	X	X	X	X
Disaster planning/Insurance	Adaptation	Physical, Mental Health				

Figure 14: Illustrating climate change actions with well-being co-benefits found in case cities

Final Thoughts

There were several elements that I identified as surprising throughout the case studies. The first surprise was the variation in framing of climate action across the four cities, even though the literature had suggested that there is no set process for developing a climate change plan (Bassett and Shondas 2010). Among the three cities with Sustainability Plans, framing of climate action ranged from sustainable economic development, to greening of the city, to enhancing livability. In addition, the language in framing climate action often reflected the city's vision of itself. In the case of Milwaukee, it was even used as an explicit way to redefine their image. A second surprise was that each city recognized the connection between its actions to address climate change and sustainability and increased well-being. Improvements to physical health and basic access were the commonly cited dimensions of well-being. It is important to note that many times the connection between a sustainability initiative and climate change was not explicitly made, indicating that cities have yet to fully capitalize on the co-benefits of climate action, or perhaps that the politicization of climate change deters cities from doing so.

The case studies also presented several characteristics that were expected based on the academic literature. For instance, it has been reported (Bassett and Shondas 2010) that cities favor highly visible climate actions, and those that produce immediate results. Visible actions such as green roofs and planting trees or creating bike paths were present in each case city. As

these climate change strategies also have well-being implications, these visible actions are certainly meaningful. However, less visible and more difficult climate adaptation efforts were almost entirely overlooked in the case cities. This includes risk assessments for floods and infrastructure viability under climate impacts, disaster planning, and extreme weather response programs. Foster (2011) highlights the importance of institutional adaptation approaches such as buying insurance or reserving funds in anticipation of climate related disasters. Chicago is the only case city to have developed extreme weather plans and acknowledged the need to assess infrastructure risk. Without these adaptation measures, cities remain at risk to climate change impacts. In most cases, cities also had a short-term planning focus of about five to ten years. Chicago was the exception, with a long-term target for 2050. Minneapolis has a GHG emission target for 2025, but its other Sustainability Indicators utilize an earlier target date.

It was discouraging, but not entirely surprising, that only Chicago and Minneapolis have worked to integrate their climate change and sustainability efforts into the city's comprehensive plan. There was a distinct lack of involvement by city planning departments in the climate planning process, even though many climate change initiatives involving the built environment stem from traditional city planning strategies.

Recommendations and Future Research

Based on the academic literature and the case study analysis, I would recommend a well-being framework for climate change action in cities, but one that is grounded in the science of climate change impacts, and includes deep adaptation measures such as infrastructure resiliency and disaster planning. Rather than focusing heavily on visible, short term projects, cities should seek strategies that have the highest impact and produce the greatest co-benefits. Giddens (2009) argues that climate planning needs a long-term focus, as well as comfort with risk and uncertainty, and a critical mass of public support. Three of the case cities are framing climate action around a pursuit of sustainability and as the analysis showed, they are achieving varying degrees of success at addressing climate change and well-being co-benefits. This leads to several questions. Can cities successfully address climate change without a formal Climate Action Plan? Is a Sustainability Plan part of Climate Action Plan or the other way around? Does it matter?

I would argue cities that do not develop a formal climate plan may have a more difficult time addressing actions that are less visible and longer term. A GHG emissions inventory is necessary to be able to track the progress of carbon mitigation, yet as of this research, Milwaukee has yet to conduct one and Grand Rapids has not set any targets based on the inventory it conducted in 2009. However, climate strategies will likely be more successful if they are place-based and reflect local conditions. In other words, cities can and should frame climate action in a variety of ways, but they must still fully address

climate mitigation and adaptation. Cities should also strive to include city planning professionals in the climate change planning process. As indicated previously, many built environment strategies that reduce or alleviate climate impacts have their foundation in urban planning principles. This would also facilitate a more formal connection between climate planning and a city's comprehensive plan, and might even prompt cities to realize that climate change planning is really just representative of good city planning.

The work presented in this thesis could be expanded through future research in several areas. First, it would be useful to expand the case city analysis to include cities in other regions of the country, and also to deepen the scope of the research through interviews with individuals from cities who are involved in the climate planning process. Second, it would be valuable to have research that looks more closely at the emotional health impacts of climate change, as well as how to address the health and well-being disparities that exist amongst various groups within cities. It has been shown that low-income neighborhoods tend to have less tree canopy and poorer access to mental health care. The goal for cities must be to pursue climate change actions that serve to lower the vulnerability for all populations, preparing the way for improved overall well-being.

Chapter 7

Conclusion

In an effort to maximize their limited resources, cities must look for ways to connect agendas. This research emphasizes that municipal actions to curb climate change and the elements of well-being, specifically those defined by the Gallup-Healthways Well-Being Index, are positively linked. Climate change has become a politically sensitive subject, making it difficult to achieve the critical mass of public support that Giddens (2009) refers to. Consequently, cities would benefit from more explicitly framing climate action around improved well-being, and expanding beyond the physical health dimension of well-being to include connections to mental and emotional health, access to basic needs, and promotion of healthy behaviors.

City level climate work is still relatively new and it will take time to evaluate its effectiveness. As of this writing, three of the four case cities examined are in the process of developing new climate change or sustainability plans, or are updating existing ones. It is difficult for cities to measure what they are getting for their efforts to address climate change. Portney (2003) cautions that it could take years for the benefits of a city's sustainability policy to become visible or measurable. In addition, formal evaluation of these efforts is expensive and subjective aspects such as improvements in well-being are difficult to capture in a traditional cost-benefit analysis.

This is the value of the data being collected by the Gallup-Healthways Well-being Index, which will rank cities annually on six dimensions of well-being for 25 years. The Well-Being Index serves as a valuable and free resource for cities. For the case cities, it is too early in the implementation phase of their climate action or sustainability plans to evaluate climate action against changes in their Well-Being Index rank. However, over time, the connection between a city's climate actions and the well-being of its residents could become clearer as trends in well-being are revealed. The Well-Being Index may serve as a long-term evaluation tool of these actions. Cities in the Great Lakes Region and beyond should utilize the Well-Being Index to better understand how their efforts to mitigate and adapt to climate change are impacting well-being.

Although it might take time for the Well-Being Index results to reinforce the co-benefits for cities between climate action and well-being, I do not advocate that cities take a “wait and see” approach. This research establishes the link between climate change action and improvements in well-being. Working to increase well-being will simultaneously increase human resilience, which is necessary for climate adaptation. The intent of this thesis is to alert cities to the possibility of these dual benefits and encourage them to maximize the value of resources by seeking to enhance resident well-being through climate change action.

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